# A MACROECONOMETRIC ANALYSIS OF THE INCIDENCE AND ECONOMIC EFFECTS OF THE CORPORATION INCOME TAX IN CANADA

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By

REZA GHAELI, B.A., M.A.

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AUTHOR: Reza Ghaeli, B.A. (University of Tehran)

M.A. (McMaster University)

SUPERVISOR: Professor J.B. Burbidge

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## ABSTRACT

Even though the short-period shifting of the corporate income tax has been the subject of numerous econometric studies, the issue still remains controversial. The question of whether or not corporate profits taxes are shifted is important because of its implications for the distribution of income, the allocation of resources, and economic growth.

A fundamental problem with the existing econometric studies of the short-run shifting of the corporate income tax is the lack of a well defined underlying theory. On one hand, the authors examine the short-run shifting of the corporate income tax while ignoring how the government uses the additional revenues when the tax is raised; that is, they seem to have adopted either a partial-equilibrium or a general-equilibrium full-employment model, where aggregate demand is always fixed at the full-employment level. On the other hand, the inclusion of some Keynesian cyclical variables in their regression equations for the rate of return implies that the authors have implicitly adopted a Keynesian approach. This theoretical inconsistency on the part of empirical investigators of the short-run shifting of the corporate income tax makes their results extremely difficult to interpret.

In this thesis we show that in a conventional Keynesian IS-LM model the incidence and other economic effects of the corporate income tax depend on how the government uses the additional tax revenues when

the tax is raised. Furthermore, we demonstrate this point empirically by adapting an existing macroeconometric model of the Canadian economy and conducting several experiments involving the corporate income tax. One of the major conclusions of this thesis is that the shifting of the corporate income tax takes place under expansionary conditions in the economy. In other words, the shifting mechanism operates primarily through changes in aggregate demand and real output, not through changes in prices relative to wages, as is assumed in the conventional approach to the corporate income tax.

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# CHAPTER ONE

## Introduction

The incidence and other economic effects of the corporation income tax are among the most important and controversial issues in the field of public finance. One controversy centres around the question of whether or not corporations can shift the burden of a higher or newly imposed tax on profits in such a way as to prevent their after-tax real profits from being reduced. Depending on the answer to this question, the corporate income tax will have different implications for the distribution of income, the allocation of resources, and economic growth. For example, it has been argued that if the burden of a higher corporate profits tax is shifted onto consumers through higher prices, then the effects of the tax are similar to those of an excise tax; the incidence (effects on income distribution) of the corporate income tax would be regressive and would hinder efficient exchange in the economy.[1] On the other hand, if the tax were borne out of corporate profits, it would be progressive, but the tax might still interfere with efficiency in production, and hence economic growth, through misallocation of resources between the corporate and noncorporate sectors and also through reduction of corporate investment.[2] So far, economists have been unable to agree on the actual effects of the corporate income tax.

The theoretical models used to analyze the effects of the corporate income tax are cast either in a partial-equilibrium or a general-equilibrium full-employment framework. These studies suggest that in the short run the burden of the corporate income tax falls entirely on profits, unless firms charge less than profit-maximizing prices and raise their prices and/or lower money wages in response to a tax increase, thus shifting the tax forward onto customers or backward onto labour. In the long run, the tax is thought to be shared by all economic units because of a reduction in investment.[3]

The econometric studies of the corporate income tax are largely directed at attempting to resolve the issue of short-run shifting. These studies have produced conflicting results, ranging from full shifting proposed by Krzyzaniak and Musgrave (1963) to zero shifting suggested by some of their critics. A fundamental problem with these studies is that the authors ignore the question of how the government responds to the extra revenues when the tax is raised, or the way revenues are obtained when the tax is reduced. Either way, the government response is likely to have appreciable economy-wide impacts because any change in the tax rate involves a significant change in revenues. That these effects have been ignored indicates that the authors have adopted either a partial-equilibrium or a general-equilibrium full-employment model, where aggregate demand is always fixed at the full-employment level. At the same time, the inclusion of Keynesian cyclical variables in their regression equations for the rate of return indicates that the authors have implicitly adopted a Keynesian approach. Thus, there is clearly a theoretical inconsistency on the part of empirical investigators of the short-run shifting of the corporation income tax that makes their results extremely difficult to interpret.

This thesis has two major purposes. First, we demonstrate that in a Keynesian IS-LM framework the short-run incidence and economic effects of the corporation income tax depend on what the government does with the tax revenues raised when the tax is increased, or the way additional revenues are obtained when the tax is reduced.[4] Second, we provide empirical support of our theoretical discussion by examining the question of the shifting of the corporate income tax in the context of TRACE, an existing annual macroeconometric model of the Canadian economy which has Keynesian features.[5] For this purpose, we first modify and extend the TRACE model in such a way as to make it more suitable for our analysis. Then we use historical simulation analysis to assess the impact of various government policies involving the corporation income tax on the distribution of income between profit earners and wage earners, and on consumers. We also examine the effects of these policies on some key variables such as output, investment, employment, the interest rate, and so on. Since the Canadian economy was generally at less than full employment over the period of our simulations, the Keynesian conditions alluded to earlier are satisfied in this approach.

The structure of this thesis is as follows. In Chapters 2 and 3 we review and appraise the theoretical and empirical studies on corporate tax shifting, respectively. In Chapter 4 we use a Keynesian IS-LM model to examine theoretically the short-run and long-run incidence and economic effects of the corporate income tax. Chapter 5 presents a brief discussion of the structure of corporation income taxation in Canada. In Chapter 6, we introduce TRACE, an annual econometric model of the Canadian economy, and adapt it for the purposes of this thesis. In Chapter 7, we use the modified version of TRACE in a simulation analysis to support the theoretical analysis of Chapter 4. Finally, in Chapter 8, we provide a summary of the thesis and attempt to draw some conclusions with regard to the incidence and economic effects of the corporate income tax.

# FOOTNOTES

1. See Ballentine (1980), ch. 2.
2. Ibid., ch. 5.
3. Ibid., p. 11.
4. This point has been demonstrated by Asimakopulos and Burbidge (1974) and Burbidge (1974, 1976) in the context of a simple aggregate demand model similar to the one used by Kalecki (1937).
5. The TRACE model will be introduced in Chapter 6.

# CHAPTER TWO

## Review of the Theoretical Literature

### II.I Introduction

Asimakopulos and Burbidge (1974) set out a Kaleckian (Keynesian) theory of the short-run effects of tax and expenditure changes. This article and its message for the empirical literature on the short-run shifting of the corporation income tax was later elaborated and extended by Burbidge (1974, 1976). This literature is the starting point for the present study.

The short-run[1] studies of the shifting[2] of the corporate profits tax are cast in either partial-equilibrium or general-equilibrium full-employment frameworks. The authors examine the distributional effects of a higher tax on profits under the assumption that the government's use of revenues does not affect demand conditions in the economy; the incidence and shifting of the tax is assumed to be independent of the government response. In other words, the authors focus on the micro-economics of the tax change and assume that there is no relationship between the level of aggregate demand and the distribution of income. Aggregate demand is always fixed at the full-employment level regardless of how the government adjusts its revenue and expenditure patterns.

One problem with partial-equilibrium and general-equilibrium full-employment studies is that economies are not always in full-employment equilibrium. If one is to conduct a meaningful analysis of the incidence of the profits tax, then the chosen theortical framework must relate, albeit loosely, to the economy for which it purports to have relevance. One such framework is adopted by Asimakopulos and Burbidge (A-B). A-B study the incidence of changes in government policies in a Kaleckian framework, where the economy can come to rest at a <u>less than full-employment position</u>. In this analysis, they are primarily concerned with one short period, during which physical plant and equipment are fixed. There are three economic agents in the system; entrepreneurs who control and supervise production, rentiers who provide for the financial needs of the firms, and workers who operate the machines. In consumption, the entrepreneurs form part of the capitalist class and receive part of profits. It is assumed that the desired investment by firms in real terms is fixed in the short run. It is also assumed that the worker's propensity to save is zero.

The A-B model contains 12 equations. By choosing appropriate assumptions, they produce two different versions of their model; a competitive version and a non-competitive version. Then, they conduct a number of differential and budget incidence analyses and arrive at the following three conclusions. First, they argue that in a Kaleckian world, there is no such thing as <u>the</u> incidence of a higher tax on profits. The incidence results depend on what the government does with the extra tax revenues. Second, they show that in a Kaleckian framework, full tax shifting is consistent with perfect competition. Third, they argue that when after-tax profits are lowered by some change in government policy, non-profit maximizing firms may not be able to shift the burden of higher profits taxes onto consumers or onto workers. These results are in sharp contrast with the traditional view that the only way a profits tax can be shifted in the short run is by non-profit maximizing firms raising their prices relative to money wages.[3] The work of A-B suggests that changes in aggregate demand and thus pre-tax profits, as well as changes in real wages, may be a route by which higher corporate taxes do not lead to proportionately lower after-tax profits; that is, to the possibility of some "tax shifting". To shed some light on these points, we now turn to review the existing theoretical literature on the incidence of the profits tax.

## II.2 The Short-Run Incidence of the Corporation Income Tax: Traditional Theories of Firm Behaviour

The traditional view regarding the short period incidence of the corporate income tax is based largely on partial-equilibrium models of a single firm or industry. These studies conclude that, in the short run, a tax on profits at any rate less than 100 per cent will give the profit-maximizing firm no reason to change its price and output levels; that is, the tax will be paid entirely out of profits.[4] This conclusion is valid regardless of the state of competition in the market.

The above conclusion is based on the neoclassical theory of the firm, where a firm's objective is to maximize profits by choosing the optimum input and output levels. A brief formal presentation of this view is summarized below.

If TR represents total revenue and TC total cost, then profits ($\pi$) can be defined by:

$$\pi = TR - TC \, . \tag{2.1}$$

To maximize profits, a firm has to equate the marginal revenue (MR) to the marginal cost (MC).[5] With the introduction of a profits tax at the rate of $t_\pi$, the after-tax profit ($\pi'$) becomes:

$$\pi' = (1 - t_\pi)\ (TR - TC) \qquad\qquad 0 < t_\pi < 1. \tag{2.2}$$

Here again, profit maximization requires that the marginal revenue be equal to the marginal cost. Therefore, given that MR and MC are not affected, the tax is paid out of profits and there is no shifting at all.

The neoclassical view that the short-period burden of the profits tax falls on profits has come under attack on various grounds. One criticism suggests that the profit maximization rule used by the neo-classists does not represent usual business practices.[6] Thus, it is argued that a tax on profits can be shifted forward to consumers if non-profit-maximizing firms charge less than the short-run profit-maximizing price and increase their prices in response to any tax increase. There can also be backward shifting onto labour if, in response to higher tax rates, monopsonistic firms set the wage rate below the value of labour's product or monopolistic labour unions moderate their wage demands because of a reduction in each firm's ability to pay. This so-called non-profit-maximizing view is based on various assumptions about the behaviour of a firm and is apparently aimed at explaining the significant short-run shifting found in some of the econometric studies as we shall see in the next chapter.

## II.3 The Short-Run Incidence of the Corporation Income Tax: Non-Profit-Maximizing Models

The following are some of the non-profit-maximizing models which could result in the shifting of a profits tax in the short run.

### (a) Oligopoly Behaviour

In oligopolistic markets the price is often set by a price leader in the industry.[7] There is a tendency for a firm not to charge a price different from the set price for the fear of reprisals by other firms in the industry. In other words, a price reduction by one firm may result in parallel reductions by other firms with the result that the original firm fails to increase its sales substantially. Similarly, an increase in price by one firm may not be followed by other firms, resulting in lower sales. Under these circumstances, a higher tax on profits may act as a signal to all firms to raise their prices. By a uniform increase in price, firms may succeed in shifting at least part of the tax burden to consumers.

(b) Constrained Sales Revenue Maximization

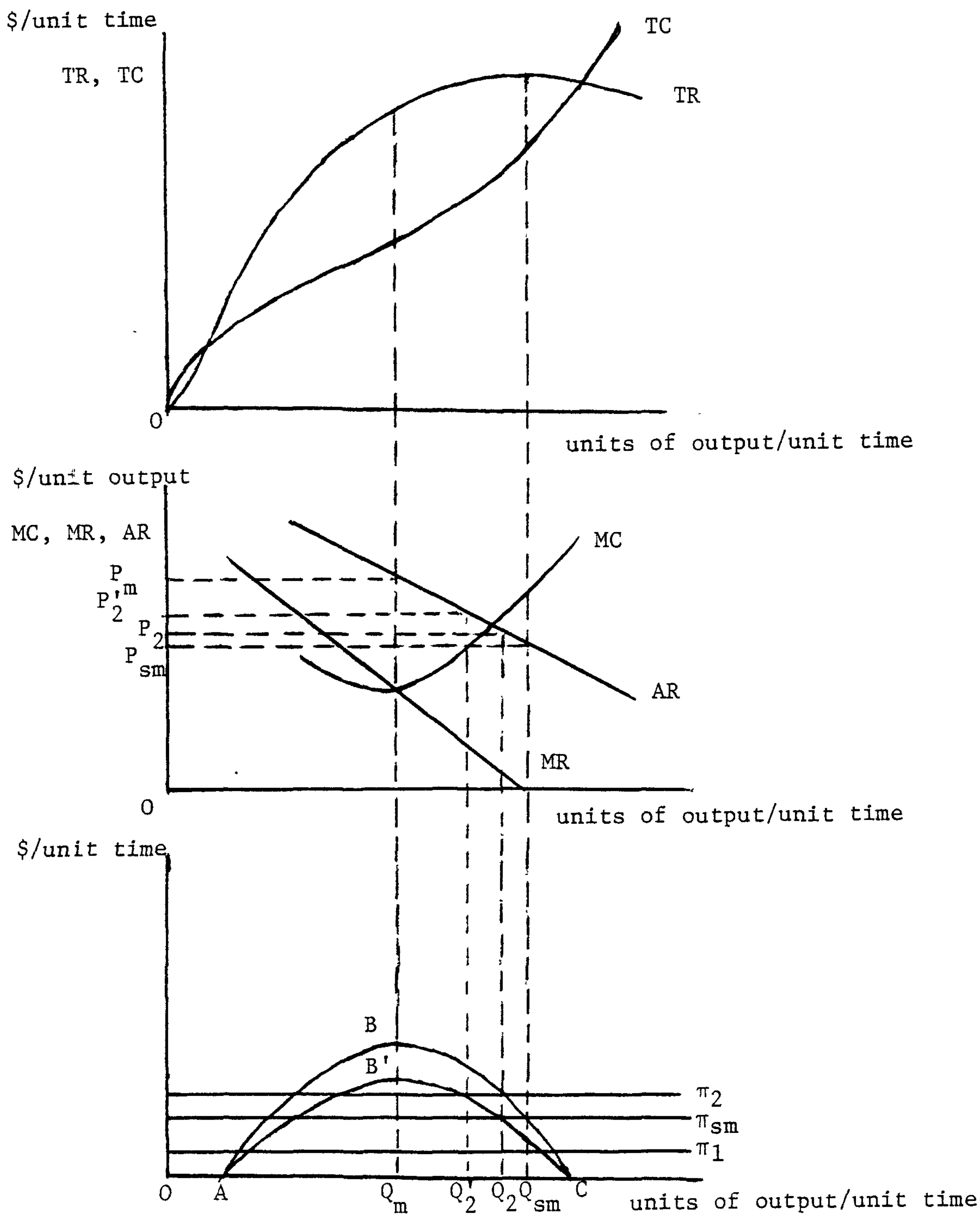
Sales revenue maximization behaviour subject to a profit constraint was first suggested by Baumol (1958). In his study, Baumol points out that "the typical large corporation in the United States seeks to maximize not its profits but its social revenues, which the businessman calls his sales. That is, 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."[8] This argument is illustrated in Figure II-1.

The upper part of the diagram represents the total revenue (TR) and total cost (TC) curves. In the lower part of the diagram curve ABC represents total profits before taxes.

If the firm were a profit maximizer, it would choose to produce $OQ_m$ units of output. At this level of output, marginal revenue (MR) is equal to marginal cost (MC), as shown in the middle part of the diagram. However, a sales-maximizing firm produces $OQ_{sm}$ units, where

Figure II-1

Constrained Sales Maximization



sales revenue is maximum (MR = 0). Whether or not $0Q_{sm}$ will be attained depends on the minimum acceptable level of profits. If this minimum level is set at $\pi_{sm}$, the firm will produce the sales-maximizing level of output $0Q_{sm}$, but if it is set at $\pi_2$, the firm will produce $0Q_2$ units which is less than $0Q_{sm}$. Now, with the introduction of a profits tax the after-tax profits curve will shift down to AB'C. The vertical distance between ABC and AB'C shows total tax liabilities. Given that $\pi_2$ is the minimum acceptable level of after-tax profits, the sales-maximizing firm will choose to produce $0Q'_2$ units of output. Therefore, the imposition of a profits tax leads to a lower level of output and, hence, a higher price. In other words, the tax may be shifted partly onto consumers in the form of a higher price.

(c) Mark-up Pricing

It is often argued that firms cannot measure their marginal revenue and marginal cost and hence cannot determine their profit maximizing levels of price and output. Thus, it is necessary for firms to find other practical rules of price determination. One such rule is "mark-up" pricing.[9]

Under the mark-up pricing rule, a firm sets its price equal to its average cost, which is easier to compute, plus a mark-up which guarantees a certain desired level of profits if the plant is operated at some normal level of utilization, e.g., 85% of full capacity. If a higher tax on profits reduces the desired profit margin, the firm tries to regain its former level of profitability through higher prices, which results in tax shifting onto consumers.

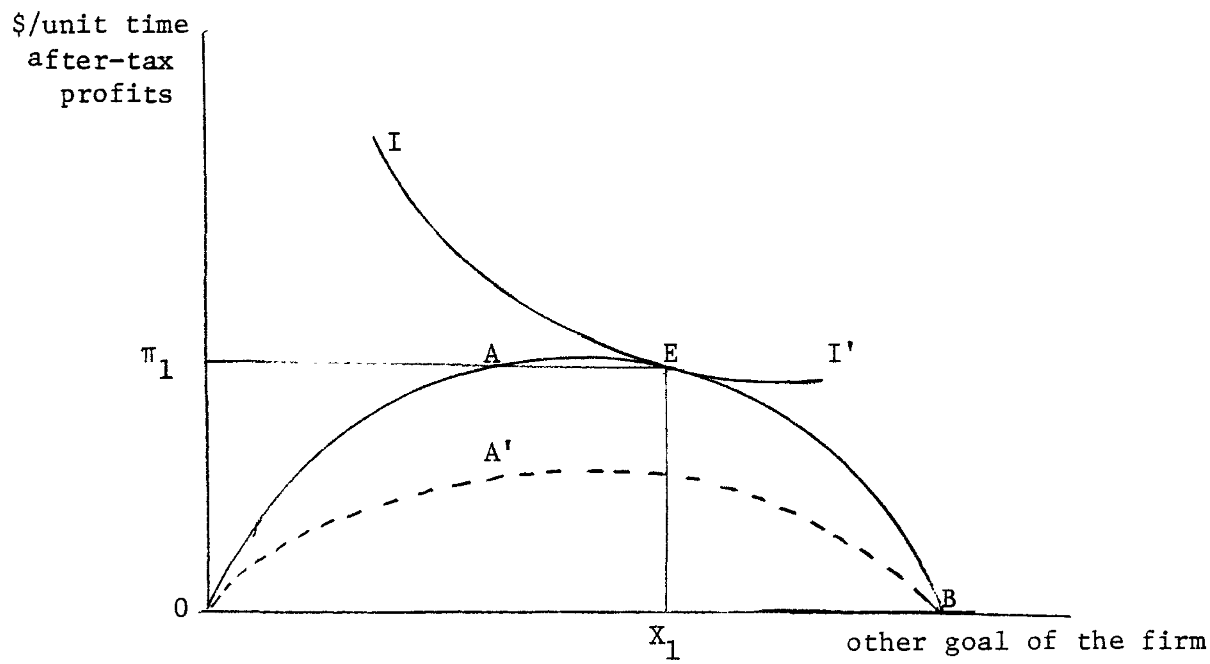
(d) Managerial Objectives and Utility Maximization

Another form of non-profit maximizing behaviour on the part of firms can be explained by models of managerial discretion. Among the most important works dealing with managerial objectives are the studies by Williamson (1967), Sebold (1970), Cauley and Sandler (1974, and Ballentine (1977). These studies are conducted in a utility maximization framework. Williamson specifies three different models: the staff model, the emoluments model, and the staff and emoluments model. In all these models the typical firm attempts to maximize its utility function subject to a minimum level of after-tax profits. The utility function is defined over after-tax profits and either a staff variable or an emoluments variable or both, depending upon the model used. Although Williamson's analysis does not lead to a conclusive set of results regarding tax shifting, he observes that profits taxes can be avoided by increasing expenditures on staff and emoluments.

In a similar framework Sebold examines the effect of the imposition of a profits tax on the behaviour of a utility-maximizing firm, where the firm's function is defined over the after-tax profits and "other goals" of the firm such as the revenue goal. This is shown in Figure II-2, below.

Figure II-2

Utility Maximization Model of the Firm




The curve II' is an indifference curve drawn on the basis of the managerial utility function. OAB represents possible combinations of net profits and other goals (such as the revenue goal) of the firm. A utility maximizing firm will operate at E, earning $\pi_1$ of pure profits and achieving $X_1$ of other objectives. Imposition of a profits tax will shift OAB downward to OA'B, implying a lower after-tax profits at various levels of "other goals". If the after-tax equilibrium of the firm (the point of tangency between OA'B and a lower indifference curve) is to the left of E on OA'B, then the firm will shift much of the tax burden through price adjustments, thereby raising before-tax profits. However, the tax may not be shifted or may be borne by the firm if the after-tax equilibrium lies below or to the right of E on the OA'B curve.

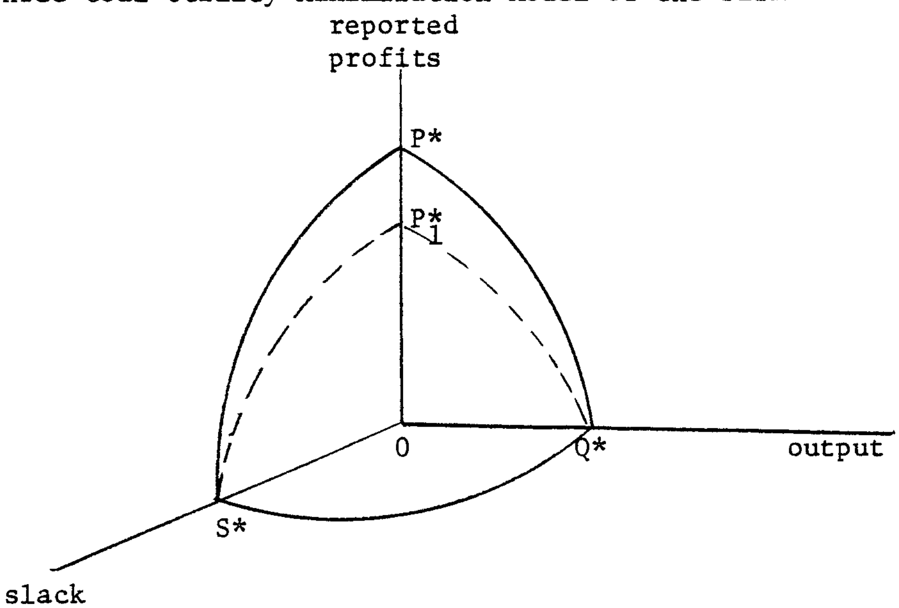
Sebold decomposes the impact of a higher profits tax into income and substitution effects. The income and substitution effects are found to have conflicting impacts on profits (before- and after-tax) and other objectives of the firm. Therefore, Sebold argues that "the overall shifting can be reasonably positive, negative, or absent, and that the sign as well as the degree of shifting depends on the relative strengths of the income and substitution effects of the tax-rate variation."[10]

Cauley and Sandler (1974) reach similar conclusions, using a three-goal utility-maximization model. They assume that the firm's peak coordinating unit attempts to maximize its utility function which is defined over reported profits, output level and management slack variable. Based on a three-dimensional diagram, such as Figure II-3 below, Cauley and Sandler define the goal-fulfilling constraint as P*Q*S*. Maximum utility is achieved at the tangency point between the constraint surface and the "peak coordinating unit's" indifference surface.

With the introduction of a profits tax, the goal fulfilling

Figure II-3

Three-Goal Utility Maximization Model of the Firm




constraint surface changes from P*Q*S* to $P_1$Q*S*. As shown, the maximum amount of output (Q*) and slack (S*) remain unchanged when the tax is introduced. However, the relative degrees of trade-off between profits and slack and between profits and output are affected by the tax.

Using the above diagrammatical exposition, Cauley and Sandler examine different cases of shifting ranging from zero-shifting to over-shifting. Accordingly, they conclude that on an <u>a priori</u> basis, nothing conclusive can be said about the incidence of the corporation income tax. They also argue that whether or not a particular firm decides to shift when the corporate income tax is raised, depends on a host of organizational and socio-economic factors.

Ballentine (1977) uses a similar non-profit maximizing managerial model in which he separates a tax that falls on pure profits from one that falls on normal profits. With regard to the tax that falls on pure profits, Ballentine's analyses and conclusions are similar to those of Sebold; that is, no specific answers can be obtained. However, if the tax falls on normal profits, Ballentine concludes, it is entirely borne by capital, i.e., the tax is paid out of the quasi-rent earned by fixed capital in the short run. All in all, therefore, the short-run incidence of the corporation income tax in Ballentine's model depends on the share of normal profits in total profits and the amount that the tax on pure profits is shifted.

It is appropriate to note that Ballentine's distinction between normal and pure profits in this context had originally been made much earlier by Brown (1954). Brown argues that a higher tax on profits could result in an upward shift in the firm's marginal cost curve if the tax falls on the working capital financed by issuing equities. This is the case when the tax laws do not allow for the deductibility of dividends paid out of profits.

The above reviewed studies are clearly based on partial-equilibrium models of an individual firm. It is assumed that, in the short run, demand conditions facing each firm remain constant regardless of how the government adjusts its revenue and expenditure patterns in the wake of a higher tax rate on profits. This assumption, in general, is valid only if the economy operates at full employment. As mentioned earlier, however, the relevance of full-employment models is limited for a study of the incidence and economic effects of policies involving the profits tax in modern economies.

## II.4 The Incidence of the Corporation Income Tax in the Long Run

Most public finance theorists seem to agree that the long-run effects of the corporate income tax depend on its short-run incidence.[11] For instance, even if the burden of the corporate income tax falls on profits in the short run, the long-run burden may be spread throughout the economy through changes in the stock of capital (or investment) and its accompanying effects. The long-run incidence and economic effects of the corporation income tax have been discussed in the context of both static and dynamic models. In a static model, total capital is fixed but it can be reallocated between the taxed and the non-taxed sectors. In a dynamic model, however, total capital stock and investment is likely to change in the wake of changes in the corporate income tax rate. The following section examines the long-run incidence of the corporate income tax in a static model. In the next section the issue will be studied in a dynamic model.

(a) The Long-Run Incidence of the Corporation Income Tax in a Static Model: The Harberger Model

Harberger (1962) uses a general equilibrium model to analyze the incidence of the corporation income tax. The use of a general equilibrium framework for incidence analysis had been emphasized by earlier economists such as Rolph (1954) and Musgrave (1959). Although these studies made important contributions to the development of incidence theory, they did not provide the comprehensive theoretical model that Harberger does.

Harberger presents a two-sector, two-commodity, two-factor, nine-equation model to examine the distributional effects of a tax on capital employed in the corporate sector, the revenue from which is used to finance a higher level of government expenditure. His model is characterized by perfect competition, full employment, fixed factor supplies, perfect factor mobility between sectors, linear homogeneous production functions, no fixed money assets, and identical spending habits for all economic units including the government.

Harberger emphasizes the importance of the long-run effects of the corporation income tax. In the short run, given his assumption, especially the assumption of full-employment equilibrium, the tax will be paid entirely out of earnings of capital in the affected industry. In response to a lower rate of return in the short run, capital moves from the taxed sector to the non-taxed sector. The long-run equilibrium is reached when net rates of return to capital are the same in both sectors.

Harberger measures the long-run incidence of a tax on capital in the corporate sector in terms of its effects on the price of capital ($P_K$). By solving his system of equations he arrives at the following expression:

$$dP_K = \frac{Ef_K\left(\frac{K_X}{K_Y} - \frac{L_X}{L_Y}\right) + S_X\left(\frac{f_L K_X}{K_Y} + \frac{f_K L_X}{L_Y}\right)}{E(g_K - f_K)\left(\frac{K_X}{K_Y} - \frac{L_X}{L_Y}\right) - S_Y - S_X\left(\frac{f_L K_X}{K_Y} + \frac{f_K L_X}{L_Y}\right)} T \qquad (2.3)$$

where, X represents the corporate sector, Y is the non-corporate sector, E is price elasticity of demand for X, $f_L$ and $f_K$ are initial shares of labour and capital in the X sector, respectively, $g_L$ and $g_K$ are initial shares of labour and capital in the Y sector, respectively, $L_X$, $K_X$, $L_Y$, $K_Y$ are the amounts of labour and capital, used in sectors X and Y, T is the amount of tax per unit of capital, $S_X$ and $S_Y$ are elasticities of substitution between labour and capital in sectors X and Y, respectively, and price of labour, $P_L$, is set at unity. Given the expression (2.3), the long-run incidence of a tax on capital in the corporate sector depends on factor intensities, factor shares, elasticities of substitutions and so on. Thus, various conclusions can be reached, depending on the values that these parameters take. Note that these long run conclusions are based on the model's implication that the tax burden falls entirely on earnings of capital in the short run, when capital in each sector is fixed.

In an attempt to give empirical content to his theory, Harberger obtains data on the above parameters and applies them to the expression for $dP_K$. His findings lead him to conclude that in the U.S. economy, capital bears very close to 100 per cent of the tax burden in the long run.[12]

The Harberger general-equilibrium model has been extended and elaborated by McLure (1969, 1970, 1971, 1975), Mieszkowski (1967, 1969), Shoven and Whalley (1972), and Anderson and Ballentine (1976). These studies have made significant contributions towards improvement of the original Harberger model. McLure has relaxed some of the restrictive assumptions of the original model such as perfect capital mobility and closed economy, and applied it to other factor and commodity taxes. Mieszkowski uses the Harberger model to study the differential incidence of equal yield taxes. Anderson and Ballentine extend the Harberger model by introducing imperfect competition into the analysis, and by assessing the tax against the firm's pure and normal profits. They specifically assume that firms in the corporate sector face downward sloping demand curves and maximize their pure profits subject to those demand conditions. Despite all these modifications, however, these authors obtain results similar to those of the original Harberger model.

One of the features of the Harberger model is that it is written in differential forms and it is useful only for an analysis of infinitesimally small tax changes. In such a case, the distortions caused by non-general taxes are presumably too small to worry about. However, problems arise when the Harberger model is used for the purpose of examining effects of significant tax changes, because the tax-induced distortions in the economy become too large to ignore.

To deal with the problem of significant distortions, Shoven and Whalley (S-W) (1972) have adopted an algorithm approach to compute the general-equilibrium solution for a two-sector model with and without a tax on capital in the corporate sector. The S-W model is a more general form of the Harberger model. S-W allow for flexible factor supplies and pre-existing taxes. Their results are mixed. Depending on the magnitude of various elasticities and other parameters, capital could bear the full burden of the tax or could shift part of it to labour. However, when S-W use U.S. data similar to those used by Harberger they obtain results very close to his.

One of the major shortcomings of the Harberger-type models is that they fail to deal with effects of the tax changes on savings, investment, and economic growth. It is generally accepted that a reallocation of capital between the taxed and non-taxed sectors, as suggested in the Harberger model, must take place in a growing economy through diversion of new capital formation into the non-taxed sector instead of the taxed sector. As we shall see below, dynamic incidence analyses allow for these adjustments to take place.

(b) The Long Run Incidence of the Corporation Income Tax in a Dynamic Model

In dynamic incidence studies the long run adjustments to the tax come through changes in savings, investment, and capital stock. This is in sharp contrast with the Harberger-type models where the tax is assumed not to affect these variables. The analysis of the incidence of profits tax is in a dynamic content was first conducted by Krzyzaniak (1967). In this study and his follow-up articles, Krzyzaniak uses a neoclassical growth model to examine the effects of general and non-general taxes on profits. These studies are primarily designed to determine the long-run incidence and shifting of the corporate income tax. Generally speaking, Krzyzaniak concludes that the short-run burden of a non-general tax on profits falls on profits, but in the long run, capital avoids this burden through adjustments in new capital formation arising from the tax-induced effects on aggregate savings. The extent of the shifting of the tax burden, he argues, depends on the elasticities of substitution between factors and between products and on factor share parameters embodied in the production function.

Similar conclusions have been reached by Sato (1967) and Feldstein (1974). Using a Cobb-Douglas production function and assuming neutral technical change, Sato shows that the burden of a higher tax on corporate profits is shared between capital and labour. In his words: "while capital gradually shifts its initial burden of the profit tax, labour is forced to share more and more of such burden."[13] Similarly, Feldstein shows that with reasonable values for elasticities and factor share parameters, a higher tax on profits can result in substantial reduction in labour's share.

In another dynamic study, Ballentine (1978) suggests that long-run adjustments to a change in the corporate income tax do not come only through aggregate savings. Another way in which the tax could affect investment and capital formation and result in long-run shifting is through a change in the price of investment goods. Ballentine argues that these two effects tend to reinforce each other. Using a two-sector growth model, he shows that even if savings are assumed to be constant, 15 to 30 per cent of the corporate tax burden may be shifted in the long run due to higher prices of investment goods.

Clearly, these studies of long-run incidence of the corporate income tax conclude that the tax is not borne entirely by capital. Instead, the burden of the tax is spread throughout the economy and is borne by all economic agents, i.e., investors, workers, and consumers. This conclusion suggests that the corporation income tax is not as progressive as it would be if it were to be paid out of earnings of capital.

To summarize, the existing studies on the short-run shifting of the corporate profits tax are mostly partial equilibrium. The authors examine the effects of a higher profits tax for an individual firm and then generalize their results for the economy as a whole. The key assumption in all these studies is that demand conditions are taken to be constant in the short run, regardless of what the government does with its extra revenues when the tax is raised, or how it responds to its loss in revenues when the tax is reduced. Generally speaking, this assumption is valid for a competitive economy only if the economy is like the short-run version of Harberger's (1962) model with its full-employment equilibrium feature. However, the full-employment assumption is inconsistent with the workings of modern capitalist economies for which these studies purport to have relevance. We believe that the question of the shifting of the corporate profits tax has to be studied in the context of a macroeconomic model where the economy can be at rest below the full-employment position. In such a framework the incidence results of a higher tax on profits depend on what the government does with the extra tax revenues. This is shown by Asimakopulos and Burbidge (as reviewed in Section II.1) in the context of a Kaleckian macromodel. We shall demonstrate the same point in Chapter 4, using a conventional IS-LM macromodel.

FOOTNOTES

1. The term "short-run" in this study refers to a time period during which changes in capital stock (plant and equipment) can be neglected.

2. The term "shifting" refers to the process of transmission of the tax burden through price adjustments, from its impact point (the place of statutory incidence) to its final resting point (the place of economic incidence). See Musgrave and Musgrave (1980), p. 260.

3. See Burbidge (1976), p. 220.

4. Goode (1951), p. 48.

5. The second order conditions must also be met. In other words, the MC curve must cut the MR curve from below ($\frac{d^2\pi}{dQ^2} < 0$).

6. See Musgrave and Musgrave (1980), pp. 403-407.

7. See Scherer (1970), ch. 5.

8. Baumol (1958), p. 187.

9. See Hall and Hitch (1939).

10. Sebold (1970), p. 371.

11. Ballentine (1980), p. 11.

12. Harberger (1962), p. 234.

13. Sato (1967), p. 354.

# CHAPTER THREE

## Review of the Econometric Literature

### III.1 Introduction

Despite numerous econometric studies on the short-run shifting of the corporate income tax, the issue is still controversial.[1] The results of these studies range from full shifting proposed by Krzyzaniak and Musgrave (1963) to zero shifting suggested by some of their critics, as we shall see below.

These studies have been conducted either for the entire corporate manufacturing sector or for selected industries or both. They use a "rate-of-return approach" or a "factor-share approach". In the former, the rate of return is expressed as a function of various variables, including a tax on corporate profits. The coefficient pertaining to this variable is considered to indicate the degree of shifting. The factor-share approach examines the effects of the tax on factor shares as a measure of shifting.

A fundamental problem with the existing econometric studies on the short run shifting of the corporate income tax is that they do not allow for the government's response to the tax change. Thus, they seem to have been particularly based on the partial-equilibrium models reviewed in Chapter 2, which rest on the full-employment equilibrium assumption. However, the authors include some Keynesian cyclical variables in their regression equations to explain the rate of return in the corporate sector. The inclusion of these variables in the regression equations implies that the authors implicitly assume significant changes in aggregate demand in their sample periods, an assumption which is totally inconsistent with their underlying theory.

Regardless of this apparent inconsistency, we believe that since aggregate demand and cyclical variables are very important for studying the effects of profits taxes, as is recognized in the econometric literature, the issue should be examined in some sort of Keynesian model and the results should be interpreted accordingly. To substantiate these points, we now turn to review some of the major econometric studies on the short run shifting of the corporate income tax for the U.S. and Canada. The U.S. studies are reviewed first for chronological consistency. This chapter concludes with a critique of this empirical evidence.

## III.2 U.S. Studies

### (a) The Krzyzaniak-Musgrave Study

Among the best known econometric studies of the short-period shifting of the corporate income tax is the one by Krzyzaniak and Musgrave (K-M) (1963). These authors broke fresh ground by introducing an econometric analysis of the corporate profits tax, moving away from the early empirical work on the subject by Lerner and Hendriksen (1956), Ratchford and Han (1957), and Adelman (1957).

In their study, which covers the years 1935-42 and 1948-59, K-M attempt to measure the degree of tax shifting in U.S. manufacturing in the short run. K-M specify a behavioural equation for the rate of return to capital;

$$Y_g - Y' = a(\frac{T}{K}) \qquad a > 0 \tag{3.1}$$

where $Y_g$ is gross rate of return to capital, $Y'$ is net rate of return, T is corporate tax liabilities, and K is value of capital in the corporate sector. This equation implies that the corporation increases its gross rate of return by a constant fraction, a, of the ratio of tax liabilities to capital. The parameter "a" is said to indicate the degree of tax shifting. If "a" is between zero and unity, the corporation recoups part of the tax, if it is greater than unity, after-tax profits are higher and the corporation increases its gross profits by more than the amount of the tax. Expanding (3.1) to include non-tax determinants of the rate of return, K-M specify the following equation.

$$Y_g = a_0 + a_1\Delta C_{-1} + a_2V_{-1} + a_3J + a_4L + a_5G + a_6L_{-1} + \text{error term} \tag{3.2}$$

where C is private consumption expenditures standardized by gross national product (GNP); V is the ratio of inventories to sales in manufacturing; J is the ratio of tax accruals other than corporate taxes minus government transfers to GNP; G represents government expenditures standardized by GNP; and L is the ratio of corporate tax liabilities (T) to capital stock at the beginning of period. The a's are coefficients to be estimated, $\Delta$ is the one-period differencing operator and subscript -1 implies a one period lag. Since the tax variable, L, is not independent of the error term, K-M use the effective rate of the corporate income tax ($Z^*$) as a proxy for L.

In order to measure the degree of shifting, K-M formulate an index, S, as

$$S = \frac{Y_g - Y'}{Z^* Y_g} . \qquad (3.3)$$

S measures the ratio of gross gain from raising the gross rate of return, to actual taxes paid. It can be shown easily that S coincides with the estimated coefficient of the tax variable in the rate of return equation.

The OLS estimates of the "standard model" for the corporate manufacturing sector for the period 1935-42 and 1948-59 are as follows. The figures in brackets are t-values.

$$Y_g = .286 + \underset{(2.67)}{.404\Delta C_{-1}} - \underset{(-3.00)}{.527V_{-1}} - \underset{(-4.72)}{.833J} + \underset{(12.22)}{1.34L} \qquad (3.4)$$

$$R^2 = .953 \quad \text{D-W} = 2.76 \quad \text{shifting measure} = 134\% .$$

The variables G and $L_{-1}$ are eliminated from the standard model, as they are found not to be significant at the 5 per cent level. The estimated coefficient of L reveals the measure of shifting to be about 134 per cent.

K-M estimate their standard model under several different assumptions and in all cases, except one, the results show shifting significantly in excess of 100 per cent. In the case where the data were adjusted for inflation, the degree of shifting dropped to 78 per cent.

In view of their results, K-M conclude that the corporation income tax is similar to a sales tax and is shifted forward to consumers in the form of higher prices, in the short run. Thus, there will be no depressing effects on investment and hence, long-run shifting will not be significant. Further, they argue that there is no symmetrical shifting in the short run when the corporate income tax is reduced.

The K-M study has been criticized mainly on the choice of the independent variables in their model. K-M argue that: "... in order to obtain an adequate explanation of $Y_g$, variables had to be looked for which are highly correlated with $Y_g$, but not with each other. Experimentation led to ... [our equation]."[2] In view of this quotation, it is obvious that K-M are concerned to present a model with considerable explanatory power. One might even argue that in this quest they have disregarded their underlying macromodel. Such being the case, their equation for $Y_g$ may not be consistent with their macromodel specifically, or with any macromodel in general.

Slitor (1966) and Goode (1966) criticize the K-M model because it fails to incorporate some very important explanatory variables. Furthermore, they state that during the period covered by the K-M study the effective corporate tax rate ($Z^*$) moved in the same direction as the business cycle. Thus, the degree of shifting in the K-M model is overestimated; that is, the tax variable picked up the effects of some variables which are not included in the model.

Slitor takes the K-M "standard model" and adds to the right-hand-side variables a pressure variable defined as the ratio of actual to potential GNP. He then estimates this model, using the OLS technique, and observes that the shifting parameter falls by 47 percentage points. Moreover, he substitutes the pressure variable for $\Delta C_{-1}$ or $V_{-1}$ in the K-M model and observes that the measure of shifting falls by even more.

Goode also claims that the tax shifting parameter in the K-M model is overestimated. He takes the "standard model" and replaces the tax variable with the pressure variable (introduced by Slitor). Estimating this model by OLS, Goode observes that the estimates are very close to those of the original K-M model. Furthermore, he demonstrates that even is the tax rates remained unchanged, the K-M model would imply that the estimated rate of return during 1936-39 (a depression period) is higher than in 1955-57 (a boom period). On these grounds, Goode concludes that in the short run the corporate profits tax is largely paid out of profits.

In reply to Slitor and Goode, K-M (1966) admit that the pressure variable is important in explaining the rate of return, but since it is endogenous, the OLS results obtained are inconsistent. K-M also argue that the corporate income tax rate is highly correlated with the pressure variable and therefore the coefficient of the latter represents part of the tax effect on the dependent variable. Finally, K-M demonstrate that Goode's model fails to explain the rate of return for the period 1927-29. Therefore, they cast doubt on the accuracy of Goode's conclusions for the years 1936-39 and 1955-57.

In a paper by Cragg, Harberger, and Mieszkowski (1967) (C-H-M) the authors also argue that the K-M model is misspecified. They claim that in the time series for 1935-42 and 1948-59 there is a spurious relation between the corporate tax rate and gross rate of return on capital for U.S. manufacturing. To allow for this, C-H-M add to the K-M model two more variables, namely the unemployment rate and a dummy variable for the mobilization and war years. With these variables added, they apply OLS to the K-M model and observe that the tax parameter falls drastically and becomes statistically insignificant. Accordingly, C-H-M conclude that the short run burden of the tax falls entirely on capital.

In their reply, K-M argue that since the employment rate is a dependent variable, the C-H-M results are biased and inconsistent. Further, K-M use the employment rate and the dummy variable separately in their model and, using the OLS technique, observe no significant changes in their original results. They also notice that the coefficient of the dummy variable is not significantly different from zero. Thus, K-M claim that shifting in war years does not differ significantly from the peace years. Such being the case, K-M add the employment rate to their model and estimate it, using OLS, for the years 1935-42 and 1948-59. Again, they find the tax parameter to be above unity.

Another major criticism of the K-M study is by Gordon (1967) who claims that the K-M model not only excludes cyclical variables, but also fails to incorporate the effects of rising productivity on the rate of return over the period covered. Gordon's work will be discussed in detail, shortly.

As demonstrated above, the controversy between K-M and their critics is centered around the inclusion and exclusion of Keynesian cyclical variables in the rate of return equation. Although the discussion does not settle the question of the short-run shifting of the corporate income tax, it reveals that all the authors involved seem to accept the importance of cyclical variables in explaining the rate or return ($Y_g$). In spite of this, however, none of the authors works out the effects that one would expect in a Keynesian model or interprets the empirical results in the context of a Keynesian framework or any other framework where cyclical effects are important. Note that, in a Keynesian world the short-run shifting of the corporate income tax depends on how the tax revenues are used. This point is shown by Asimakopulos and Burbidge (1974) in a Kaleckian model as reviewed in Chapter 2. We shall demonstrate the same point in Chapter 4, in the context of a conventional IS-LM model.

(b) The Gordon Study

Gordon (1967) employs a mark-up pricing model for a representative firm. He claims that the firm attempts to maintain some specified mark-up over its costs rather than maximize its profits. Thus, the mechanism by which shifting takes place is by prices being pushed up relative to costs.

Gordon starts his theoretical section by specifying a total cost function for the representative firm, where he distinguishes between costs of production workers, non-production workers, and raw materials. He then calculates the price of output for the representative firm (P) as a product of its average total cost at capacity output and a mark-up factor. Then on the assumption that the ratios of unit cost of production workers and non-production workers to the "general price index" ($P_g$) are constant, he arrives at a profit function for the representative firm as follows;

$$\pi = a_1(\frac{R}{h}) + a_2(\frac{R^*}{h}) \qquad (3.5)$$

where $\pi$ is gross pre-tax profits in manufacturing, R is actual sales,

$R^*$ is total sales at capacity output, h is the ratio of output price to the general price index ($h = P/p_g$), and a's are parameters to be estimated. He then specifies two versions of the above equation; when $\pi$ is standardized by K (total assets), and one in which $\pi$ is standardized by R. Adding two more explanatory variables, $\frac{\Delta Q}{Q}$ and $\frac{\Delta P}{P}$ and incorporating a shifting parameter ($a_5$) into these equations, Gordon obtains two equations, one of which is as follows;

$$\frac{\pi}{K} = a_1\frac{R}{(1-a_5t_\pi)hK} + a_2\frac{R^*}{(1-a_5t_\pi)hK} + a_3\frac{\Delta P}{(1-a_5t_\pi)P} + a_4\frac{\Delta Q}{(1-a_5t_\pi)Q} + \frac{D}{(1-a_5t_\pi)K} \qquad (3.6)$$

where $\pi$ is gross before-tax profits, $t_\pi$ is the corporate profits tax rate, P is output price, Q is level of output, and D represents depreciation, depletion and interest paid. $\frac{\Delta P}{P}$ represents the effects of price changes on the inventory valuation of profits. $\frac{\Delta Q}{Q}$ is included to allow for the business cycle effects. In other words, if wages lag behind prices in the initial stages of an economic boom, and rise faster later, profits will vary directly with $\frac{\Delta Q}{Q}$ . A similar equation can be derived when $\pi$ is standardized by R.

Gordon estimates the rate of return equation (3.6) for the period 1925-1962, excluding the war years. He uses an iterative method for estimation. His results indicate that the tax shifting parameter ($a_5$) is not significantly different from zero at the 1 per cent level. Thus, Gordon concludes that there has been no short-run shifting of the corporation income tax for the period covered in the study.

Furthermore, Gordon extends his analysis to examine the shifting of the tax at the industry level. The rate of return and income share equations are applied to 10 two-digit industries. In general, the industry results, too indicate no evidence of tax shifting. In his words; "Thus, the aggregate and industry equations tell a consistent story - tax shifting in manufacturing is not significantly different from zero ...".[3]

Gordon's work has been criticized on several grounds. Mieszkowski (1969) and Sebold (1970) claim that the shifting parameter in Gordon's study is biased toward zero because the output price is assumed to be invariant to the tax. More specifically, Sebold argues that Gordon essentially relates the price level to the input cost of labour and material. The price of output is not related to the tax and therefore Gordon's analysis can not lead to either forward or backward shifting.

Oakland (1969) argues that Gordon's model can be constructed under any theory of the firm, given his assumptions about costs. Therefore, he maintains, the mark-up pricing behaviour is a redundant assumption in Gordon's study.

Finally, K-M (1968) claim that the use of the endogenous variables $\frac{\Delta Q}{Q}$ and $\frac{\Delta P}{P}$ on the right hand side of Gordon's equations imparts a downward bias to the estimates of the shifting parameter. Gordon, however, rejects this claim by showing that even when these variables are omitted from the rate of return equation, the estimates turn out to be the same, indicating zero shifting of the corporation income tax in the short run.

(c) The Oakland Study

Oakland's (1972) model is based on the standard assumption that firms are competitive. He assumes that realized gross profits ($\pi_g$) fluctuate around "normal" profits in response to the business cycle. He also assumes that normal profits are determined by the value of capital stock and the rate of return, where the rate of return itself depends on capital intensity and technology represented by a technological parameter. On the basis of these assumptions and after the introduction of a tax variable, Oakland obtains the following equation.

$$\log \frac{\pi_g}{rK} = a_1 + a_2 \log M + a_3 \log A + a_4 \log CAP + a_5 \log CAP_{-1} + a_6 \log (1-t_\pi) \qquad (3.7)$$

where $\pi_g$ is gross pre-tax profits, rK is the value of capital, M is the labour-capital ratio, A represents the state of technology, CAP is the level of capacity utilization, and $t_\pi$ is the tax rate on gross profits.

Oakland estimates the above euqation for U.S. manufacturing for the period 1930-1968. The OLS estimates indicate that the shifting coefficient is not significantly different from zero. Accordingly, Oakland concludes that in the short run the entire burden of the tax falls on profits.

(d) The Dusansky Study

Dusansky (1972) examines the short-period shifting of the corporation income tax in U.S. manufacturing, using a model based on multi-goal behaviour of the firm. It is assumed that firms attempt simultaneously to achieve a profit goal, a sales effectiveness goal and an inventory goal.

Dusansky formulates the following equation for the gross rate of return (R);

$$R = a_0 + a_1\frac{I}{S} + a_2\frac{Pm}{P} + a_3\frac{W}{P} + a_4 0 + a_5\frac{L}{K} + a_6\frac{GNP_a}{GNP_p} + a_7\frac{T}{K} \tag{3.8}$$

where, $\frac{I}{S}$ is the inventory-sales ratio, Pm is the material price index, P is the aggregate price level, W is the annual wage rate, 0 is annual percentage change in output per man, $\frac{L}{K}$ is the labour-capital ratio, $\frac{GNP_a}{GNP_p}$ is the ratio of actual to potential GNP, and $\frac{T}{K}$ is the ratio of corporate income tax liabilities to capital stock. The coefficient of $\frac{T}{K}$ in the above equation serves to measure the degree of short-run shifting.

Dusansky treats his rate of return equation as part of a 16-equation fully specified macromodel. Using the conventional two-stage least square technique, he estimates the model for the entire period 1952-62 and also for two subperiods, by eliminating the World War II years. In all these cases, the coefficient of the tax variable is found to be above unity and statistically significant at the one per cent level, implying full short-run shifting of the corporation income tax.

By and large, the empirical investigators of the short-run shifting of the corporation income tax regard the studies by Gordon, Oakland, and Dusansky to be successful attempts to tackle the deficiencies of the K-M model. Oakland introduces some pressure variables in the rate of return equation and Gordon goes even further to allow for non-profit maximizing behaviour of the representative firm. On top of these, Dusansky attempts to remove the alleged simultaneous equation bias in estimating the rate of return equation. We do not intend to discount these improvements over the original K-M model, but, as we shall argue later, these improvements fail to resolve the fundamental theoretical problem from which these studies suffer; they all lack a macro framework for understanding what determines aggregate profits and they assume (implicitly) that what is done with the extra revenues as a result of a higher tax rate has no impact on the results obtained.

(e) The Kilpatrick Study

The fundamental assumption underlying the Kilpatrick (1965) study is that in any industry, short-run forward shifting (viewed by him as an increase in price relative to the wage rate) has a direct relationship with the industry's monopoly power. Industries with no monopoly power can not change their profits rates and hence fail to shift the tax. By the same token, one industry with more monopoly power than another is able to shift the tax to a greater extent.

Kilpatrick specifies the following basic equation

$$\frac{P_1}{P_0} = a_0 + a_1 C \tag{3.9}$$

where, $P_1$ is the industry before-tax profit rate after the tax is raised, $P_0$ is the industry profit rate in the absence of the tax, and C is the industry concentration index and its coefficient, $a_1$, indicates whether or not short-run forward shifting occurs. He argues if $C = 0$, then $a_0 = 1$; that is, the industry can not shift the tax at all $(\frac{P_1}{P_0} = 1)$.

Kilpatrick adds to the right hand side of his basic equation several other variables such as the profit rate in the absence of the tax, the percentage change in the industry's shipments $\frac{Z_1}{Z_0}$, changes in the concentration index, changes in productivity, the share of shipments in unincorporated industries, factor cost variable, and so on. Subsequent tests of the independent variables, however, lead him to drop all but C, $P_0$, and $\frac{Z_1}{Z_0}$. His final equation is

$$\frac{P_1}{P_0} = a_0 + a_1 C + a_2 P_0 + a_3 (\frac{Z_1}{Z_0}) . \tag{3.10}$$

Using a cross-section analysis, Kilpatrick estimates the above equation for more than 100 U.S. manufacturing industries for the periods 1947-49, when the corporate income tax rate was 38 per cent, and 1955-57 when the tax rate was 52 per cent. He carries out regressions for five alternative pairs of years, using OLS technique. In all these cases, the estimated coefficient of the concentration index is found to be significantly greater than zero at the one per cent level, indicating the existence of the short-run forward shifting of the tax.

To measure the degree of tax shifting, Kilpatrick computes the ratio of the annual change in profits to the corresponding change in tax liabilities for each industry separately. Then, he calculates a weighted average of these measures to arrive at the degree of shifting for manufacturing as a whole.

The degree of shifting thus estimated varies widely, depending on the pairs of years and the tax rates used. Using the statutory tax rate, the degree of shifting ranges from 62 per cent for the 1949-1954 pair to 100 per cent for the 1948-1955 pair. When the effective tax rate is used, the degree of shifting ranges from 75 per cent for the 1949-1954 pair to 126 per cent for the 1948-1955 pair. At the industry level Kilpatrick finds that the degree of shifting ranges from 16 per cent for the least concentrated industries to 211 per cent for the most concentrated industries.

On the basis of his estimates, Kilpatrick concludes that there is sufficient evidence of significant short-run forward shifting of the corporation income tax in U.S. manufacturing.

Kilpatrick's study has been criticized for two reasons. First, the $R^2$ values are low, even by cross-section standards, and indicate that the right-hand-side variables explain only 19 to 33 per cent of the change in the dependent variable. This indicates that there are other variables influencing the dependent variable which are not included. If so, introduction of them might significantly alter the estimates and hence the shifting evidence. Secondly, as Gordon shows, the zero concentration-zero shifting assumption is not valid. By regressing the average rate of tax shifting on the concentration index for 10 industries, Gordon (1968) produced evidence against this assumption. More specifically, he shows that the average rate of tax shifting for all manufacturing is not significant and it is negative for relatively more competitive industries.

(f) The Hall Study

Hall (1964) develops an alternative approach to the study of the short-run shifting of the corporate income tax. His technique consists of two stages. In the first stage, he computes the contribution of technical change to the growth of output per man, using Solow's (1957) method, with the assumption of Hicks neutral technical change. In the second stage, Hall regresses the output per man-hour adjusted for technical change, on capital per man-hour under three different shifting hypotheses; (i) the tax is borne by capital (reflected in a lower share of capital in output), (ii) the tax is fully shifted forward onto consumers via a higher output price, and (iii) the tax is fully shifted backward onto labour (reflected in a lower share of labour in output).

Hall estimates his equations for the period 1919-59, using OLS. His estimation results show that the regression with the no-shifting assumption produces the best fit. Therefore, on the basis of the goodness of fit, he concludes that in the short run higher corporate income taxes fall entirely on capital.

In criticizing Hall's work, Levesque (1965), Slitor (1966), and Mieszkowski (1969) argue that the goodness of fit can not be a good criterion for accepting or rejecting any hypothesis, particularly if the difference in $R^2$ values is not significant. Specifically, Mieszkowski, argues that when the value of dependent variable itself varies with the shifting hypothesis, the value of $R^2$ is not a reliable criterion. Instead, he suggests that one should look at the sum of squared residuals.

Another deficiency in Hall's work is pointed out by Levesque

(1967). He argues that while Hall's model is based on the perfect competition assumption, the shifting hypotheses tested are compatible only with imperfect competition. This criticism is justifiable only if one believes in the traditional incidence theory. In general, however, shifting and perfect competition are not incompatible.[4]

(g) The Turek Study

The study by Turek (1970) is an extension of Hall's work. Turek estimates technical change simultaneously with the tax effect on the relative factor shares. The tax rate is used explicitly as an independent variable and the possibility of non-neutral technical change is allowed for.

Turek starts her analysis with the assumption that each factor receives the value of its marginal product according to a CES production function. She also assumes that the efficiency of labour and capital grow over time at a constant rate. Turek then derives the factor-share ratio as a function of capital-labour ratio and the ratio of efficiency of capital to the efficiency of labour. After introducing a corporate income tax rate, she adds cyclical variables into her regression equation in an ad hoc manner and then makes a log transformation. Turek's final regression equation is

$$\ln\left(\frac{W}{R}\right) = \ln\delta + \upsilon \ln(1-t_{\pi}) + \rho\ln\left(\frac{E_K(0)K}{E_L(0)L}\right) + \rho(\phi - \lambda) - a\ln \nu + b\ln\left(\frac{U}{U_{-1}}\right) + D \ln k + \text{error term} \tag{3.11}$$

where W and R are shares of labour and capital in output, respectively, $\rho = \frac{1-\sigma}{\sigma}$, where $\sigma$ is the elasticity of substitution, $t_\pi$ is the corporate income tax rate, $E_K$ and $E_L$ are efficiency values of capital and labour, respectively, $\phi$ and $\lambda$ are growth rates of $E_K$ and $E_L$, respectively, $\frac{K}{L}$ is the capital labour ratio, U is the unemployment rate and represents the business cycle, D is a dummy variable used to account for a change in classification of National Income and Product Accounts in 1947, and $\nu$ is a parameter representing the degree of tax shifting.

Turek estimates her model for U.S. manufacturing for the period 1935-65, using OLS. She uses three definitions of the tax rate; the statutory tax rate, statutory tax rate plus the excess profits tax rate and the effective tax rate. Her empirical results show that in all cases, the tax shifting parameter is very small and statistically insignificant at the 5 per cent level. Accordingly, she concludes that the corporation income tax is not shifted in the short run.

This concludes the survey of the econometric studies on the short-run shifting of the corporation income tax for U.S. manufacturing. In all these studies, the authors seem to have accepted the importance of the Keynesian cyclical variables in explaining the rate of return. In spite of this, however, the authors think and interpret their results in terms of a partial-equilibrium model of single firm or industry, in that they have not worked out a consistent framework in which tax changes occur and business cycle effects are possible. We believe that this theoretical inconsistency casts serious doubts on the validity of the conclusions of the above reviewed studies.

## III.3 Canadian Studies

The econometric studies on the short-run shifting of the corporation income tax for Canada are very few. In fact, there are only three such studies, namely those by Levesque (1965), Spencer (1969), and Dusansky and Tanner (1974). These authors have basically applied some of the models developed for the U.S. economy to the Canadian economy. We now discuss each of these studies in turn.

### (a) The Levesque Study

Levesque (1965) studies the short-period shifting of the corporation income tax for Canada in a model similar to Kilpatrick's model discussed in the previous section. He claims 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 rate of return should be observed in favour of the former industries as a result of higher tax rates".[5] To test this hypothesis, Levesque relates the change in the gross rate of return in an industry to variables such as the concentration ratio, capital intensity, and capital structure of the industry in question. Focusing on the concentration ratio, he argues that short-run shifting takes place if, during a period when the corporate income tax rises, the percentage increase in the rate of return is positively related to the industry's concentration rate.

Levesque also hypothesizes that "if some industries have a smaller amount to shift per dollar of output relative to others (ie, 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".[6] To test this hypothesis, Levesque specifies regression equations relating the change in the price of output to variables such as concentration ratio, capital intensity, capital structure and so forth.

Levesque applies his models (the rate of return equations and the price equations) to a sample of 31 Canadian industries using cross-sectional data for different pairs of years during the period 1948-52. This period is chosen because (a) it covers a full business cycle with a peak in 1948, a through in 1949, and a peak in 1951, and a through again in 1952, (b) the corporate income tax increased significantly during this period - from 30 per cent in 1948 to 52 per cent in 1952, and (c) the Korean war boom (early 1950's) provided a good opportunity for businessmen to shift the tax.

From the OLS estimates of the rate of return equations, Levesque reaches two main conclusions. First, he finds the coefficient of the concentration ratio to be constantly positive and always significant at the 5 per cent level. Accordingly, Levesque concludes that the more concentrated industries would increase their rate of profit relative to that of the less concentrated industries during a period when the tax on corporate profits is raised - a higher proportion of the tax will be passed on by more concentrated industries, in the short run. Second, Levesque finds that the coefficient of the capital intensity variable is negative and statistically significant at the 5 per cent level. Thus, he concludes that more capital intensive industries are not as successful as less capital intensive ones in raising their rate of return in order to maintain their after-tax earnings.

As for the price equation, the OLS estimates indicate that the coefficient of the capital intensity variable is always positive and statistically significant at the one per cent level. Therefore, Levesque concludes that capital intensive industries show a greater relative increase in their prices vis-à-vis non-capital intensive industries.

To measure the degree of short-run shifting, Levesque computes various indexes on the basis of (i) estimated cross-sectional data on the rates of return in different industrial groups for the period 1948-52 and (ii) time-series data on rates of return and relative shares of profits in national income for all manufacturing for the period 1947-62. In all cases Levesque finds a significant degree of tax shifting, in the order of 70 per cent. He also concludes that tax decreases tend to be shifted but to a lesser extent than tax increases.

Levesque's study is subject to the same shortcomings as the Kilpatrick work discussed in the previous section; that is, it is criticized for low $R^2$ values and the zero-concentration zero-shifting assumption.

(b) The Spencer Study

Spencer's (1969) approach is similar to the K-M approach discussed in the preceeding section. He examines the short-period shifting of the corporate income tax in the Canadian manufacturing sector for the period 1935-1964. Spencer's model takes the following form;

$$Y = a_0 + a_1\Delta C_{-1} + a_2V_{-1} + a_3J + a_4X + a_5G + a_6L + a_7L_{-1} + a_8P_r \tag{3.12}$$

where, Y is the rate of return, C is private consumption expenditures standardized by gross national product (GNP), V is the ratio of inventories to sales in manufacturing, J is the ratio of tax accruals (all governments) other than corporate taxes, less government transfers, to GNP, G is government expenditures standardized by GNP, X is the ratio of merchandise exports to GNP, $P_r$ is the ratio of actual to potential GNP, L is the tax variable defined by the actual tax payment divided by capital stock,

$\Delta$ is the one-period differencing operator and the subscript -1 implies one period lag.

Spencer estimates the above model by the instrumental variable technique, using the statutory tax rate as a proxy for L. During the course of estimation, he eliminates some of the explanatory variables for reasons of insignificance and collinearity. In particular, he drops G because its coefficient is not significantly different from zero at the 5 per cent level. Note that K-M drop this variable from their model because of its collinearity with the tax variable. Spencer also finds that exclusion of the pressure variable ($P_r$) from the model does not significantly change the degree of shifting. On these grounds, Spencer claims that the tax influence on the rate of return in his model is not "contaminated" by the effects of government expenditures and the business cycle. Having found the coefficient of L to be significantly different from zero at the 1 per cent level, Spencer concludes that "... short-run burden of the corporation income tax on the profits of manufacturing corporations in Canada is approximately completely shifted".[7]

The Spencer study is subject to criticisms similar to those already mentioned in connection with the K-M study.

(c) The Dusansky-Tanner Study

The study by Dusansky-Tanner (D-T) (1974) is a straight application of the Dusansky model for U.S. manufacturing to the Canadian economy for the period 1935-65. Since a summary of the Dusansky model was presented in the previous section we do not repeat it here. The empirical results of the D-T study include 2SLS estimation of the rate of return equation under assumptions of (a) exogenous wage rate, (b) endogenous wage rate, and (c) deletion of war years (1940-45) from the estimation period. In all these cases, the coefficient of the tax variable is significantly different from zero at the 1 per cent level. The degree of short-run shifting indicated by this coefficient is between 54% and 126%. In their words, D-T conclude that, "These findings ... indicate very strongly that about three-fourth of the Canadian corporate-profits tax liability is shifted".[8]

The Canadian studies just reviewed suffer from the same fundamental theoretical problem as the U.S. studies. In spite of the fact that they follow a Keynesian approach, the authors think and interpret their results in terms of a partial-equilibrium model of a single firm or industry. Below, we shall elaborate on this point.

## III.4 A Critique of the Econometric Literature

In Sections III-2 and III-3 above, we described and reviewed some of the major econometric studies on the short-run shifting of the corporate income tax for Canada and the U.S. For each study, we mentioned some of the most common criticisms concerning the problem of specification error and a biased estimation technique. Although valid, these criticisms are not fundamental and, hence, do not lead to any resolution regarding the shifting and incidence of the corporation income tax.

A fundamental problem with these studies is the lack of a well-defined underlying theory. On one hand, the authors conduct their analyses of the short-run shifting of the corporate income tax without any reference to how the government responds to higher tax revenues when the tax is raised. Such being the case, the authors seem to have based their studies on the partial-equilibrium or general-equilibrium full-employment frameworks discussed in Chapter 2. Under these conditions, a higher tax on profits will be paid out of profits, regardless of what the government does in response to the tax change. The government does not influence aggregate demand one way or another, as it is always fixed at the full-employment level. On the other hand, the authors include some Keynesian cyclical variables in their regression equations to explain the rate of return. Thus, the tax change is assumed to affect aggregate demand in the economy, an assumption which is inconsistent with their underlying theory. Regardless of this apparent inconsistency however, one thing is clear: the authors accept the importance of using Keynesian cyclical variables in their regression equations. Proof of this statement can be found in the controversy between Krzyzaniak and Musgrave, Cragg, Harberger and Mieszkowski, Gordon, Oakland, and others, which we have already reviewed.

If the aggregate demand and cyclical variables are deemed to be so important then the econometric results must be interpreted within some sort of Keynesian macrotheoretical framework. As shown by Asimakopulos and Burbidge (1974), and as discussed in Chapter 2, in a Kaleckian framework the incidence of a tax on profits depends on what the government does with the extra tax revenues. This point has been completely ignored by the empirical investigators of the profits tax. Thus, by failing to account for the effects of the tax on government behaviour, these studies fail to provide a valid answer to the question of the short-run shifting of the corporate income tax. The following passage from Shoup (1969) refers to this problem:

> "The corporate income tax increases involved so much change in revenue, relative to gross national product, that there must have been appreciable effects on corporate sales and profits from the use made of the money, yet (the empirical studies) do not seem to have made adequate allowance for this problem. Under the view taken here, that the very concept of the incidence of a corporation income tax (or other broad-based tax) as such is invalid, these econometric studies necessarily reveal nothing about this non-existent phenomenon". 9

In the next chapter, we use a conventional IS-LM macrotheoretical model and demonstrate the point that the short-run incidence of the corporation income tax depends on what the government does with the tax revenues.

## FOOTNOTES

1. See Ballentine (1980), ch. 2.

2. Krzyzaniak and Musgrave (1963), p. 33.

3. Gordon (1967), p. 750.

4. This is one of the conclusions of the study by Asimakopulos and Burbidge (1974), p. 274.

5. Levesque (1967), p. 50.

6. Ibid., p. 51.

7. Spencer (1969), p. 33.

8. Dusansky and Tanner (1974), p. 120.

9. Shoup (1969), p. 19.

# CHAPTER FOUR

## A Standard IS-LM Framework for Studying the Effects of the Corporation Income Tax

### IV.1 Introduction

In the previous chapter it was argued that the econometric studies of the short-run shifting of the corporate income tax are inconsistent: although they seem to have been based on partial-equilibrium full-employment models, these studies make use of Keynesian cyclical variables in their estimating equations. It was also pointed out that if aggregate demand and Keynesian cyclical effects are important, as is apparently accepted by all empirical investigators of this issue, then consistency requires that the question of the shifting of the corporation income tax be examined in a Keynesian general-equilibrium framework and that the results be interpreted accordingly.

The primary purpose of this chapter is to show that in a conventional Keynesian theoretical macromodel (IS-LM model), the short-run incidence and economic effects of policies involving a higher profits tax depend on what the government does with the extra tax revenues. We also demonstrate that in a Keynesian framework perfect competition(with profit maximization) may be consistent with full shifting of the tax, a phenomenon which is in sharp contrast with the conclusions of the partial-equilibrium studies reviewed in Chapters 2 and 3. In so doing, we examine the effects of balanced-budget substitution of the profits tax for one of sales, personal income or payroll taxes. We also analyze a simultaneous increase in both the profits tax rate and government expenditures when the overall budget is balanced. This chapter is designed to set the stage for a similar exercise in Chapter 7, which involves the use of TRACE, an annual econometric model of the Canadian economy.

In what follows, we first describe the structure of the model and then use it to evaluate the effects of the above policy changes. The model used in this section is similar to the one used in Burbidge and Scarth (1980) except for following modifications. Firstly, we replace their production function, which is in general form, with a Cobb-Douglas production function. Secondly, we assume that there is no integration of personal and corporate income taxes. Thirdly, we adopt Auerbach's (1979) reformulation of Boadway's (1979) formula for the user cost of capital in the investment function. Finally, while Burbidge and Scarth use their model for a study of the effects of balanced budget tax substitutions involving the payroll, sales, and personal income taxes, here we emphasize changes in the profits tax rate.

## IV.2 The Structure of the Model

The following model is a conventional closed economy IS-LM model with the addition of a personal income tax, a profits tax, a sales tax, and an employer payroll tax all at proportional rates, The output and price levels are determined by the intersection of the aggregate demand and supply schedules. Aggregate demand is the sum of endogenous consumption and investment expenditures and exogenous government expenditures. On the supply side, there is only one output, and it is produced using a Cobb-Douglas production function with capital and labour as inputs. The money wage rate is assumed to be fixed in the short run and there is perfect competition in the output market. The money supply is exogenous and is equal to the demand for money, where the latter depends on the levels of output and interest rate. The government budget is assumed to be balanced; that is, government spends an amount equal to its revenues. Definitions of the variables used and a detailed description of the structure of the model are given immediately after the equations.

$$X = C + I + G \tag{4.1}$$

$$C = b(1-t_p)H \tag{4.2}$$

$$H = \frac{1}{1+t_s}\left(\frac{WN}{P} + \frac{A}{P} + \pi - T_\pi\right) \tag{4.3}$$

$$P^* = P(1+t_s) \tag{4.4}$$

$$\frac{I}{K} = a\left(\frac{F_K}{\lambda} - 1\right) + \delta; \quad F_K = \frac{\partial X}{\partial K} > 0 \tag{4.5}$$

$$\lambda = \frac{(i+\delta)\ (1+\delta'(1-t_\pi))}{(1-t_\pi)\ (i+\delta')} \tag{4.6}$$

$$i = \frac{r(1-xt_\pi)}{1-t_p} \tag{4.7}$$

$$M = P(X+t_sC)\ L(r); \qquad L_r = \frac{dL}{dr} < 0 \tag{4.8}$$

$$X = K^\beta N^{1-\beta} \tag{4.9}$$

$$\frac{(1+t_w)W}{P} = F_N; \qquad F_N = \frac{\partial X}{\partial N} > 0 \tag{4.10}$$

$$\pi = X - (1+t_w)\ \frac{WN}{P} - \delta K - \frac{A}{P} \tag{4.11}$$

$$G = T_\pi + t_p\ (\frac{WN}{P} + \pi - T_\pi + \frac{A}{P}) + t_w\ \frac{WN}{P} + t_sC \tag{4.12}$$

$$T_\pi = t_\pi\ (\pi-\delta'K'+\delta K) \tag{4.13}$$

The endogenous variables are:

$X$ = real output

$C$ = real consumption

$H$ = Household real income

$I$ = real gross investment

$N$ = employment of labour

$P$ = price of output at factor cost

$P^*$ = market price of output

$\pi$ = real profits before taxes, net of depreciation

$r$ = interest rate (net of personal income taxes)

$T_\pi$ = profits tax revenues

$i$ = weighted average personal cost of capital

$\lambda$ = the rental price of capital

$t_\pi$ = the profits tax rate.

The exogenous variables are:

$A$ = interest payments on pre-existing consols issued by firms

$G$ = real government expenditures

$M$ = nominal stock of money

$W$ = money wage rate paid to employees

$K$ = actual capital stock

$K'$ = capital stock as measured according to tax laws

$t_p$ = personal income tax rate

$t_s$ = sales tax rate

$t_w$ = payroll tax rate

$x$ = ratio of the value of debt to the value of capital

$a$ = an adjustment parameter

$b$ = propensity to consume

$\delta$ = actual depreciation rate

$\delta'$ = depreciation rate allowed by tax authorities

$x$, $a$, $b$, $\delta$, and $\delta'$ are all positive and less than unity.

Equation (4.1) represents the goods market equilibrium, where aggregate demand is equal to current supply. Aggregate demand consists of consumption, investment, and government expenditures. The supply of output is determined by capital and labour through a standard Cobb-Douglas production function represented in equation (4.9). It is assumed that employment of labour is the only variable input in the short run.

Equation (4.2) determines private consumption. It is assumed that consumption is a constant proportion, b, of household real disposable after-tax income. Household income is defined in equation (4.3) as the sum of wage income, interest payments, and after-tax profits.

Equation (4.4) defines the market price (P*) as the price of output at factor cost plus the sales tax.

Equation (4.5) explains gross investment as the sum of net and replacement investment. Net investment takes place when the marginal product of capital exceeds the rental cost of capital ($\lambda$). $\lambda$ is explained by equation (4.6). "a" is the adjustment coefficient and is assumed to be constant.

The formula for the rental price of capital is based on Auerbach's (1979) reformulation of Boadway's (1979) formula for the user cost of capital in the investment function. Similarly, (4.7) follows from Auerbach's formula for the personal cost of capital on the assumption that the tax rate on interest income and dividends are equal and both equal to the proportional personal tax rate on earned income. Step by step derivations of (4.6) and (4.7) are given in Appendix A to this Chapter.

Equation (4.8) is the money market equilibrium condition. It is assumed that the income ($=P(X + t_s C)$) elasticity of the demand for money is unity. This is a convenient assumption and does not affect the character of the results obtained here. There are in fact some empirical studies which support the assumption of unitary real income elasticity in the demand for money.[1]

The labour demand is represented by equation (4.10). This equation assumes that firms are profit maximizers and hire labour up to a point where the value of marginal product of labour ($P.F_N$) is equal to the rigid money wage rate inclusive of the payroll tax. The money wage rigidity is the Keynesian assumption that prevents the model from attaining full employment in each short period. The workers here are assumed to be off their labour supply curve.

Equation (4.11) defines profits as the difference between output and all factor payments. This equation is derived from the national income identity, where output is equal to the sum of all factor payments

$(X = \pi + (1+t_w) \frac{WN}{P} + \frac{A}{P} + \delta K)$.

Equation (4.12) is the government budget constraint, implying that real government expenditure is equal to total taxes collected; i.e. the sum of profit taxes, personal income taxes, payroll taxes, and sales taxes.

Finally, equation (4.13) indicates that profits tax revenue is a fraction, $t_\pi$, of the corporate tax base. The corporate tax base is computed by deducting from gross profits ($\pi + \delta K$) the capital cost allowances permitted by tax authorities. These allowances are calculated according to a depreciation rate, $\delta'$, which may be different from the actual depreciation rate, $\delta$. $K'$ is the capital stock measured according to the tax laws.

These thirteen equations determine the values of the thirteen endogenous variables, $X$, $C$, $I$, $H$, $P$, $P^*$, $\lambda$, $i$, $r$, $N$, $\pi$, $T_\pi$ and one of the government variables. Note that in deriving the analytical and numerical results of the policy changes below, it is convenient to permit $t_\pi$ to be endogenous, because all these experiments involve the profits tax rate.

## IV.3 Short-Run Policy Implications

To assess the short-run effects of policy changes in our model, we take the logarithmic differential of the system and reduce it to a system of three equations representing the aggregate demand curve (AD) by combining (4.1) - (4.9),[2] the aggregate supply curve (AS) from (4.10), and a "tax" equation (TAX) by combining (4.9) and (4.11)-(4.13). This is three-equation system is given by:

$$
\begin{array}{l} \underline{AD}: \\ \underline{AS}: \\ \underline{TAX}: \end{array}
\begin{bmatrix} D_1 & D_2 & D_4 \\ S_1 & -1 & 0 \\ T_1 & T_2 & T_4 \end{bmatrix}
\begin{bmatrix} \hat{N} \\ \hat{P}^* \\ \hat{t}_\pi \end{bmatrix} =
\begin{bmatrix} -D_3 & 0 & -D_5 & D_6 & 0 \\ 0 & -S_2 & -S_3 & 0 & -1 \\ -T_3 & -T_5 & -T_6 & T_7 & -T_8 \end{bmatrix}
\begin{bmatrix} \hat{t}_p \\ \hat{t}_w \\ \hat{t}_s \\ \hat{G} \\ \hat{W} \end{bmatrix} \quad (4.14)
$$

where $\hat{y} \equiv d(\ln y)$ and the new notation is:

$$D_1 = (1-\beta)\left(1 - \frac{b}{\phi}\right) - \theta_1 + \frac{\theta_2(1+t_s)\ (1-\beta)\ X}{\varepsilon_{M,r}\ \phi(X+t_sC)} \gtrless 0$$

$$D_2 = \frac{\theta_2}{\varepsilon_{M,r}} > 0$$

$$D_3 = \theta_4 > 0$$

$$D_4 = \theta_3 \gtrless 0$$

$$D_5 = \frac{t_s(1-b)C}{\phi X} + \frac{\theta_2 t_s C}{\varepsilon_{M,r}(X+t_sC)\phi} - \frac{\theta_2 t_s}{(1+t_s)\varepsilon_{M,r}} \gtrless 0$$

$$D_6 = \frac{G}{X} - \frac{bG}{X} + \frac{\theta_2 t_s bG}{\phi\varepsilon_{M,r}(X+t_sC)} > 0$$

$$S_1 = \beta > 0$$

$$S_2 = \frac{t_w}{1+t_w} > 0$$

$$S_3 = \frac{t_s}{1+t_s} > 0$$

$$T_1 = \frac{(t_p + t_\pi(1-t_p))\ \beta(1-\beta)\ X}{G} + \frac{t_s b(1-\beta)\ X}{\phi G} + \frac{(t_w + t_p)\ WN}{PG} > 0$$

$$T_2 = \frac{t_\pi(1-t_p)\ A}{PG} - \frac{(t_w + t_p)\ WN}{PG} \gtrless 0$$

$$T_3 = \frac{t_p}{G}\ (\frac{WN}{P} + \pi - t_\pi\ (\pi - \delta' K' + \delta K)\ + \frac{A}{P}) > 0$$

$$T_4 = \frac{(1-t_p)t_\pi\ (\pi - \delta' K' + \delta K)}{G} > 0$$

$$T_5 = \frac{t_w WN}{PG} > 0$$

$$T_6 = \frac{t_s C}{\phi G} - \frac{t_s}{1+t_s}\ (\frac{t_\pi(1-t_p)\ A}{PG} - \frac{(t_w + t_p)\ WN}{PG}) \gtrless 0$$

$$T_7 = \frac{1+t_s}{\phi} > 0$$

$$T_8 = \frac{(t_w + t_p)\ WN}{PG} > 0$$

$$\phi = 1 + t_s(1-b) > 0$$

$\varepsilon_{M,r}$ - elasticity of the demand for money with respect to r, expressed as a positive number

$\theta_i$, i = 1, 2, 3, 4: the elasticities of investment with respect to N, r, $t_\pi$, $t_p$, respectively, expressed as positive numbers.

Using Cramer's rule one can solve this system of equations in the usual way. For example,

$$\left.\frac{\hat{N}}{\hat{t}_p}\right|_{t_\pi \text{ endogenous}} = \frac{1}{\Delta_{t_\pi}} \det \begin{bmatrix} -D_3 & D_2 & D_4 \\ 0 & -1 & 0 \\ -T_3 & T_2 & T_4 \end{bmatrix} = \frac{1}{\Delta_{t_\pi}}(D_3T_4 - D_4T_3), \quad (4.15)$$

where $\Delta_{t_i}$, $i = \pi$, p, w, s, or $\Delta_G$ stands for the determinant of the left-hand side matrix when the particular tax rate, $t_i$, or G is endogenous. The derivation of individual multiplier expressions is presented in Appendix B to this chapter.

In this section, we use the model to examine the short-run effects of four different policy changes involving the profits tax rate. Three of the changes involve differential incidence analysis and one involves budget incidence analysis. More specifically, we examine the effects of balanced budget substitution of the profits tax rate for either (1) the personal income tax rate, or (2) the payroll tax rate, or (3) the sales tax rate. We also examine the effects of a simultaneous increase in the profits tax rate and government expenditure under the balanced budget condition. For each case, we report the effects on employment (N), the price level (P*), the level of after-tax profits ($\pi - T_\pi$), the share of after-tax profits in total output $\frac{\pi - T_\pi}{X}$, and the per capita consumption ($\frac{C}{N}$). While $\frac{C}{N}$ is chosen to measure the effects of policy changes on consumers in the model, $\pi - T_\pi$ and $\frac{\pi - T_\pi}{X}$ will measure changes in the relative position of profit earners. Note that, given a constant level of capital stock, changes in $\pi - T_\pi$ in response to any policy change in the model show as movements in the rate of return on capital.

Clearly, the sign of all the derivatives of the system (4.14) are ambiguous without further restrictions on the basic parameters. Thus, in order to simplify and to obtain more specific results, we assign "reasonable estimates" to all parameters appearing in the model, namely $\varepsilon_{M,r}$, a, r, $\delta$, $\delta'$, x, $\beta$, b and the four tax rates. Given values for these twelve parameters, and an assumed capital-output ratio of 2, equations (4.1) - (4.13) determine D, S, and T coefficients in (4.14).[3] In assigning these values, we have chosen to concentrate on two cases: (a) the "monetarist" case with a steep LM curve ($\varepsilon_{M,r}$ = .05) and responsive investment (a = .25), and (b) the "Keynesian" case with opposite assumptions ($\varepsilon_{M,r}$ = 0.5 and a = 0.10). For these values of $\varepsilon_{M,r}$ and a, considerable experimentation with the other basic parameters was required to obtain results where the model was stable ($\frac{\hat{N}}{\hat{W}} < 0$) and the initial values of WN, I, G, C, $\pi$, $\frac{A}{P}$ and personal income $(\frac{WN}{P} + \pi - t_\pi\,(\pi - \delta'K' + \delta K) + \frac{A}{P})$, each relative to X, were reasonable.

The results of the policy changes are given in Tables IV-1 (Monetarist estimates) and IV-2 (Keynesian estimates) below. These tables are meant to be only illustrative of the ranges of possible results. In presenting these results we found it convenient to switch the multipliers around to have $t_\pi$ as the exogenous tax rate and another tax rate or government expenditure as the accommodating government variable.[4] Thus, each entry in Tables IV-1 and IV-2 is the elasticity of the particular endogenous variable (N, P*, $(1-t_\pi)\pi$, $(1-t_\pi)\frac{\pi}{X}$ or $\frac{C}{X}$) with respect to $t_\pi$ with the indicated government variable adjusting to maintain a balanced budget. A value of 0 in column four indicates full shifting of the profits tax and a value equal to $-\frac{t_\pi}{1-t_\pi}$ shows that $\pi$ has not changed which implies no tax shifting.[5] Thus, values less than -.818 in column four in Table IV-1 indicate that firms bear more than the full burden of the tax in the short run. The corresponding figure for Table IV-2 is -.667.

Before turning to a discussion of the results it should be emphasized that these results are based on an assumed set of parameter values. Thus, it is possible to find different sets of reasonable parameter values and produce different results. However, since we are primarily concerned with demonstrating the point that the incidence and economic effects of a higher profits tax rate depends on what is done with the tax revenue, this observation is not troubling. Almost any set of parameter values could be used to establish this point. The following discussion focuses on the results presented in Table IV-1. Most of the discussion can be duplicated in interpreting the results in Table IV-2. Note that for both tables the aggregate demand curve (AD) always slopes

Table IV-1

Effects of Increases in the Profits Tax Rate

"Monetarist" Case

| Endogenous government variable | $\hat{N}$ | $\hat{P}^*$ | $\widehat{(1-t_\pi)\Pi}$ | $\widehat{(1-t_\pi)\frac{\Pi}{X}}$ | $\widehat{(\frac{C}{N})}$ |
|---|---|---|---|---|---|
| Case 1. $\hat{t}_p$ | -.023 | -.007 | -.868 | -.853 | -.035 |
| Case 2. $\hat{t}_w$ | .398 | -.274 | .011 | -.263 | .608 |
| Case 3. $\hat{t}_s$ | .017 | -.091 | -.781 | -.792 | .130 |
| Case 4. $\hat{G}$ | -.022 | -.007 | -.868 | -.852 | -.086 |

Parameter values: $\varepsilon_{M,r} = .05$, $a = .25$, $r = .02$, $\delta = .10$, $\delta' = .15$, $\varkappa = .33$, $\beta = .311$, $b = .85$, $t_p = .25$, $t_\pi = .45$, $t_w = .18$, and $t_s = .10$

## Table IV-2

### Effects of Increases in the Profits Tax Rate

"Keynesian" case

| Endogenous government variable | $\hat{N}$ | $\hat{P}^*$ | $\widehat{(1-t_\pi)\Pi}$ | $\widehat{(1-t_\pi)\frac{\Pi}{X}}$ | $\widehat{(\frac{C}{N})}$ |
|---|---|---|---|---|---|
| case 1. $\hat{t}_p$ | -.243 | -.104 | -.949 | -.810 | -.278 |
| case 2. $\hat{t}_w$ | -.183 | -.129 | -.883 | -.788 | -.210 |
| case 3. $\hat{t}_s$ | -.170 | -.134 | -.865 | -.767 | -.128 |
| case 4. $\hat{G}$ | -.239 | -.100 | -.940 | -.808 | -.290 |

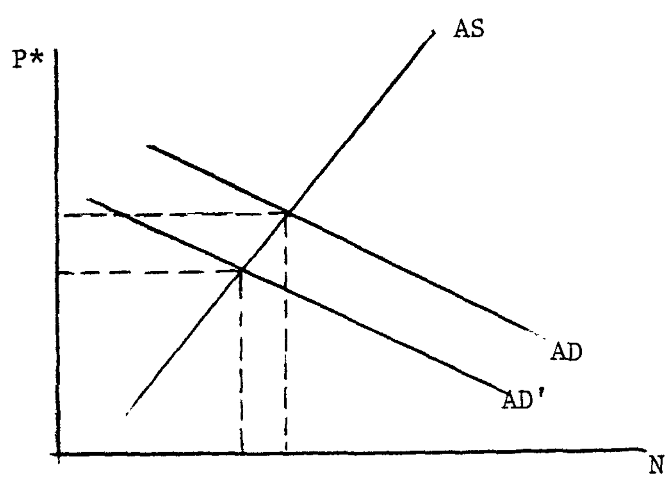
Parameter values: $\epsilon_{M,r} = .50$, $a = .10$, $r = .02$, $\delta = .10$, $\delta' = .15$
$\chi = .33$, $\beta = .427$, $b = .77$, $t_p = .20$, $t_\pi = .40$, $t_w = .18$,
and $t_s = .10$

downwards $(\frac{\hat{N}}{\hat{P}*} = -\frac{D_1}{D_2} < 0)$ and the aggregate supply surve (AS) is upward sloping $(\frac{\hat{N}}{\hat{P}*} = S_1 > 0)$.

We first consider the case in which $t_\pi$ is increased and $t_p$ is permitted to fall to maintain a balanced budget. From the system of equations (4.14), one can see that changes in $t_\pi$ and $t_p$ affect the position of AD, but they have no influence on AS. More specifically, the increase in $t_\pi$ shifts AD to the left and given the values of $T_3$ and $T_4$ in (4.14), in this case, the reduction in $t_p$ tends to shift AD to the right, but not by enough to counteract the increase in $t_\pi$. Consequently, AD shifts to the left (AD') and, as AS is not affected, N and P* both fall (Figure IV-1) as do $(1-t_\pi)\pi$, $(1-t_\pi)\frac{\pi}{X}$ and $\frac{C}{N}$. Numerical results for this case are shown in the first row of Table IV-1.

Figure IV-1

Balanced Budget Substitution of Profits Taxes for Personal Income Taxes

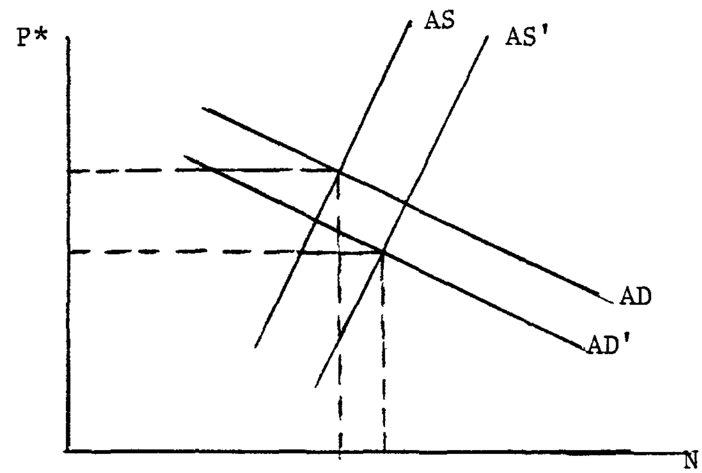


The figures in column four (elasticity value) indicate that firms bear more than the full burden of the profits tax in the short run. Recall (see footnote 5) that values less than -.818 in column four imply no tax shifting at all. Also, the elasticity value in column six indicates that, in this case, consumers become worse off as real per capita consumption declines. Therefore, the overall outcome of balanced budget substitution of the profits tax for the personal income tax appears to be recessionary, reducing employment and prices. Moreover, such a policy change adversely affects profit earners and consumers by reducing after-tax profits (both level and share in output) and per capita consumption, respectively. However, those wage earners who remain employed tend to better off as the real wage rate $(\frac{W}{P*})$ increases because of the fall in P*.

Quite similar results are obtained in case 4 when $t_\pi$ is increased and G is permitted to increase to maintain a balanced budget. This policy change also appears to be recessionary, leading to lower employment and prices. Profit earners and consumers are worse off due to lower after-tax profits and per capita consumption, respectively. Here, too, those workers who do not lose their employment are better off because of a higher real wage rate $(\frac{W}{P*})$.

Figure IV-2

Balanced Budget Substitutions of Profits Taxes for Payroll Taxes




Now consider Case 2, in which $t_\pi$ is increased and $t_w$ is permitted to fall to maintain a balanced budget. As can be seen from Table IV-1, more than full tax shifting may be consistent with profit maximization (perfect competition) by firms, a phenomenon which is in sharp contrast with the conclusions of the partial-equilibrium and general-equilibrium full-employment studies reviewed in Chapter 2. In the present case, the increase in $t_\pi$ shifts AD to the left (AD') and the reduction in $t_w$ shifts, by reason of a higher value of marginal product of labour, AS to the right (AS') in such a way that employment (N) increases and the price level (P*) falls (Figure IV-2). The increase in employment and hence pre-tax profits is sufficient to raise the level of after-tax real profits, though its share in output declines. <u>This aggregate demand</u>

shifting mechanism is ignored in the theoretical literature discussed in Chapter 2 and is mainly responsible for the difference in conclusions.[6]

The results of Case 2 also show that consumers appear to be better off, as per capita consumption tends to increase when $t_\pi$ is increased and $t_w$ decreased, under the balanced budget condition. Wage earners, too, appear to be better off as a result of a higher real wage rate $(\frac{W}{P*})$. In short, a balanced budget substitution of the profits tax for the payroll tax appears to be expansionary and consumers, wage earners and profit earners tend to be better off.

Turning to Case 3, in which $t_\pi$ is raised and $t_s$ is permitted to fall to maintain a balanced budget, we arrive at similar conclusions regarding the impact on employment, price level, real wage rate, share of after-tax profits in output, and per capita consumption. However, contrary to Case 2, in this case firms appear to absorb part of the tax burden.

The above results clearly indicate that the short-run incidence and economic effects of the profits tax depend on what the government does with the extra revenue raised when the tax is increased, or how it makes up for the reduction in revenue when the tax is reduced. The effects on aggregate demand, and hence the overall economic effects, are different depending upon the manner in which the government responds to changes in revenues. Thus, the aggregate demand shifting mechanism is a very significant factor in the incidence analysis. Once the level of the aggregate demand is fixed, as is the case in the partial-equilibrium and general-equilibrium full-employment studies discussed in Chapter 2, the incidence of the profits tax is more likely to be independent of the government response to the tax change. In what follows, we shall verify this by duplicating the above four policy changes, using a full-employment version of the model.

## IV.4 Long-Run (Full-Employment) Policy Implications

For the purpose of examining the long-run effects of policy changes involving the profits tax, we augment the model with a labour supply equation and let the nominal wage rate fluctuate so that the full-employment equilibrium is attained. To achieve analytical simplicity we assume a vertical labour supply equation represented by

$$N = \bar{N} \tag{4.16}$$

where $\bar{N}$ is the full-employment level. We also assume a stationary state in which investment expenditures take place only for replacement purposes ($I = \delta K$). In other words, we assume that the marginal product of capital ($F_K$) is equal to its rental cost; that is,

$$F_K = \lambda . \tag{4.17}$$

Such an assumption makes our analysis somewhat similar to Harberger (1962).

Furthermore, we assume that in the long run, interest incomes after personal income taxes are equal to interest payments by firms on the bond-financed portion of the capital stock. That is,

$$\frac{A}{P} = \frac{rxK}{1-t_p} \,. \tag{4.18}$$

This relationship was not used in our short-run analysis, as interest payments (A) were assumed to be fixed. However, in a long-run analysis it is more reasonable to assume A to be endogenous. Finally, the marginal propensity to consume, b, is assumed to be unity. Again, we should emphasize that while the above assumptions are made for analytical simplicity, their relaxation does not affect the nature of our results in this section.

Now, to assess the long-run effects of policy changes involving the profits tax rate, we follow the approach adopted in the previous section. In other words, we take the logarithmic total differential of the long-run version of the model and reduce it to a set of three equations in $\hat{r}$, $\hat{p}^*$, and $\hat{t}_\pi$ as functions of $\hat{t}_p$, $\hat{t}_w$, $\hat{t}_s$, and $\hat{G}$.

$$\begin{bmatrix} D_1^* & 0 & -D_2^* \\ \varepsilon_{M,r} & -1 & 0 \\ -T_1^* & 0 & T_2^* \end{bmatrix} \begin{bmatrix} \hat{r} \\ \hat{p}^* \\ \hat{t}_\pi \end{bmatrix} = \begin{bmatrix} D_3^* & 0 & 0 & 0 \\ 0 & 0 & S_1^* & -S_2^* \\ -T_3^* & -T_4^* & -T_5^* & T_6^* \end{bmatrix} \begin{bmatrix} \hat{t}_p \\ \hat{t}_w \\ \hat{t}_s \\ \hat{G} \end{bmatrix} \tag{4.19}$$

$$D_1^* = i\left[\frac{\delta' - \delta}{(i+\delta)\ (i+\delta')} + \frac{1}{i+\delta'\ (i-t_\pi)}\right] > 0$$

$$D_2^* = \left[\frac{-xt_\pi D_1^*}{i-xt_\pi} - \frac{\delta' t_\pi}{i+\delta'\ (1-t_\pi)} + \frac{t_\pi}{1-t_\pi}\right] \gtrless 0$$

$$D_3^* = \frac{D_1^*\ t_p}{1-t_p} > 0$$

$$S_1^* = \frac{t_s C}{X + t_s C} - \frac{t_s}{1 + t_s} \gtrless 0$$

$$S_2^* = \frac{t_s G}{X+t_s C} > 0$$

$$T_1^* = \frac{r\ xK\ t_\pi\ (1+t_p)}{(1-t_p)G} > 0$$

$$T_2^* = \frac{(1-t_p)T_\pi}{G} > 0$$

$$T_3^* = \left(\frac{t_p Y_p}{G} - \frac{r\ xK\ t_p\ t_\pi\ (1+t_p)}{(1-t_p)^2\ G}\right) \gtrless 0$$

$$T_4^* = \frac{t_w\ (1-t_p)\ WN}{(1+t_w)\ PG} > 0$$

$$T_5^* = \frac{t_s C}{G} > 0$$

$$T_6^* = (1+t_s) > 0$$

Applying Cramer's rule to this system of equations, one can derive the multiplier expressions for the four policy changes involving the profits tax rate, which were introduced in the previous section. These expressions are presented in Appendix C to this Chapter. A priori, we expect to get results very much like those arrived at in Harberger (1962); that is, firms bear the full burden of the profits tax. Without going into a detailed analysis, this point can be demonstrated as follows. Take the logarithmic total differential of the expression for real after-tax profits to get

$$\widehat{(1-t_\pi)\pi} = \frac{-t_\pi}{1-t_\pi}\hat{t}_\pi + \hat{\pi} \tag{4.20}$$

where $\hat{\pi} = \frac{-rxK}{(1-t_p)\pi}(\hat{r} + \frac{t_p}{1-t_p}\hat{t}_p)$ from equation (4.11). Substituting for $\hat{\pi}$ into (4.17) and dividing both sides by $\hat{t}_\pi$ we get

$$\frac{\widehat{(1-t_\pi)\pi}}{\hat{t}_\pi} = \frac{-t_\pi}{1-t_\pi} - \frac{rxK}{(1-t_p)\pi}\frac{\hat{r}}{\hat{t}_\pi} - \frac{rxKt_p}{(1-t_p)^2\pi}\frac{\hat{t}_p}{\hat{t}_\pi}\ . \tag{4.21}$$

Now, following the same approach as we used in our short-run analysis and also using the assumed parameter values for the "Monetarist" case, $\frac{\widehat{(1-t_\pi)\pi}}{\hat{t}_\pi}$ takes values of -.8819, -.9126, -.9039, and -.9038 for Cases 1 to 4, respectively. These values indicate that, in the long run, firms bear more than the full burden of a higher profits tax regardless of what is done with the revenue raised. Recall that in the "Monetarist" case, a value less than -.818 for $\frac{\widehat{(1-t_\pi)\pi}}{\hat{t}_\pi}$ was shown to indicate that more than the full burden of the tax is borne by firms (See footnote 4). Similar results can easily be shown to hold for the "Keynesian" case.

To conclude, in this chapter we demonstrated that what is done with the tax revenue raised by the increase in $t_\pi$, or the way revenue is made up for when $t_\pi$ is reduced, clearly affects what happens to after-tax real profits and other endogenous variables in the system. This point has been completely ignored by the empirical investigators of the short-run effects of profits taxes. As we showed in Section IV.4, this practice can only be valid in the partial-equilibrium and general-equilibrium full-employment world of the neoclassical economists. However, the empirical work on the issue does not seem to have followed any of these assumptions. In other words, empirical investigators of the corporate profits tax use and accept the importance of Keynesian cyclical variables in their estimating equations. As mentioned earlier, if these variables are found to be important, then a consistent empirical analysis of the issue has to be conducted in some sort of Keynesian general-equilibrium framework.

Our purpose in the remainder of this thesis is to conduct an empirical analysis of the incidence and economic effects of the corporate income tax in the context of an existing macroeconometric model of the

Canadian economy. The model chosen for this purpose, is TRACE. Comparing the macrotheoretical model of this chapter with TRACE, we can say that both are Keynesian; however, TRACE is a highly disaggregated and open model of an actual economy. Due to structural differences between these models, the experiments in this chapter cannot precisely be introduced in our empirical analysis which involves the TRACE model. This will become clear in Chapter 6 where we introduce TRACE. Therefore, our empirical analysis is not intended to have any implications with regard to individual experiments in this chapter. Nevertheless, it is expected that our empirical analysis which involves TRACE will lead us to the same fundamental conclusions as arrived at in this chapter; that is, we expect to find that the incidence and economic effects of the corporate income tax depend on what is done with the tax revenues raised by an increase in the tax rate, or the way revenues are made up for if the tax is reduced.

In the next chapter we review the structure of Canadian corporate income taxation. Then, in Chapters 6 and 7, we use the TRACE model, after it is modified and extended, to examine the question at hand.

# APPENDIX IV-A

The formula for the rental price of capital ($\lambda$) is based on Auerbach's (1979) reformulation of Boadway's (1979) formula for the user cost of capital in the investment function. This analysis centres on the behaviour of a competitive firm in a continuous infinite-horizon framework. The firm finances its investment projects through sales of common stock, floatation of debt, and retention of earnings. The following presents the process of the derivation of $\lambda$.

Let $r'$ be the discount rate of equity owners (equal to $r$ when personal income taxes are zero $(r = r'(1-t_p))$ and $E_t$ be the rate of cash flow arising from undertaking a project at time t. The change in equity value from undertaking a project at time t, denoted $V_t$, is:

$$V_t = \int_{s=t}^{\infty} e^{-r'(s-t)} E_s ds . \tag{A.1}$$

Differentiating (A.1) with respect to time and rearranging terms, we get

$$r'V_t = E_t + V_t . \tag{A.2}$$

Now, define $F_t$ as the rate of cash flow at time t net of increments in stock of debt ($A_t$) and interest payments net of corporate taxes. $F_t$ can be represented by

$$F_t = E_t - \dot{A}_t + r''(1-t_\pi) A_t \tag{A.3}$$

where $r''$ is the gross nominal interest rate (equal to r in the absence of personal taxes) and $t_\pi$ is the corporate profits tax rate.

Combine (A.2) and (A.3) to get

$$r'V_t = F_t + \dot{A}_t - r''(1-t_\pi)\ A_t + \dot{V}_t . \tag{A.4}$$

Defining x as the ratio of the value of debt to the value of debt plus equity ($x = \frac{A_t}{A_t + V_t}$ and is assumed to be fixed) and rearranging the terms in (A.4) then

$$\dot{V}_t + \dot{A}_t - i(V_t + A_t) = -F_t \tag{A.5}$$

where i is the weighted average of the cost of capital and is represented by

$$i = xr''(1-t_\pi) + (1-x)\ r'. \tag{A.6}$$

If we define $w_t$ as the value to the firm from undertaking a project at time t ($w_t = V_t + A_t$), (A.5) becomes

$$\dot{w}_t - iw_t = -F_t . \tag{A.7}$$

The general solution to the differential equation (A.2) is:

$$w_t = -e^{it}\int_{t_o}^{t} e^{-is}F_s ds + Be^{it} = e^{it}\int_{t}^{t_o} e^{-is}F_s ds + Be^{it} \tag{A.8}$$

where B is a constant. Letting $t_o = \infty$, $t = 0$ and $B = 0$, we get

$$w_o = \int_o^\infty e^{-is}F_s ds. \tag{A.9}$$

Given the constraint imposed on the firm that debt not exceed the value of the project which it finances,

$$F_t = (1-t_\pi)pf(K_t) - q(\dot{K}_t+\delta K_t) + t_\pi q\delta' K'_t \tag{A.10}$$

where p is the price of output and q is the price of capital goods. Thus (A.9) can be written as

$$w_o = \int_o^\infty \bar{e}^{is}[(1-t_\pi)pf(K_t) - q(\dot{K}_t+\delta K_t) + t_\pi q\delta' K'_t]ds. \tag{A.11}$$

Maximizing $w_o$ gives us the following Euler equations:

$$\frac{\partial H}{\partial K_t} = \frac{d}{dt}\left(\frac{\partial H}{\partial \dot{K}_t}\right) \tag{A.12}$$

$$\frac{\partial H}{\partial K'_t} = \frac{d}{dt}\left(\frac{\partial H}{\partial \dot{K}'_t}\right) \tag{A.13}$$

where

$$H = \bar{e}^{it}[(1-t_\pi)pf(K_t)-q(\dot{K}_t+\delta K_t)+t_\pi q\delta' K'_t]+\mu(t)[q(\dot{K}_t+\delta K_t- \dot{K}'_t-\delta' K'_t)]. \tag{A.14}$$

Substituting for terms in (A.12) and (A.13) we get

$$\bar{e}^{it}[(1-t_\pi)pf'(K_t)-q\delta]+\mu(t)q\delta = \frac{d}{dt}[-\bar{e}^{it}q+\mu(t)q]=q(i\bar{e}^{it}+\dot{\mu}(t)] \tag{A.15}$$

$$e^{-it}(q\delta' t_\pi)-\mu(t)q\delta' = \frac{d}{dt}(-\mu(t)q) = -q\dot{\mu}(t). \tag{A.16}$$

Add (A.15) and (A.16) to get

$$\bar{e}^{it}[(1-t_\pi)pf'(K_t)-q\delta-qi+q\delta' t_\pi]+\mu(t)q(\delta-\delta') = 0. \tag{A.17}$$

Differentiating (A.17) with respect to t

$$-i\bar{e}^{it}[(i-t_\pi)pf'(K_t)-q(\delta+\bar{i}\delta' t_\pi)]+\mu(t)q(\delta-\delta') = 0 \tag{A.18}$$

and substituting in (A.16), we get

$$\bar{e}^{it}(q\delta' t_\pi) + \frac{\bar{e}^{it}[(1-t_\pi)pf'(K_t)-q(\delta+i-\delta' t_\pi)]}{\delta-\delta'}$$

$$= \frac{-i\bar{e}^{it}[(1-t_\pi)pf'(K_t)-q(\delta+i-\delta' t_\pi)]\delta'}{\delta-\delta'} . \qquad \text{(A.19)}$$

After collecting terms and simplification, (A.19) becomes:

$$(\delta-\delta')q\delta' t_\pi+[(1-t_\pi)pf'(K_t)-q(\delta+i-\delta' t_\pi)](\delta'+i) = 0. \qquad \text{(A.20)}$$

Solve for $f'(K_t)$ to get

$$f'(K_t) = \frac{q(\delta+i)}{p(1-t_\pi)\ (\delta'+i)}(i+\delta'(1-t_\pi)). \qquad \text{(A.21)}$$

This is the expression for the rental price or user cost of capital ($\lambda$). Note that if $\delta = \delta'$ and if $p = q$, as it would in a one-sector model, the expression for the rental price of capital becomes

$$f(K_t) = \frac{1}{1-t_\pi}(i+\delta(1-t_\pi)). \qquad \text{(A.22)}$$

APPENDIX IV-B

The multiplier expressions for the four policies involving profits tax changes which were discussed in the main text are derived by taking a logarithmic total differential of the 13-equation model and reducing it to a 3-equation system represented by (4.14). For reasons of convenience, the profits tax rate ($t_\pi$) is treated as an endogenous variable adjusting to changes in either $t_p$, $t_w$, $t_s$ and G in order to attain the balanced budget condition. Therefore, the following multiplier expressions are derived with respect to $\hat{t}_p$, $\hat{t}_w$, $\hat{t}_s$ and $\hat{G}$ in cases 1, 2, 3, and 4, respectively. Then, given the relationship between $t_\pi$ and each of $\hat{t}_p$, $\hat{t}_w$, $\hat{t}_s$, and $\hat{G}$ we use these expressions to calculate elasticity values for N, P*, $(1-t_\pi)\pi$, $(1-t_\pi)\frac{\pi}{X}$ and $\frac{C}{N}$ with respect to $t_\pi$, as shown in Tables IV-1 and IV-2. This is easily accomplished given that $\frac{\hat{t}_i}{\hat{t}_j} = -\frac{\Delta t_j}{\Delta t_i}$ for i, j = π, s, p, w and for ΔG. For example,

$$\left.\frac{\hat{N}}{\hat{t}_\pi}\right|_{t_p \text{ endogenous}} = -\frac{\Delta t_\pi}{\Delta t_p} \cdot \left.\frac{\hat{N}}{\hat{t}_p}\right|_{t_\pi \text{ endogenous}} .$$

Case 1

In this case the personal income tax rate is changed exogenously and the profits tax rate adjusts to satisfy the balanced budget condition. Thus, the application of Cramer's rule results:

$$\frac{\hat{N}}{\hat{t}_p} = \frac{D_3T_4-D_4T_3}{\Delta t_\pi} \tag{B.1}$$

$$\frac{\hat{P}*}{\hat{t}_p} = \frac{S_1(D_3T_4-D_4T_3)}{\Delta t_\pi} \tag{B.2}$$

$$\frac{\hat{t}_\pi}{\hat{t}_p} = \frac{-D_3(S_1T_2+T_1)+T_3(D_1+S_1D_2)}{\Delta t_\pi} \tag{B.3}$$

$$\frac{\widehat{(1-t_\pi)\pi}}{\hat{t}_p} = \frac{\beta(1-\beta)X}{\pi}\frac{\hat{N}}{\hat{t}_p} + \frac{A}{p_\pi}\frac{\hat{P}*}{\hat{t}_p} - \frac{t_\pi}{1-t_\pi}\frac{\hat{t}_\pi}{\hat{t}_p} \tag{B.4}$$

$$\frac{\widehat{(1-t_\pi)\frac{\pi}{X}}}{\hat{t}_p} = \frac{\widehat{(1-t_\pi)\pi}}{\hat{t}_p} - (1-\beta)\frac{\hat{N}}{\hat{t}_p} \tag{B.5}$$

$$\frac{\widehat{(C/N)}}{\hat{t}_p} = \left(\frac{b(1-\beta)X}{\phi C} - 1\right)\frac{\hat{N}}{\hat{t}_p}\,. \tag{B.6}$$

<u>Case 2</u>

In this case the payroll tax rate changes exogenously and the profits tax rate adjusts to maintain a balanced budget. The application of Cramer's rule results in the following expressions.

$$\frac{\hat{N}}{\hat{t}_w} = \frac{-D_4(S_2T_2+T_5) + T_4S_2D_2}{\Delta t_\pi} \qquad (B.7)$$

$$\frac{\hat{P}*}{\hat{t}_w} = \frac{-D_4(S_1T_5-S_2T_1) - D_1S_2T_4}{\Delta t_\pi} \qquad (B.8)$$

$$\frac{\hat{t}_\pi}{\hat{t}_w} = \frac{S_1(D_1T_2-T_1D_2) + T_5(D_1+S_1D_2)}{\Delta t_\pi} \qquad (B.9)$$

$$\frac{\widehat{(1-t_\pi)\pi}}{\hat{t}_w} = \frac{\beta(1-\beta)X}{\pi}\frac{\hat{N}}{\hat{t}_w} + \frac{A}{p_\pi}\frac{\hat{P}*}{\hat{t}_w} - \frac{t_\pi}{1-t_\pi}\frac{\hat{t}_\pi}{\hat{t}_w} \qquad (B.10)$$

$$\frac{\widehat{(1-t_\pi)\frac{\pi}{X}}}{\hat{t}_w} = \frac{\widehat{(1-t_\pi)\pi}}{\hat{t}_w} - (1-\beta)\frac{\hat{N}}{\hat{t}_w} \qquad (B.11)$$

$$\frac{\widehat{(C/N)}}{\hat{t}_w} = \left(\frac{b(1-\beta)X}{\phi C} - 1\right)\frac{\hat{N}}{\hat{t}_w} \qquad (B.12)$$

Case 3

In this case the sales tax rate is changed exogenously and the profits tax rate adjusts to satisfy the balanced budget condition. Using Cramer's rule, we obtain the following multiplier expressions.

$$\frac{\hat{N}}{\hat{t}_s} = \frac{-D_4(S_3T_2+T_6)+T_4(D_5+D_2S_3)}{\Delta t_\pi} \tag{B.13}$$

$$\frac{\hat{P}^*}{\hat{t}_s} = \frac{D_4(S_3T_1-S_1T_6)+T_4(S_1D_5-S_3D_1)}{\Delta t_\pi} \tag{B.14}$$

$$\frac{\hat{t}_\pi}{\hat{t}_s} = \frac{-D_5(S_1T_2+T_1)+S_3(D_1T_2-T_1D_2)+T_6(D_1+S_1D_2)}{\Delta t_\pi} \tag{B.15}$$

$$\frac{\widehat{(1-t_\pi)\pi}}{\hat{t}_s} = \frac{\beta(1-\beta)X}{\pi}\frac{\hat{N}}{\hat{t}_s} + \frac{A}{p_\pi}\frac{\hat{P}^*}{\hat{t}_s} - \frac{At_s}{P^*\pi} - \frac{t_\pi}{1-t_\pi}\frac{\hat{t}_\pi}{\hat{t}_s} \tag{B.16}$$

$$\frac{\widehat{(1-t_\pi)\frac{\pi}{X}}}{\hat{t}_s} = \frac{\widehat{(1-t_\pi)\pi}}{\hat{t}_s} - (1-\beta)\frac{\hat{N}}{\hat{t}_s} \tag{B.17}$$

$$\frac{\widehat{(C/N)}}{\hat{t}_s} = \left(\frac{b(1-\beta)X}{\phi C} - 1\right)\frac{\hat{N}}{\hat{t}_s} - \frac{t_s}{\phi} \tag{B.18}$$

Case 4

In this case the level of government expenditure is changed exogenously and the profits tax rate adjusts to maintain a balanced budget. Using Cramer's rule we obtain the following multiplier equations.

$$\frac{\hat{N}}{\hat{G}} = \frac{D_4T_7-D_6T_4}{\Delta t_\pi} \tag{B.19}$$

$$\frac{\hat{P}*}{\hat{G}} = \frac{S_1(D_4T_7-D_6T_4)}{\Delta t_\pi} \tag{B.20}$$

$$\frac{\hat{t}_\pi}{\hat{G}} = \frac{D_6(S_1T_2+T_1)-T_7(D_1+S_1D_2)}{\Delta t_\pi} \tag{B.21}$$

$$\frac{\widehat{(1-t_\pi)\pi}}{\hat{G}} = \frac{\beta(1-\beta)X}{\pi}\ \frac{\hat{N}}{\hat{G}} + \frac{A}{p\pi}\ \frac{\hat{P}*}{\hat{G}} - \frac{t_\pi}{1-t_\pi}\ \frac{\hat{t}_\pi}{\hat{G}} \tag{B.22}$$

$$\frac{\widehat{(1-t_\pi)\frac{\pi}{X}}}{\hat{G}} = \frac{\widehat{(1-t_\pi)\pi}}{\hat{G}} - (1-\beta)\ \frac{\hat{N}}{\hat{G}} \tag{B.23}$$

$$\frac{\widehat{(C/N)}}{\hat{G}} = \left(\frac{b(1-\beta)X}{\phi C} - 1\right)\frac{\hat{N}}{\hat{G}} - \frac{bG}{\phi C} \tag{B.24}$$

# APPENDIX IV-C

## Derivation of the Long-Run Multiplier Expressions

The following multiplier expressions for cases 1 to 4 are derived from the system (4.19). Here, again for reasons of convenience, the profits tax rate ($t_\pi$) is treated as an endogenous variable, adjusting to changes in either $t_p$, $t_w$, $t_s$, or G in order to maintain the balanced budget condition. Thus, the multipliers are derived with respect to $\hat{t}_p$, $\hat{t}_w$, $\hat{t}_s$, and $\hat{G}$. Then, given the relationship between $t_\pi$ and each of $\hat{t}_p$, $\hat{t}_w$, $\hat{t}_s$, and $\hat{G}$ one can use these expressions to calculate the elasticity values for N, P*, $(1-t_\pi)\pi$, and $\frac{C}{N}$ with respect to $t_\pi$ (see Appendix B).

Case 1

$$\frac{\hat{r}}{\hat{t}_p} = \frac{T_3^* D_2^* - D_3^* T_2^*}{\Delta t_\pi} \tag{C.1}$$

$$\frac{\hat{P}^*}{\hat{t}_p} = \frac{\varepsilon_{M,r}(T_3^* D_2^* - D_3^* T_2^*)}{\Delta t_\pi} \tag{C.2}$$

$$\frac{\widehat{(1-t_\pi)\pi}}{\hat{t}_p} = \frac{-t_\pi}{1-t_\pi} \frac{\hat{t}_\pi}{\hat{t}_p} - \frac{rxK}{(1-t_p)\pi} \frac{\hat{r}}{\hat{t}_p} - \frac{rxKt_p}{(1-t_p)^2\pi} \tag{C.3}$$

$$\frac{\widehat{(C/N)}}{\hat{t}_p} = 0 \tag{C.4}$$

Case 2

$$\frac{\hat{r}}{\hat{t}_w} = \frac{T_4^* D_2^*}{\Delta t_\pi} \tag{C.5}$$

$$\frac{\hat{P}^*}{\hat{t}_w} = \frac{\varepsilon_{M,r} T_4^* D_2^*}{\Delta t_\pi} \tag{C.6}$$

$$\frac{\widehat{(1-t_\pi)\pi}}{\hat{t}_w} = \frac{-t_\pi}{1-t_\pi} \frac{\hat{t}_\pi}{\hat{t}_w} - \frac{rxK}{(1-t_p)} \frac{\hat{r}}{\hat{t}_w} \tag{C.7}$$

$$\frac{\widehat{(C/N)}}{\hat{t}_w} = 0 \tag{C.8}$$

Case 3

$$\frac{\hat{r}}{\hat{t}_s} = \frac{T_5^* D_2^*}{\Delta t_\pi} \tag{C.9}$$

$$\frac{\hat{P}^*}{\hat{t}_s} = \frac{\varepsilon_{M,r} T_5^* D_2^* + S_1^*(D_1^* T_2^* - T_1^* D_2^*)}{\Delta t_\pi} \tag{C.10}$$

$$\frac{\widehat{(1-t_\pi)\pi}}{\hat{t}_s} = \frac{-t_\pi}{1-t_\pi}\,\frac{\hat{t}_\pi}{\hat{t}_s} - \frac{rxK}{(1-t_p)\pi}\cdot\frac{\hat{r}}{\hat{t}_s} \tag{C.11}$$

$$\frac{\widehat{(C/N)}}{\hat{t}_s} = 0 \tag{C.12}$$

Case 4

$$\frac{\hat{r}}{\hat{G}} = \frac{-T_6^* D_2^*}{\Delta t_\pi} \tag{C.13}$$

$$\frac{\hat{P}^*}{\hat{G}} = \frac{-\varepsilon_{M,r} T_6^* D_2^* - S_2^* (D_1^* T_2^* - T_1^* D_2^*)}{\Delta t_\pi} \tag{C.14}$$

$$\frac{\widehat{(1-t_\pi)\pi}}{\hat{G}} = \frac{-t_\pi}{1-t_\pi}\,\frac{\hat{t}_\pi}{\hat{G}} - \frac{rxK}{(1-t_p)\pi}\,\frac{\hat{r}}{\hat{G}} \tag{C.15}$$

$$\frac{\widehat{(C/N)}}{\hat{G}} = \frac{G}{C} \tag{C.16}$$

FOOTNOTES

1. See Laidler (1977).

2. Note that here AD is a relationship between P* and N. Conventionally, AD represents a relationship between P* and X.

3. For simplicity we assume $\delta K = \delta' K'$. Note that this implies that

$$\widehat{(\pi - t_\pi(\pi - \delta' K' + \delta K))} = \widehat{(1-t_\pi)\pi}.$$

4. Since $\frac{t_i}{t_j} = -\frac{\Delta_{t_j}}{\Delta_{t_i}}$ for i, j = $\pi$, s, p, w, and for $\Delta G$, this is easily accomplished. For example

$$\left.\frac{\hat{N}}{\hat{t}_\pi}\right| t_p \text{ endogenous} = -\frac{\Delta_{t_\pi}}{\Delta_{t_p}} \cdot \left.\frac{\hat{N}}{\hat{t}_p}\right| t_\pi \text{ endogenous}.$$

5. This can be shown as follows.

$$\widehat{(1-t_\pi)\pi} = \widehat{(1-t_\pi)} + \hat{\pi} = \frac{-t_\pi}{1-t_\pi}\hat{t}_\pi + \hat{\pi}$$

$$\frac{\widehat{(1-t_\pi)\pi}}{\hat{t}_\pi} = \frac{-t_\pi}{1-t_\pi} + \frac{\hat{\pi}}{\hat{t}_\pi}$$

Zero shifting occurs when pre-tax profits remain constant in the wake of a higher profits tax rate $(\frac{\hat{\pi}}{\hat{t}_\pi} = 0)$. Thus,

$$\frac{\widehat{(1-t_\pi)\pi}}{\hat{t}_\pi} = \frac{-t_\pi}{1-t_\pi} \text{ implies zero shifting.}$$

6. In a similar incidence exercise in the context of a neoclassical growth model Feldstein (1974a) concludes that the profits tax is likely to be shifted by a substantial amount in the long run. Given the full employment assumption, the shifting in Feldstein's study takes place through the effect of the tax on saving and investment functions. This is in contrast with the aggregate-demand mechanism that is responsible for shifting in our model.

# CHAPTER FIVE

## The Structure of the Corporation Income Tax in Canada

### V.1 Introduction

The corporation income tax in Canada is primarily a federal tax. Over 80 per cent of total revenue from this source accrues at the federal level. At the same time, this tax is also used by all provinces, though at significantly lower rates than at the federal level. In what follows, we examine the structures of the federal and provincial corporate taxes, concentrating on the sample period covered in the empirical work of this study, 1954-75. The structure of this chapter is as follows. In Section V.2 we discuss the question of why corporate profits are taxed. Sections V.3 and V.4 deal with the structures of the federal and provincial corporate taxes, respectively. Finally, Section V.5 explains the determination of corporate taxable income.

### V.2 Why Tax Corporate Profits?

Corporate taxation in Canada has been the subject of several Royal Commissions and has been discussed by various parliamentary committees.[1] On one hand, opponents of the tax take the view that the corporate income tax, in conjunction with the tax on personal income, is "unfair" double taxation of corporate-source income. Being based on corporate profits with no consideration given to the individual stockholder who receives dividends, the tax cannot be justified by the ability-to-pay principle which says that taxes should fall most heavily on those with greater income or wealth. It is also believed that the corporate profits tax tends to hinder efficiency and economic growth through (a) misallocation of capital between the corporate and non-corporate sectors and (b) reduction of corporate savings and hence sub-optimal level of new corporate investment.[2] Thus, some of the opponents of the tax call for full integration of the personal and corporate income taxes. For example, one of the recommendations of the Carter Royal Commission on Taxation, known as Carter's "full integration" approach, suggested that dividends be taxed only once, and then at the personal tax rate of the stockholder who receives them. In addition, it called for the elimination of the tax on retained earnings, but corporations were to be permitted to allocate those earnings to stockholders without having to pay cash dividends.[3] On the other hand, proponents of the tax argue that the corporate income tax is relatively progressive and is socially desirable and yet has hardly any harmful economic effects.[4] The tax, they believe, could be viewed as a benefit tax; that is, it falls most heavily on those who benefit the most from the spending of the tax revenues. It also enables the government to have some control over the corporate behaviour in the economy.[5]

It is important to note that the above controversy amongst the opponents and proponents of the corporate income tax is based on the assumption that in the short run the tax falls entirely on profits. However, as shown in Chapters 2 to 4, the question of actual, as opposed to legislative, burden of the profits tax is far from settled, and the controversy over the profits tax will continue as long as it is so. In the meantime, the tax is likely to remain a significant source of revenue for governments. "It is all the more important, therefore, to reach an understanding of the effect of that tax on economic growth, efficiency, and the distribution of income".[6]

Resolution of this controversy over the corporate income tax requires comprehensive studies of the incidence and economic effects of the corporate income tax. To date, the arguments by opponents and proponents of the tax seem either to have been based on incomplete studies, such as those reviewed in Chapters 2 and 3, or to represent value judgements. Consequently it is not surprising that the issue remains controversial. In this study, we attempt to add materially to the discussion of this issue by conducting an empirical general-equilibrium analysis of the corporate income tax.

## V.3 Structure of Federal Corporation Income Tax

Corporate income taxes form a major source of revenue for the federal government in Canada. As shown in Table V-1, these taxes are the second most important source of revenue, and provided almost 16 per cent of the total in 1976. This proportion, however, has been declining over the post-war period and especially since the 1960's.

The federal government corporation income tax was first introduced in 1917 and has been in effect ever since. During both world wars this tax was supplemented by excess profit taxes; business profit taxes about the time of the First World War (1915-1920) and excess profit tax about the time of the Second World War (1940-1947).

In 1917 the corporate income tax was a uniform levy of 4 per cent on taxable income of corporations whose taxable income was more than \$3000. During the period 1917-1949 the corporate income tax followed the same pattern, although its rate almost constantly increased. The corporate income tax rate was 30 per cent in 1948 with no exemption.

In 1949 the federal government corporate income tax changed to a two-bracket levy. This move was made (a) to enable small corporations to compete with unincorporated businesses and (b) to assist small corporations to accumulate funds for financing expansion, since they are presumably in a disadvantegeous position in capital markets. Under the two-bracket levy, a corporation pays in taxes $t_1^{\pi}$ per cent of the first \$$\pi_1$ of its taxable income and $t_2^{\pi}$ per cent ($t_2^{\pi} > t_1^{\pi}$) of its remaining taxable income. $t_1^{\pi}$ and $t_2^{\pi}$ are the low and high tax rates, respectively, and $\pi_1$ is the cut-off point between the low and high tax rates. Table V-2 provides information on $t_1^{\pi}$, $t_2^{\pi}$, and $\pi_1$ during the sample period of this study.

In addition to $t_1^{\pi}$ and $t_2^{\pi}$, corporations have also, since 1952,

Table V-1

Revenues of the Federal Government for Selected Years

During the 1960-76 Period

| Source | Fiscal Year | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1960-61 | | 1965-66 | | 1970-71 | | 1975-76 | |
| | ($m) | (%) | ($m) | (%) | ($m) | (%) | ($m) | (%) |
| Income Taxes: | | | | | | | | |
| Personal | 1,555 | 29.3 | 2,103 | 29.3 | 5,290 | 40.6 | 11,195 | 43.5 |
| Corporate | 1,140 | 21.5 | 1,524 | 21.2 | 2,480 | 19.9 | 4,035 | 15.7 |
| Non-Resident | 75 | 1.4 | 144 | 2.0 | 255 | 2.0 | 480 | 1.9 |
| Custom Duties | 529 | 10.0 | 622 | 8.7 | 835 | 6.4 | 1,930 | 7.5 |
| Sales Taxes | 737 | 13.9 | 1,205 | 16.8 | 1,755 | 13.5 | 2,720 | 10.6 |
| Other Taxes | 714 | 13.5 | 669 | 9.3 | 1,000 | 7.7 | 2,545 | 9.9 |
| Non-Tax Revenue | 551 | 10.4 | 813 | 11.3 | 1,420 | 10.9 | 2,820 | 11.0 |
| Total | 5,301 | 100.0 | 7,180 | 100.0 | 13,035 | 100.0 | 25,725 | 100.0 |

Source: The National Finance; An Analysis of the Revenues and Expenditures of the Government of Canada, Canadian Tax Foundation, Toronto, Canada, 1960-76.

been liable for an Old Age Security Tax (OAST) tax on their entire taxable income.

During our sample period (1954-1975), $t_1^\pi$, $t_2^\pi$, $\pi_1$ and OAST changed considerably. There were also changes in the tax laws regarding the corporate income tax during this period. The following are some of the most important changes.

(a) A temporary surtax of 3 per cent on the total taxable income of corporations during the period January 1, 1968 to Jaunary 30, 1971.

(b) A 7 per cent reduction in the corporate income tax payable in respect to taxable income earned during the period July 1, 1971 to December 31, 1972.

(c) For the 1972 and 1973 taxation years, $t_1^\pi$ was 25 per cent of the first $50,000 of business income of small Canadian controlled private corporations. Once a corporation accumulates $400,000 taxable income it is no longer eligible for the low rate ($t_1^\pi$). The corresponding figures for the 1974 and 1975 taxation years were 25 per cent, $100,000, and $500,000. Also, starting from 1972, the low rate tax, $t_1^\pi$, was no longer available to public corporations and foreign controlled corporations.

(d) Since January 1, 1973, the high tax rate, $t_2^\pi$, applicable to manufacturing and processing profits earned in Canada was reduced to

40 per cent. At the same time, the low tax rate, $t_1^\pi$, applicable to such profits was reduced to 20 per cent.

(e) From May 1, 1974 to April 30, 1975 a temporary surtax of 10 per cent was in effect on other than (1) manufacturing or processing profits, (2) the entire income of a Canadian corporation eligible for the low tax rate, (3) natural resource profits, and (4) certain special corporations which receive conduit treatment under the Income Tax Act.

Corporations also pay provincial income taxes. The structure of these taxes is discussed in the following section.

## V.4 Structure of Provincial Corporation Income Taxes

The role of the corporation income tax is, generally, much less important for provinces than for the federal government. This can be seen by comparing Tables V-1 and V-3. It can be observed that the province of Alberta is an exception in this regard. Because of the extent of corporate activity in the oil industry and also due to the absence of the general sales tax, corporate income taxes are the second most important source of provincial tax revenues.

Provincial corporate income taxes were in effect in the provinces

Table V-2

Structure of the Federal Corporate Income Tax Rates

| Years | General Rates, Including OAST |
|---|---|
| 1954 | 20% on first 20,000<br>49% on remainder |
| 1955 to 1957 | 20% on first 20,000<br>47% on remainder |
| 1958 | 20% on first 25,000<br>47% on remainder |
| 1959 to 1960 | 21% on first 25,000<br>50% on remainder |
| 1961 to 1967 | 21% on first 35,000<br>50% on remainder |
| 1968 to June 30, | 21.54% on first 35,000<br>51.41% on remainder |
| 1971 (1 July to December 30) | 19.74% on first 35,000<br>46.71 on remainder |
| 1972 | 25% on first 50,000<br>46.5% on remainder |
| 1973 | 25% on first 50,000<br>49% on remainder |
| 1974 | 25% on first 100,000<br>50.6% on remainder |
| 1975 | 25% on first 100,000<br>48.2% on remainder |

Source: The National Finances; An Analysis of the Revenues and Expenditures of the Government of Canada, Canadian Tax Foundation, Toronto, Canada, various issues.

of P.E.I. and B.C. before World War I, but were introduced in most provinces in the 1930's. These taxes were suspended in all provinces over the period 1941-1946 under a war-time agreement.

During 1947-1951 the provincial corporate income tax rate was 7 per cent in the provinces of Ontario and Quebec and 5 per cent in the other eight provinces.

For the period 1952-61 provinces other than Quebec and Ontario gave up their tax rates in return for participation in the tax rental agreement with the federal government. At the same time the corporate taxable income earned in Quebec and Ontario were eligible for a federal abatement to compensate corporations for provincial taxes paid.

Beginning in 1962, all provinces levied their own corporate income taxes. Apart from Ontario and Quebec the provinces arranged for the federal government to collect the provincial corporate income taxes on their behalf. At the same time, federal tax abatements are given to corporations in order to compensate for the provincial taxes paid on profits earned in a province.

Table V-4 shows the historical values of provincial corporate income tax rates and the federal abatement rates during the sample period covered in this study. Note that the corporate tax rates for all provinces are very similar. This is because it is believed that

Table V-3

Percentage Distribution of Provincial Tax Revenues by Source for Fiscal Year Ending March 31, 1976

(%)

| Province | Consumption Taxes | Personal Income Taxes | Corporate Income Taxes | Health Insurance Premiums | Other |
|---|---|---|---|---|---|
| Nfld. | 57.8 | 31.4 | 5.1 | 0 | 5.7 |
| P.E.I. | 53.6 | 28.1 | 3.9 | 0 | 14.4 |
| N.S. | 48.7 | 40.1 | 4.8 | 0 | 6.4 |
| N.B. | 43.7 | 33.8 | 6.1 | 0 | 16.4 |
| Que. | 31.1 | 43.7 | 7.8 | 0 | 17.4 |
| Ont. | 33.1 | 31.6 | 15.6 | 9.2 | 10.5 |
| Man. | 41.2 | 42.0 | 9.8 | 0 | 7.0 |
| Sask. | 38.2 | 38.2 | 11.5 | 0 | 12.1 |
| Alta. | 11.8 | 39.8 | 30.5 | 7.3 | 10.6 |
| B.C. | 36.6 | 35.3 | 11.2 | 5.2 | 11.7 |

Source: Provincial Governments Finance, Revenues and Expenditures (Estimates) Statistics Canada, Catalogue #68-207, 1975 ,pp. 8-9.

Table V-4

Structure of Provincial Corporate Income Tax Rates

| Years | Federal Abatement Rate | Provincial Rates (percentage) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Que. | Ont. | Nfld. | Man. | Sask. | Alta. | B.C. | Other |
| 1954 to 1956 | 7 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1957 and 1958 | 9 | 9 | 11 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1959 and 1960 | 9[a] | 9-10 | 11 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1961 | 9[a] | 12 | 11 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1962 to 1966 | 9[a] | 12 | 11 | 9 | 10 | 10 | 9 | 9 | 9 |
| 1967 | 10 | 12 | 12 | 11 | 11 | 11 | 10 | 10 | 10 |
| 1968 | 10 | 12 | 12 | 12[b] | 11 | 11 | 10 | 10 | 10 |
| 1969 | 10 | 12 | 12 | 13 | 11 | 11 | 11[c] | 10 | 10 |
| 1970 to 1972 | 10 | 12 | 12 | 13 | 13 | 11 | 11 | 10 | 10 |
| 1973 to 1975 | 10 | 12 | 12 | 13 | 13 | 12 | 11 | 12 | 10 |

a. Additional 1% in Quebec in lieu of university grants allowed from 1960 to 1966.

b. 12% rate effective April 1, 1968.

c. 11% rate effective July 1, 1969.

Source: The National Finances; An Analysis of the Revenues and Expenditures of the Government of Canada, Canadian Tax Foundation, Toronto, Canada.

significant rate differentials could result in capital flows from high-rate to low-rate provinces.

Given the above discussion of the structure of the corporation income tax in Canada, it is now appropriate to examine how the corporation taxable income (tax base) is determined.

## V.5 Determination of Corporate Taxable Income

Theoretically speaking, computation of corporate taxable income is very straightforward. Gross profit (income) of a corporation is the difference between its total revenues (including operating profits, investment earnings and half of capital gains) and intermediate purchases, labour costs, rent, interest payments on borrowed funds, and selling expenses. By deducting capital cost allowances from gross income, one arrives at net corporate profits or corporate taxable income. However, since not all revenues and costs are treated in the same way, and not all cost items are easy to measure precisely, the determination of the corporate taxable income is not as easy as one might think.

To arrive at a measure of corporate taxable income, the tax authorities in Canada apply the provisions of the tax laws to gross income. This practice results in a measure of taxable income which is different from the concept defined above. In what follows, we discuss briefly the major provisions of the Income Tax Act regarding the determination of corporate taxable income.

(a) Capital Cost Allowances. Corporations are permitted to deduct over a period of one year the capital cost of all their depreciable assets. Annual deduction of normal capital cost allowances are calculated on the basis of the diminishing balance method by which a given percentage is deducted each year on the undepreciated value of the asset. The rate at which these allowances are calculated differs from one type of asset to another. Under the current system, all depreciable assets are grouped into thirty-five separate classes with a maximum rate of depreciation for each class. These rates range from 4 per cent for roads and bridges, through 50 per cent for machinery and equipment used in designated areas, to 100 per cent for tools.[7] Since these rates are maxima, a corporation has a choice of shifting its cost and hence its taxable income between periods. For instance, by choosing a high rate of depreciation now, taxable income is shifted from the present into the future.

(b) Depletion Allowances. A corporation operating mines, oil, and gas wells, and wells for extracting potash may claim a depletion allowance in calculating its taxable income. In 1928 the allowance rate was set at 25 per cent of profits (after the deduction of capital cost allowances, exploration and drilling expenses, and interest expenses) derived from minerals, oil, and gas production. The rate was raised to 33.5 per cent in 1941 and remained constant until 1974. In 1974, the allowance was set at a lesser of either one third of expenditures on research and development or 25 per cent of profits. Since 1976, an additional allowance of 25 per cent of profits may be deducted in computing taxable income.

(c) Exploration and Development Expenditures. A corporation engaged in mining, or oil and gas production may deduct the entire expenditures on exploration and development in Canada against its income in the year the costs were incurred or in subsequent years.

(d) Business Losses. A corporation may write off business losses against its income in either the following 5 years or the preceding year.

(e) Miscellaneous Deductions. Canadian tax laws allow for many other deductions from gross income of corporations. The most important ones are dividends received from other Canadian taxable corporations and certain non-resident affiliates, scientific research expenditures, charitable donations, the three-year tax holiday for operating new mines, bad debts, and so on.

Occasionally, the federal government has introduced special depreciation schemes to increase (decrease) the depreciation charges on certain assets in an attempt to stimulate (discourage) capital expenditures in the economy. Some of the most important depreciation schemes introduced during the sample period covered in this study (1954-75) are as follows.

(1) Canadian Ownership. In this scheme, manufacturing and processing industries with a required dgree of Canadian ownership were permitted a 50 per cent straight line depreciation rate on machinery and equipment during the period June 13, 1963 to December 31, 1966.

(2) Deferred Allowances. This scheme, with the goal of moderating investment expenditures during the period March 29, 1966 to October 1, 1967, was to operate by applying the normal maximum rates of depreciation for building and machinery and equipment to only a fraction of the cost of such assets. For example, for most machinery and equipment, 50 per cent of the costs had to be deducted from the undepreciated cost before capital cost allowances could be deducted.

(3) Increase in Cost Base. With the objective of encouraging manufacturing and processing enterprises, this scheme permitted new investment in buildings, and machinery and equipment to be valued at 115 per cent of their actual costs for the purpose of calculating capital cost allowances during the period December 3, 1970 to March 31, 1972.

(4) Accelerated Allowances. Under this scheme, accelerated depreciation (full write-off in two years) is permitted on machinery and equipment purchased by manufacturing and processing industries after May 8, 1971 for use in Canada.

The above concludes our summary of the tax laws and rates reagrding the corporation income tax in Canada. The information provided in this chapter will be useful throughout the remainder of the thesis in examining the incidence and economic effects of policies involving the corporation income tax in Canada.

As a final note, it should be mentioned that corporate taxable income calculated through the application of the above-mentioned provisions tends to be significantly less than book profits of corporations and thus "costs" the federal government considerable loss in tax revenues. Table V-5 compares book profits and taxable income of corporations for the period 1965-75. Note that reducing taxable income of corporations in Canada through generous depreciation and other allowances in the post-war period has been a conscious policy on the part of the federal government aimed at encouraging business investment and hence stimulating the economy. This policy has been mainly responsible for the decline in the share of profits taxes in total revenue of the federal government as shown earlier in Table V-1. A further illustration of this point is provided in Table V-6 where the shares of corporate tax liabilities in book profits and in taxable income of corporations are compared. As shown, the share of corporate tax liabilities in book profits is substantially less than the share of corporate tax liabilities in corporate taxable income during the period 1965-75. However, the success of the policy of generous depreciation and other allowances in stimulating the

Canadian economy in the post-war period has been seriously questioned by many economists. For example, Kierans (1972) has argued that such policy not only fails to stimulate the economy, but also increases unemployment and foreign ownership in the Canadian economy.

Table V-5

Comparison of Book Profits Before Taxes and

Taxable Income in Millions of Dollars - All Corporations

(1965-75)

| Year | Book Profits (1) | Taxable Income (2) | (2)/(1) (%) |
|---|---|---|---|
| 1965 | 6787.0 | 4000.0 | 60.0 |
| 1966 | 7585.0 | 4100.6 | 55.5 |
| 1967 | 7521.3 | 4198.1 | 55.8 |
| 1968 | 9046.5 | 5921.6 | 65.5 |
| 1969 | 9900.1 | 6686.4 | 67.5 |
| 1970 | 8785.6 | 6402.4 | 72.9 |
| 1971 | 10655.4 | 7203.7 | 67.6 |
| 1972 | 11911.3 | 8461.9 | 71.0 |
| 1973 | 17253.0 | 11038.4 | 64.0 |
| 1974 | 22628.4 | 15569.2 | 68.8 |
| 1975 | 22222.0 | 17456.9 | 78.6 |

Source: <u>Annual Corporation Taxation Statistics</u>, Statistics Canada, Catalogue #61-208.

Table V-6

Comparison of the Shares of Corporate Tax

Liabilities in Book Profits and in

Taxable Income - All Corporations (1965-75)

| Year | Tax Liabilities / Book Profits | Tax Liabilities / Taxable Income |
|---|---|---|
| 1965 | 32.2% | 54.5% |
| 1966 | 31.7 | 57.1 |
| 1967 | 31.7 | 56.7 |
| 1968 | 31.3 | 47.8 |
| 1969 | 32.3 | 47.8 |
| 1970 | 34.7 | 47.6 |
| 1971 | 27.6 | 41.0 |
| 1972 | 32.8 | 46.1 |
| 1973 | 29.2 | 46.7 |
| 1974 | 30.5 | 44.3 |
| 1975 | 32.2 | 41.0 |

Sources: (1) National Income and Expenditure Accounts, 1961-1975, Statistics Canada, Catalogue #13-201.

(2) Annual Corporation Taxation Statistics, Statistics Canada, Catalogue #61-208.

# FOOTNOTES

1. See Auld and Miller (1975), ch.8.
2. For example, see Ballentine (1980).
3. For a detailed discussion of integration and different approaches to integration, see Auld and Miller (1975), ch. 8.
4. Stiglitz (1973) shows that in the absence of bankruptcy costs the investment decision of the firm remains unchanged and thus there is no inter-sector inefficiency resulting from the imposition or changes in the corporate profits tax. The tax, he argues, is just like a lump-sum tax on corporations.
5. Auld and Miller (1975), ch. 8.
6. Ballentine (1980), p. 9.
7. Asset classification and depreciation rates can be found in various issues of A.W. Gilmour, Income Tax Handbook.

# CHAPTER SIX

## The TRACE Model: Review and Extensions

### VI.1 Introduction

In Chapter 4 we demonstrated that in a conventional Keynesian macromodel the incidence and economic effects of policies involving the corporate income tax depend on how the government uses the additional revenues when the tax is raised. There, we also suggested that in order to verify this proposition in a consistent manner, one has to conduct an empirical analysis of the issue in the context of some sort of Keynesian general-equilibrium framework. For this purpose we use TRACE, an annual econometric model of the Canadian economy which has Keynesian features.

One main purpose of this chapter is to modify and extend the TRACE model in order to make it more suitable for a study of the incidence and economic effects of the corporate income tax. In so doing, we concentrate on the following two areas. First, we provide an alternative formula for the calculation of the rental price of capital in the investment function, so that it reflects some of the essential features of the Canadian tax system. Second, we endogenize real government expenditure on gross fixed capital formation so that, in our simulation exercises, we are able to measure the response of this variable to changes in the corporate income tax rate. Below, we shall elaborate on the treatment of these areas in the current version of TRACE.

The structure of this chapter is as follows. Section VI.2 presents a brief discussion of the TRACE model. In Section VI.3, we modify and extend TRACE by providing an alternative formula for the calculation of the rental cost of capital and also by introducing and estimating a behavioural equation for the deflator for government current expenditure on gross fixed capital formation. Finally, in Section VI.4, we conclude with a discussion of the forecasting performance of the modified model over the historical period 1962-75.

## VI.2 TRACE, An Annual Econometric Model of the Canadian Economy

TRACE, a medium-sized model of the Canadian economy, was first completed in 1968 at the Institute for Policy Analysis of the University of Toronto.[1] Since then it has gone through a number of modifications, mainly because of data revisions and specification improvements.[2] In this study, we use the latest version of the model, known as TRACE MK IV E, in which the parameter estimates are largely based on the annual National Income and Expenditure Accounts data for the period 1954-75. All real variables are expressed in terms of 1971 constant dollar values. The estimation method is OLS. The following is a brief description of the model and is based on two publications released by the Institute.[3] Because of the complex interdependencies in the model, we do not attempt to explain its interactions.

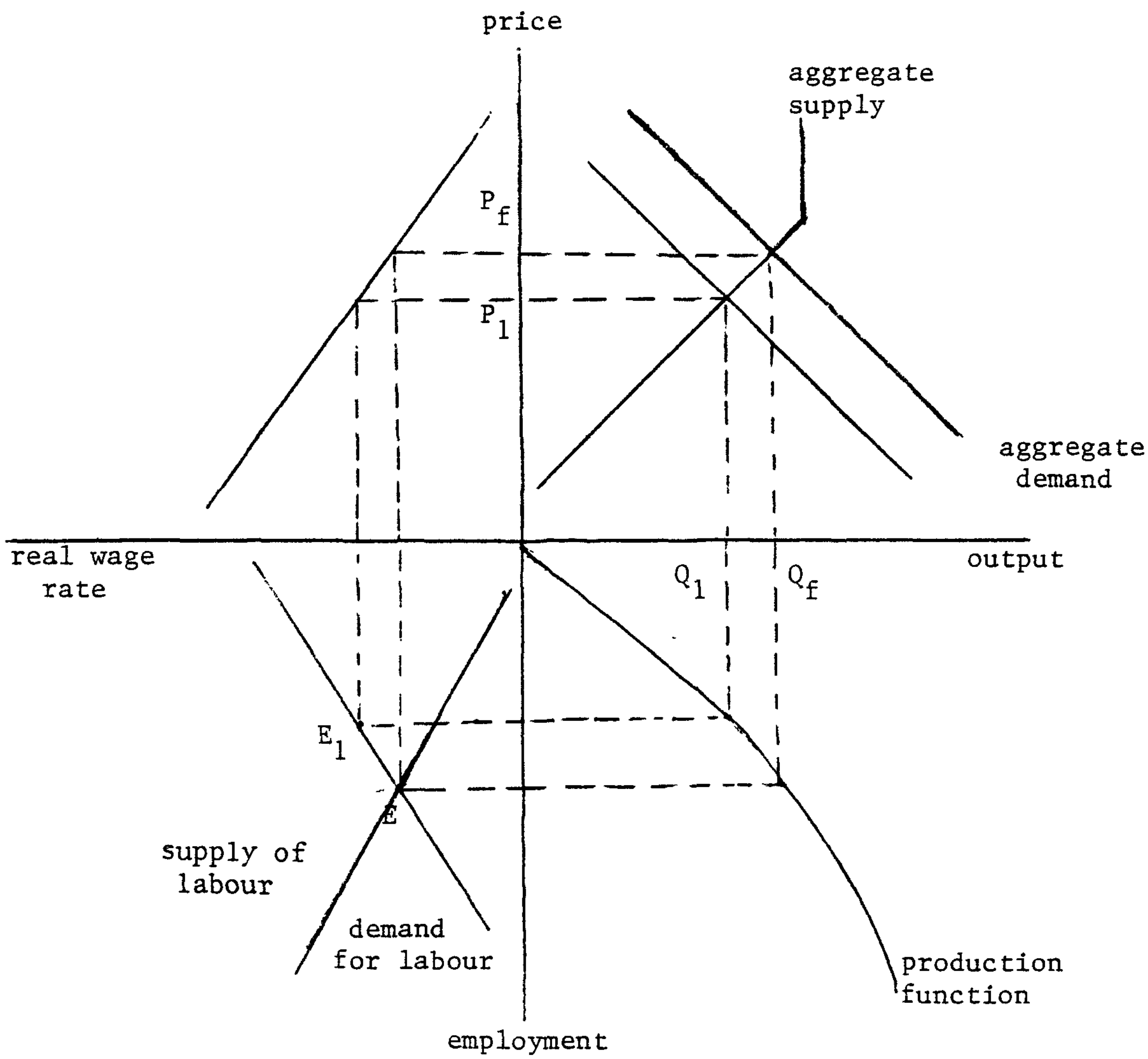
TRACE is a Keynesian model and is broadly similar to the model developed in Chapter 4, although TRACE is much more disaggregated and designed to represent the open Canadian economy. It depicts the familiar under-employment equilibrium of the Keynesian short run. It also exhibits desirable short and long-run dynamics.[4] Generally speaking, in TRACE, output can be conceived as being determined by the interaction of aggregate demand and supply schedules such as those shown in Figure VI-1.[5] The output level $Q_1$ is an under-employment equilibrium since it is smaller than the output level $Q_f$ which can be produced at the full employment. The under-employment equilibrium is attributable to the downward inflexibility of money wages which prevents the system from attaining full employment in each short period.

Equations of TRACE can be grouped in such a way as to represent the various schedules in Figure VI-1. The aggregate demand schedule is represented by equations for personal consumption, government expenditures, investment, exports, and imports. Personal consumption is broken down into expenditures on non-durable and semi-durable goods and services, and on durable goods. The former component is explained by a stock adjustment equation and the latter by a permanent-income hypothesis equation. Investment is disaggregated into expenditures on machinery and equipment, non-residential construction, residential construction, and changes in inventories. While the first two components of investment are explained by neoclassical (Jorgensonian) equations, the latter two

Figure VI-1

Determination of Output and Price Levels

in a Keynesian Model



are estimated by stock adjustment equations. Exports respond to changes in the level of economic activity abroad and the terms of trade, but imports are influenced by domestic economic conditions. Real gross national product at market prices (GNP) is computed by adding up the expenditure components of aggregate demand.

The supply side of the TRACE model (that is, the aggregate supply schedule) is determined by subtracting from real gross national product the exogenous output in the agriculture, government, and personal sectors, as well as indirect taxes less subsidies.

The relationship between output and employment and also the labour demand schedule in the lower part of Figure VI-1 are represented by equations determining employment, wage rates, and prices. In the key employment equation in TRACE, employment in the business non-agricultural sector, is explained by applying a partial adjustment model to the inverse of the Cobb-Douglas production function. The employment solutions of the model depict a point on the labour demand schedule as shown by $E_1$ on the graph. This under-employment solution is due to a slow downward adjustment in the money wage rate which prevents the model from achieving full-employment equilibrium.

In the key wage equation in TRACE, the rate of change in the money wage rate relative to the rate of change in productivity in the business non-agricultural sector is a function of actual to potential (full-employment) output and the rate of change in the prices of consumer goods and services. The wage inflexibility phenomenon referred to above, occurs through the price variable in this equation and is mainly due to the time lag between wage settlements and actual rates of inflation.

The labour supply schedule is represented by a set of equations determining labour force participation rates for eight age-sex categories. The overall labour force is calculated by adding the participation rates weighted by the relevant source population variables across these eight groups. Unemployment is obtained residually as the difference between total labour force and total employment.

The price of output in the business non-agricultural sector is obtained as a weighted average of a mark-up on unit labour costs and of the prices of exports and imports. The implicit price index of gross national product is a weighted average of the price of output in the business non-agricultural sector, the price index for the agricultural sector, and indexes of wage rates in the government and personal sectors.

National income is determined by subtracting capital cost allowances and indirect taxes less subsidies from gross national product in nominal terms. Labour income is the product of wage rates and employment levels. Corporate profits are explained stochastically as a function of the non-labour income component of value added in the business non-agricultural sector, and a capacity utilization variable.

A small set of tax and transfer payment equations is used to calculate total government revenue and expenditure and, hence, government saving and the government deficit or surplus. The government deficit influences interest on public debt, the balance of international payments, money supply, and interest rates.

The TRACE model can operate under fixed or flexible exchange rate regimes. In this study, however, we operate with the fixed-exchange-rate version since the period of our simulation experiments (1962-75) coincides for the most part with a fixed-exchange-rate regime in the Canadian economy.[6] The adoption of the fixed-exchange-rate version of the model becomes even more justifiable given the "managed" float practices by the government in early 1960's and 1970's.[7]

With respect to the monetary sector of the model, interest rates are explained by an inverse demand-for-money equation, as a function of the velocity of money and the expected rate of inflation. The expected rate of inflation is a function of current and past values of the implicit GNP price index.

The model permits the supply of money to be exogenous or to be determined in one of the following two ways: (a) it may respond to changes in official international reserves and/or the government deficit or (b) it may adjust so that the velocity of money is constant. Since the empirical work of this study in the next chapter will take place under a constant government budget deficit and we assume a fixed exchange rate regime with complete "sterilization", we adopt the exogenous-money-supply version of the TRACE model.

The foreign sector of the model includes equations for direct investment in Canada, net security outflows, and miscellaneous long-term and short-term capital flows. Interest rate differentials between Canada and the U.S. play a dominant role in these equations.

Under the fixed-exchange-rate system and exogenous money supply with full sterilization, changes in balance of international payments (current and capital accounts) affect the level of official international reserves. Under the flexible-exchange-rate regime a change in the exchange rate feeds through the model by affecting the prices of imports and exports and the prices of domestic goods and services and by influencing capital flows.

In the remainder of this chapter, we modify and extend the TRACE model and examine its overall forecasting performance.

## VI.3 Modifications and Extensions of the TRACE Model

The following modifications and extensions of the TRACE model are made in order to better suit the purposes of this study, namely the examination of the incidence and economic impacts of policies involving the corporate income tax. One of the areas in TRACE which we modify is the calculation of the rental cost of capital ($\lambda$). In TRACE, changes in the stock of capital (investment expenditures) are negatively related to $\lambda$ through a dynamic stock-adjustment equation that is Jorgensonian in character.[8] $\lambda$ is calculated as

$$\lambda = \frac{q(r+\delta)}{P} \tag{6.1}$$

where r is the real long-term rate of interest, $\delta$ is the rate of economic depreciation, q is the price index for capital goods, and P is the output price. This formula is similar to the one used by Jorgenson (1967) and is based on the assumption that firms maximize the present value of the firm subject to a production function. It suggests that the rental cost of capital in each period is the sum of the opportunity cost incurred in using the funds (q.r), net of capital gains or losses, plus depreciation (q.$\delta$). One major problem with this formulation is that it assumes no tax on business profits, thus removing the link between changes in corporate taxes and incentive policies of the tax authorities, on one hand, and investment expenditures, on the other. Since in this study we are primarily interested in examining the incidence and economic effects of higher profits taxes, it is quite important that such a link be reflected in the formulation of the rental cost of capital. One such formulation was developed in Chapter 4, based on Auerbach's (1979) work.[9] This approach was shown to lead to the following formula for $\lambda$.

$$\lambda = \frac{q(i+\delta)\ (i+\delta'(1-t_\pi))}{P(i+\delta')\ (1-t_\pi)} \tag{6.2}$$

where i is the weighted average personal cost of capital $(=\frac{r(1-xt_\pi)}{1-t_p})$, x is the proportion by which investment is debt financed, $\delta'$ is the rate of depreciation allowed by tax authorities for the calculation of taxable income, $t_\pi$ is the effective rate of corporate profits tax (tax liabilities divided by corporate profits), and $t_p$ is the effective rate of personal income tax (personal income taxes divided by personal income).

Note that in TRACE, $\lambda$ is used in the determination of two categories of investment expenditures - those on business machinery and equipment, and those on business non-residential construction. In the calculation of $\lambda$ for the former category, $\delta'$ is assumed to be 25 per cent, while in the latter case it is assumed to be 10 per cent. These numerical values appear to be reasonable in the Canadian context.[10] We may also note that estimating a precise value for $\delta'$ is extremely difficult, if not impossible, because, as discussed in Chapter 5, capital cost allowances permitted by tax authorities in Canada do not seem to be universal; they differ from industry to industry and from location to location. In any case, the assumed values for $\delta'$ in the calculation of $\lambda$ seem to generate reasonable simulation results.

Another area of TRACE which we modify is the modelling of government expenditure on gross fixed capital formation. In the TRACE MK IV E version of the model, real government expenditure on fixed capital formation (IFG) is treated exogenously, but it is endogenous in nominal terms. Consequently, the deflator for government expenditure on fixed capital formation (PIG) is endogenously obtained from the identity: $PIG = \frac{IFGV}{IFG}$ , where IFGV is government expenditure on fixed capital formation in nominal terms. However, this approach turns out to be unsatisfactory when conducting budget incidence analyses similar to the one explained in Case 4 in Chapter 4. In one such analysis, we intend to measure the change in IFGV, in response to a higher profits tax, which is consistent with a given government balance (viz., the difference between government expenditures and revenues). If IFG is treated exogenously, the change in IFGV will be reflected in a proportionate change in the deflator PIG; hence the entire change in IFGV is absorbed by the deflator. However, from the point of view of this study, this mechanism is not satisfactory, because we wish to examine the effect of government policies involving the corporate income tax on <u>real</u> government expenditure on fixed capital formation when the profits tax is changed. One way to allow for these real effects is to estimate PIG through a behavioural relationship and then find IFG by the identity $IFG = \frac{IFGV}{PIG}$. This is the approach we adopt here.

For the estimation of PIG, we follow a very simple approach and assume that PIG is positively related to the GNP price index (PGNP) through a linear relationship[11]; that is,

$$PIG = a_0 + a_1 PGNP \tag{6.3}$$

where a's are coefficients to be estimated. In order to be consistent with the remainder of the TRACE model, we estimate (6.3) by OLS, using annual National Income and Expenditure Account data for the period 1954-75. The estimates are summarized in Table VI-1. As shown in the first row of this table, the OLS estimates produce a Durbin-Watson statistic of .5797 which implies positive autocorrelation in the error term. To adjust for this, we applied the Cochrane-Orcutt (C-O) iterative technique. The estimates are given in row 2 of Table VI-1. The estimated coefficient of PGNP appears to be significantly different from zero at the 1 per cent level and has the expected sign. The $\bar{R}^2$ value is quite reasonable and suggests that over 98 per cent of variation in PIG is explained by PGNP. The standard error of the regression is very low (.031) and its ratio to the mean of the dependent variable is less than 3 per cent. Note that, although the intercept is not significantly different from zero at the 1

Table VI-1

Regression Results of the Equation for PIG

| | Regression Coefficients and their t scores in brackets | | | | | | |
|---|---|---|---|---|---|---|---|
| | inter-cept | PGNP | estimation technique | D-W | $\bar{R}^2$ | $\rho$ | estimation period |
| 1 | .0156<br>(.44) | 1.0051<br>(25.540) | OLS | .5717 | .9688 | | 1954-75 |
| 2 | -.0743<br>(-.90) | 1.0989<br>(14.439) | C-O | 1.356 | .9847 | .7838<br>(5.78) | 1955-75 |

per cent level of significance, we choose not to drop it, as it contributes to the model's ability to track the historical path.

## VI.4 Forecasting Performance of the TRACE Model

In this section we compare the forecasting performance of the TRACE model before and after making the modifications discussed above, to evaluate the effects of these modifications. In this discussion, we do not examine the absolute performance of the original model, TRACE MK IV E; that has been done in Helliwell, et. al. (1979). Hereafter we refer to the modified version of the model as TRACE MK IV G and the original version TRACE MK IV E.

In order to examine the relative forecasting performances of TRACE MK IV E and TRACE MK IV G models, we compare the values forecast by each of the two models with the actual values for some key variables during the estimation period 1962-75.[12] In so doing, we follow two routes. First, we plot the solutions of each model for each variable as well as its actual values over the period 1962-75. Second, we provide some commonly used quantitative measures of how closely individual variables follow their respective actual paths.[13] More specifically, we use the following two measures; mean absolute error (MAE) and mean absolute percentage error (MAPE) defined as:

$$MAE = \frac{1}{n} \sum_{1}^{n} \left| Y_t^s - Y_t^a \right| \tag{6.4}$$

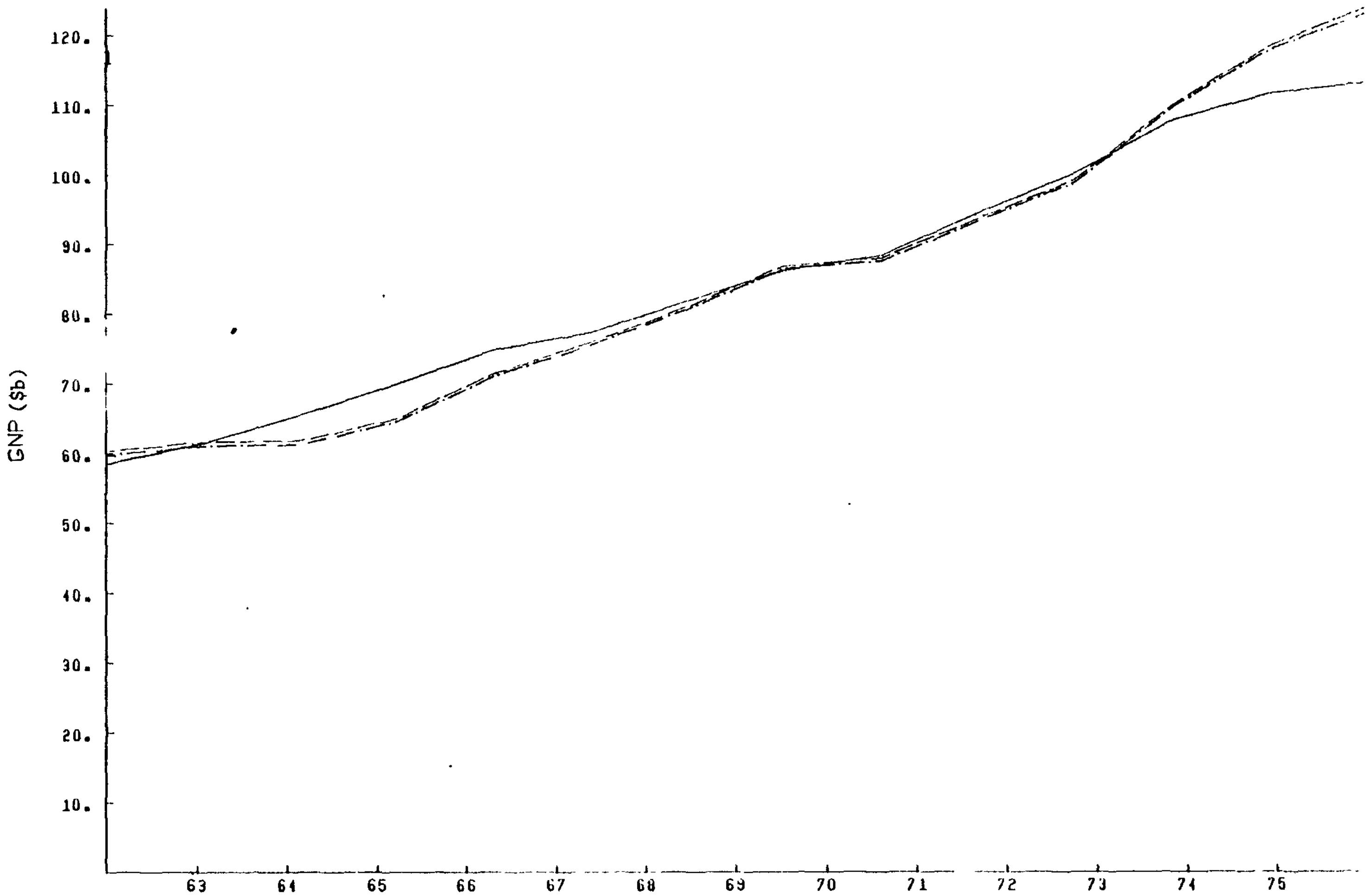
$$MAPE = \frac{1}{n} \sum_{1}^{n} \frac{\left| Y_t^s - Y_t^a \right|}{Y_t^a} \tag{6.5}$$

where $Y_t^s$ is the solution value of $Y_t$, $Y_t^a$ is the actual value of $Y_t$, and n is the number of years in the simulation period. Subscript t represents time. Both MAE and MAPE measure the deviation of solution values from actual time path for a particular variable. The lower the values of these measures, the better the variable tracks its actual path.

Figures VI-2 to VI-6 show the actual paths (—) and solution paths generated by TRACE MK IV E (---) and by TRACE MK IV G (-·-·-) for a number of selected important macroeconomic variables. These include real gross national product (GNP), the GNP price index (PGNP), the long-term nominal rate of interest (RLBG), real gross investment in machinery and equipment in non-agricultural business (IFMN), corporate tax liabilities (TYCL), and corporate profits (YC). Generally speaking, these graphs indicate that the solution paths of the two models are very close. Apart from IFMN, for which the G-version performs better over the entire sample period, the solution variables of the above variables for the two versions of the model, vis-à-vis their respective actual values, varies over the sample period. For instance, while the solution values for RLBG in the G-version is closer to the actual path for the first 5 and the last 3 years, for the rest of the sample period the E-version performs better. For YC and TYCL, the solution paths from the G-version are closer to the actual paths for most of the sample period than those obtained from the E-version. The opposite is true for GNP and PGNP. Clearly, on the basis of these graphs, one can not make any strong

Figure VI-2

Actual and Solution Paths for Real Gross National Product



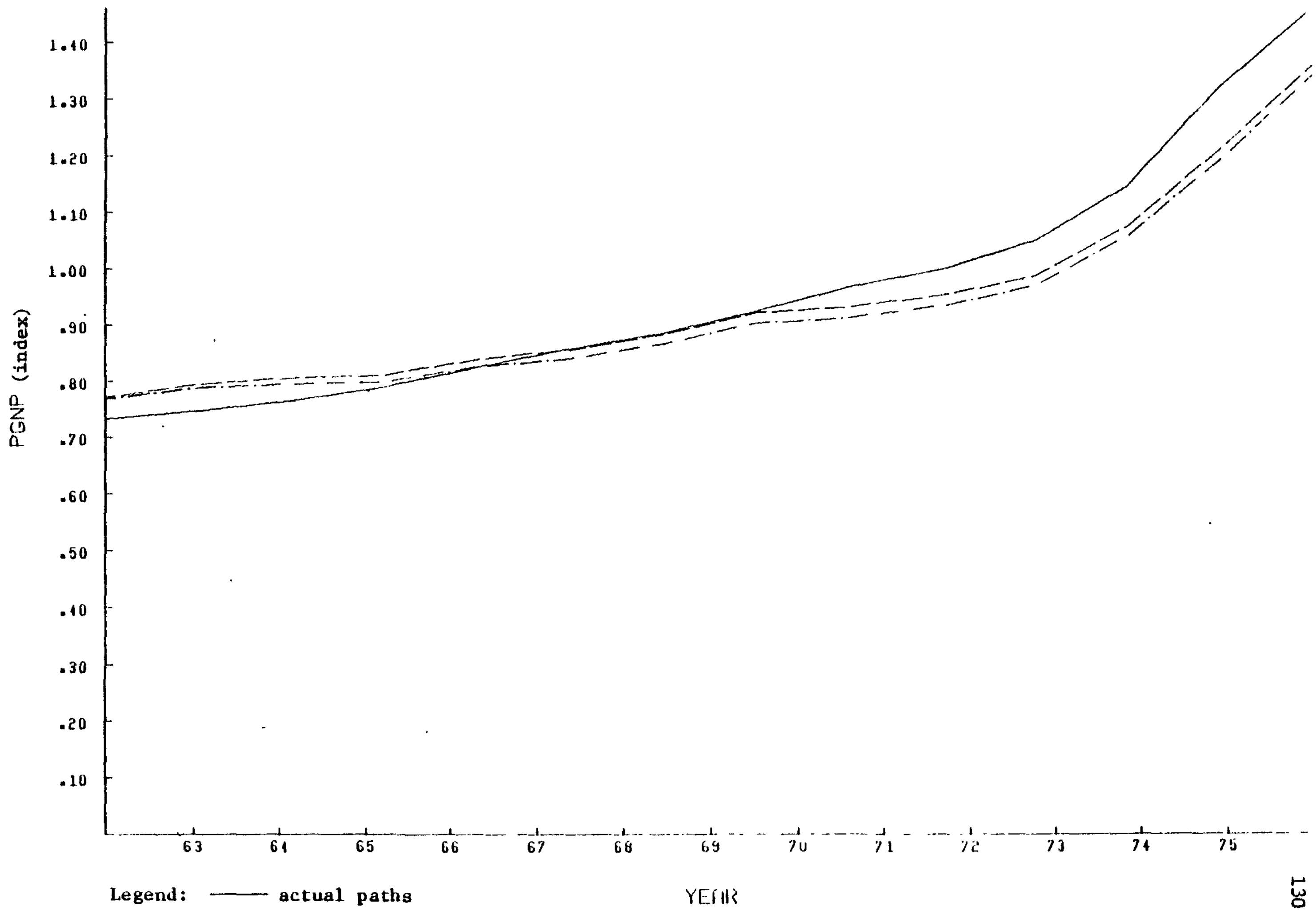

Legend: ——— actual paths

----- TRACE MK IV E

_._._ TRACE MK IV G

Figure VI-3

Actual and Solution Paths for The GNP Price Index



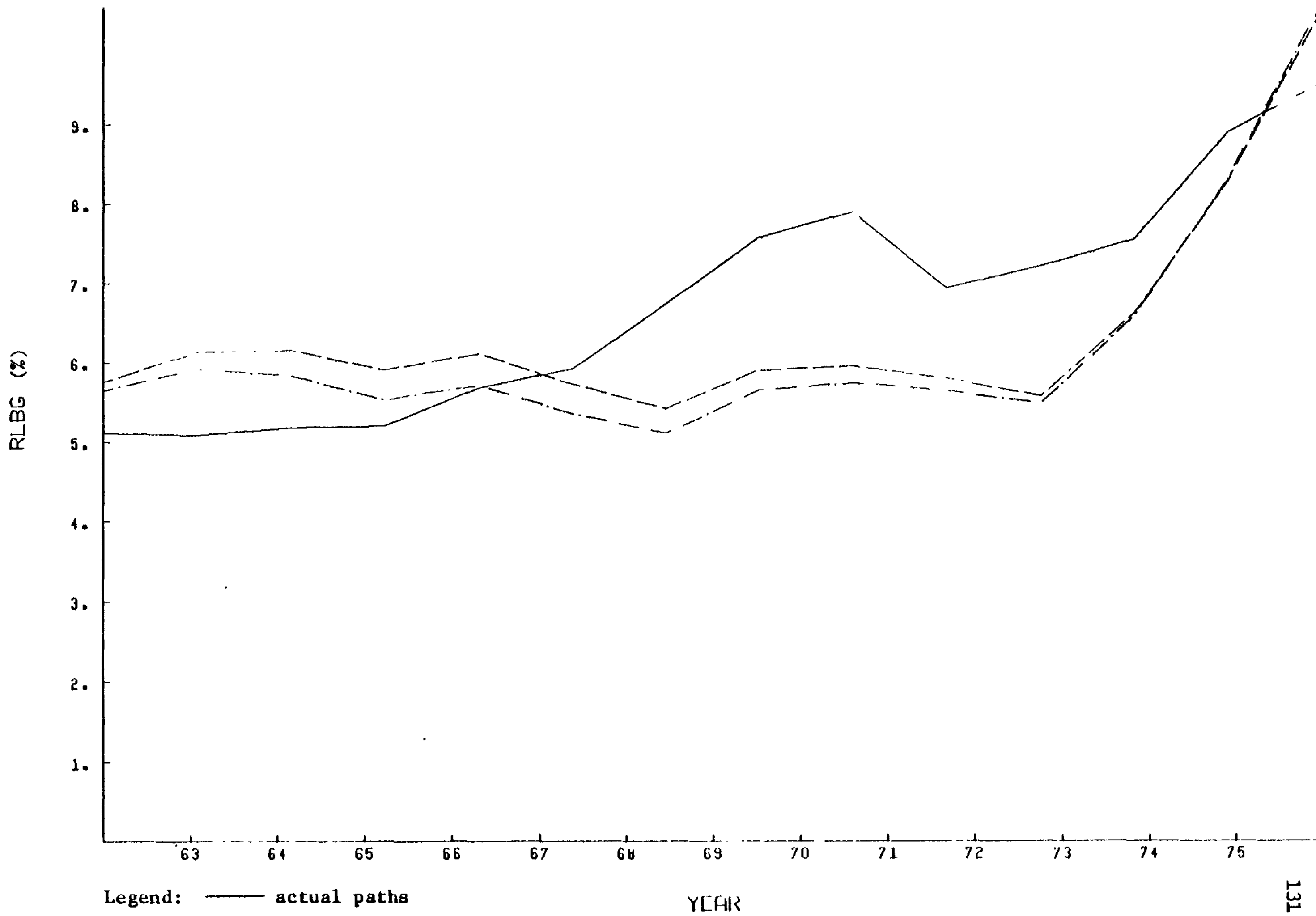

Legend: ——— actual paths

----- TRACE MK IV E

—·—·— TRACE MK IV G

Figure VI-4

Actual and Solution Paths for Long-Term Nominal Rate of Interest



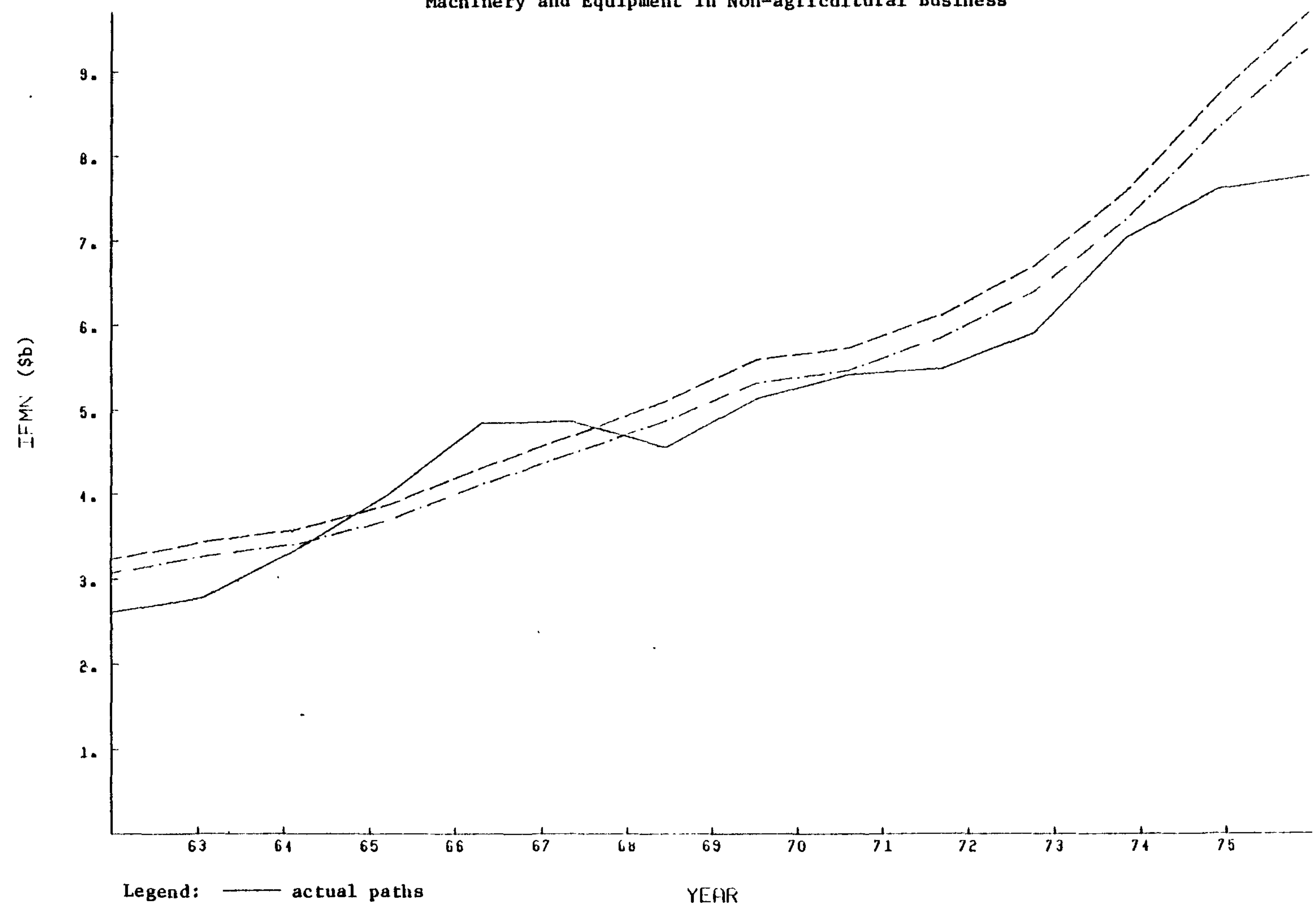

Legend: ——— actual paths

------ TRACE MK IV E

—·—·— TRACE MK IV G

Figure VI-5

Actual and Solution Paths for Investment in Machinery and Equipment in Non-agricultural Business



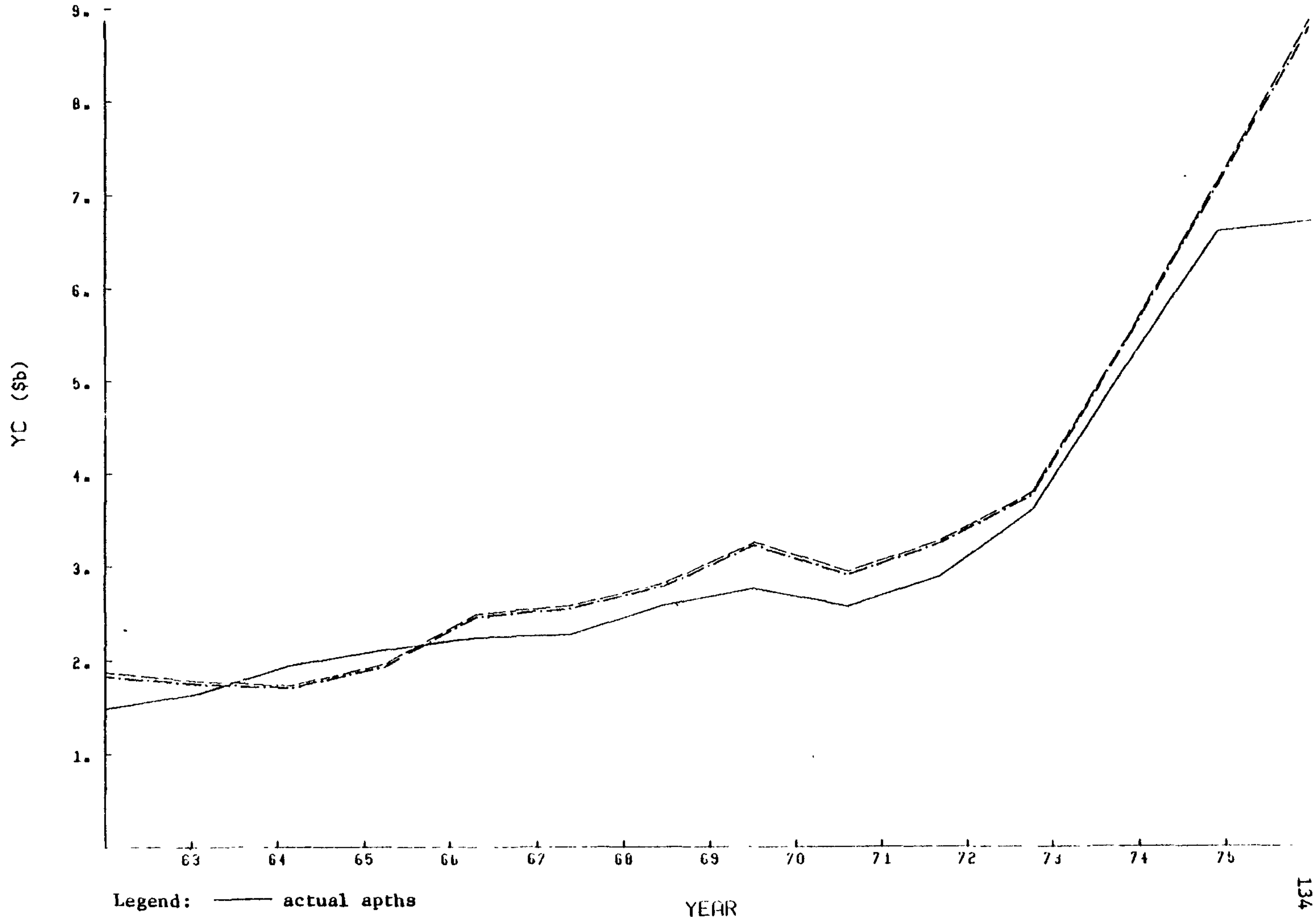

Legend: ——— actual paths

----- TRACE MKIV E

—·—·— TRACE MK IV G

Figure VI-7

Actual and Solution Paths for Before-Tax Corporate Profits




Legend: ——— actual apths

----- TRACE MK IV E

–·–·– TRACE MK IV G

Table VI-2

TRACE MK IV E vs TRACE MK IV G: Historical Comparison

| Variables / Measure | GNP | | PGNP | | IFMN | | RLBG | | YC | | TYCL | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | E | G | E | G | E | G | E | G | E | G | E | G |
| MAE | 2.761 | 2.835 | .043 | .051 | .620 | .448 | 1.011 | 1.016 | 1.305 | 1.224 | .486 | .460 |
| MAPE | 3.140 | 3.271 | 4.135 | 4.826 | 12.224 | 8.993 | 15.026 | 14.651 | 13.044 | 12.130 | 12.028 | 11.226 |

Note: E and G in the table refer to the E and G versions of TRACE.

judgement about superiority of one model over the other. We now turn to the MAE and MAPE measures to see whether or not more specific conclusions regarding relative performance of TRACE MK IV E and TRACE MK IV G can be reached.

As shown in Table VI-2, the MAE and MAPE measures for GNP and PGNP are somewhat lower for the E-version than those for the G-version, but the numerical difference is almost negligible. The opposite is true for variables YC and TYCL. For the long-term nominal rate of interest (RLBG), the value of MAE is lower for the E-version than for the G-version, but the opposite is true for the MAPE measure. Here, again, numerical differences are very small. However, MAE and MAPE for IFMN are significantly lower in the G-version than in the E-version. This particular phenomenon could be viewed as strong empirical support for the alternative formula for the rental cost of capital.

In view of the foregoing discussion, it is fair to say that the tracking performance of TRACE MK IV G is at least as good as that of TRACE MK IV E. Therefore, it seems that the modifications and extensions of the TRACE model suggested earlier in this chapter succeed in taking the model one step closer to capturing some of the features of the Canadian economy without damaging its overall macroeconomic performance.

We now proceed in the next chapter with a simulation of the effects of government policy changes involving the corporate income tax rate.

FOOTNOTES

1. This version of the model is known as TRACE MK 0 and is described in Choudhry, et. al. (1968).

2. TRACE MK I is described in Choudhry, et. al. (1972) and TRACE MK III R is described in Sawyer (1974).

3. Sawyer (1977) and also TRACE, Annual Canadian Econometric Model, Institute for Policy Analysis, University of Toronto (1977).

4. See Foot and Sawyer (1979).

5. See any intermediate macroeconomics textbook such as Gordon (1978).

6. For the period 1962-70 the value of the Canadian dollar was fixed at 92.5 U.S. cents.

7. See TRACE, Annual Canadian Econometric Model, Institute for Policy Analysis, University of Toronto (1977), p. T-R9.

8. Ibid., p. T-D4.

9. See Appendix A to Chapter 4.

10. See The National Finances, An Analysis of the Revenues and Expenditures of the Government of Canada, Canadian Tax Foundation, Toronto, Canada (any year).

11. Alternative forms of the relationship such as PIG/PGNP=f(time) were examined but did not improve significantly on this result.

12. The model's solutions for each year are obtained by the Gauss-Seidel method which consists of an iterative process and convergence to a given absolute difference. More specifically, this method starts with an initial guess for the solution and then uses the equations

one by one to adjust the solution vector by replacing all its elements with the newly calculated values. The new solution vector is used for the next iteration. This process continues until the solution vector converges to the desired level of approximation.

13. See Pindyck and Rubinfeld (1976), pp. 314-20.

# CHAPTER SEVEN

## Macroeconometric Analysis of the Incidence and Economic Effects of Policies Involving the Corporation Income Tax

### VII.1 Introduction

In this chapter, we examine the incidence and economic effects of alternative hypothetical government policies involving the corporate income tax in the context of TRACE MK IV G, a macroeconometric model of the Canadian economy. This analysis will include several differential and budget incidence analyses involving the corporate income tax. The underlying purpose of conducting these experiments is two-fold. First, we wish to test the proposition advanced in Chapter 4, that the incidence and economic effects of the corporation income tax depend on what other budget components the government changes when the corporate tax rate is changed. Second, we wish to ascertain empirically the degree of shifting of the tax and who gains and who loses from some particular changes in government policy involving the corporate income tax.

In order to demonstrate the first point we compare the control and disturbed solution values of selected key macroeconomic variables for each experiment. The control values are simply the solution values generated by the TRACE MK IV G model as summarized in the previous chapter. The disturbed values are the solutions generated by the model after accommodating differential or budget incidence analyses.

In differential incidence analyses, the corporate income tax rate is raised and either (1) the personal income tax rate (RTYP) or (2) the rate of excise and sales taxes (RTIES) adjusts in order to maintain the control value of the government budget balance (difference between government revenues and expenditures) in each time period. The control value of the government balance is the value that it takes prior to the introduction of the policy change.[1] Under budget incidence analyses, the corporation income tax rate is raised and either (1) government expenditure on fixed capital formation or (2) government transfer payments to unincorporated business adjust, so that the control value of the government balance is attained.[2] It should be mentioned that these experiments are chosen in order to provide a range of possible responses by the government to a change in the corporation income tax rate, within the structure of the TRACE model. It should also be noted that in all our experiments we focus on the "high" rate of corporation income tax. This, however, does not limit our discussion since, in the experiments not reported here, the simulation results are found to be insensitive to whether the high or low rate is chosen.

To conduct these experiments we focus on the equation for the (nominal) government balance (GBAL), given in the TRACE model by the following identity:

$$GBAL = TYP+TPM+TROP+TYCL+TYGB+TGI+TYW+TIM+TIES+TIP+CCAG-CGV-TRGP$$
$$-TRCU-TRGN-TRCB-SU-YIPD-IFGV-IIGV. \quad (7.1)$$

where

TYP is personal income taxes,

TPM is personal other direct taxes,

TROP is other personal transfers to government,

TYCL is corporate income tax liabilities,

TYGB is government business enterprise income taxes,

YGI is government investment income,

TYW is withholding taxes,

TIM is customs import duties,

TIES is excise and sales taxes,

TIP is property and other indirect taxes,

CCAG is government capital consumption allowances,

CGV is government current expenditure and goods and services,

TRGP is government transfer payments to persons,

TRCU is government capital assistance to unincorporated business,

TRGN is government transfer payments to non-residents,

TRCB is government assistance to corporate and government business enterprises,

SU is subsidies,

YIDP is interest on the public debt,

IFGV is government gross fixed capital formation, and

IIGV is the physical change in government inventories.

Now, in a differential incidence analysis,we increase the level of corporate income tax liabilities (TYCL) by raising the corporate income tax rate 10 percentage points[3] above its historical path, beginning in 1962[4], and fix the value of GBAL at its control level. We then find the rate as well as the level of either personal income taxes or of sales and excise taxes in each period which are consistent with the government balance identity. Similarly, in a budget incidence analysis, we raise the level of corporate tax liabilities (TYCL) by increasing the corporate income tax rate 10 percentage points above its historical path,beginning in 1962, and fix the value of GBAL at its control level. We then solve (7.1) for either IFGV or TRCU. These equations are used to replace the original equations for IFGV and TRCU. Generally speaking, all our experiments initiate two major direct forces. On one hand, a higher corporate income tax increases the rental cost of capital and hence decreases real investment expenditures. As a result, aggregate demand tends to fall. On the other hand, the assumption of a fixed government balance means that the accompanying induced policy change tends to increase the level of aggregate demand; that is, high corporate income taxes will imply either lower rates of other taxes, as in our differential incidence analyses, or higher government expenditures, as in budget incidence analyses. Therefore, the overall effect on the level of aggregate demand in each of the experiments depends on the relative strength of these two opposing forces.

It should be mentioned that in none of our experiments do we expect to get equal changes in TYCL and the revenues from the particular tax or the particular government expenditure variable that is changed. This is because, in addition to direct effects on TYCL and the relevant tax or expenditure variable, each experiment will indirectly influence the values of other endogenous components of government revenues and expenditures, namely TYP, TYW, TIM, TIES, CCAG, CGV, and IFGV. However, the sum of changes in all taxes must equal the sum of changes in all types of government expenditures.

Turning to the second objective of this chapter, which is the calculation of the degree of tax shifting, we introduce the following two formulas (measures). These formulations are similar to those used in earlier studies by Krzyzaniak and Musgrave (1963) and Levesque (1965). The first formula is based on the condition for 100 per cent shifting:

$$(1-t_{\pi})\pi = \pi' \qquad (7.2)$$

where $t_{\pi}$ is the effective rate of corporate income tax, $\pi$ is before-tax real profits, and $\pi'$ is corporate profits in the absence of the tax. Since we are now dealing with a rise in the tax rate, we must compare the 100 per cent shifting condition at the new tax rate ($t_{\pi}^{d}$) represented by equation (7.3) with that at the old tax rate ($t_{\pi}^{c}$) represented by equation (7.4).

$$(1-t_{\pi}^{d})\pi^{d} = \pi' \tag{7.3}$$

$$(1-t_{\pi}^{c})\pi^{c} = \pi' \tag{7.4}$$

where $\pi^d$ is before-tax profits in real terms under the new tax rate and $\pi^c$ is before-tax profits under the old tax rate. Below, we shall refer to $\pi^d$ and $\pi^c$ as before-tax profits in disturbed and control solutions, respectively. Deducting (7.4) from (7.3) and rearranging terms, we obtain the condition for 100 per cent shifting of the incremental tax rate; that is,

$$\pi^{d} - \pi^{c} = t_{\pi}^{d}\,\pi^{d} - t_{\pi}^{c}\,\pi^{c}. \tag{7.5}$$

This formula suggests that the degree of shifting can be defined as

$$S = \frac{\pi^{d} - \pi^{c}}{t_{\pi}^{d}\,\pi^{d} - t_{\pi}^{c}\,\pi^{c}} \tag{7.6}$$

which is the change in before-tax profits as a percentage of the change in tax liabilities. Such measure, however, is inadequate as it does not explicitly allow for changes in non-tax variables such as capital stock in relation to corporate profits. To deal with this problem, we standardize the profits figures by the capital stock in the business non-agricultural sector (K) and hence work with rates of return.[5] Thus, our first shifting measure (index) is:

$$S_1 = \frac{(\frac{\pi}{K})^d - (\frac{\pi}{K})^c}{t_\pi^d (\frac{\pi}{K})^d - t_\pi^c (\frac{\pi}{K})^c} \quad . \tag{7.7}$$

If $S_1 = 0$ or $S_1 = 1$, there will be zero or full tax shifting, respectively. If $0 < S_1 < 1$, it implies a positive degree of shifting. A negative value for $S_1$ implies that, in response to a tax increase, the before-tax rate of return declines and hence corporations bear more than the full burden of the tax. On the other hand, if $S_1$ is greater than unity, it implies more than 100 per cent shifting of the tax by corporations.

The second shifting measure that we use in this study is derived as follows. From equations (7.3) and (7.4) above we can write the condition for 100 per cent shifting of the incremental tax as

$$\frac{\pi^d}{\pi^c} = \frac{1-t_\pi^c}{1-t_\pi^d} \, . \tag{7.8}$$

Furthermore, zero tax shifting, realized when before-tax profits remain constant in the wake of a tax increase, can be represented by

$$\frac{\pi^d}{\pi^c} = 1 \, . \tag{7.9}$$

After standardizing the profits figures by total output in the economy (to work with profits share) and combining equations (7.8) and (7.9), the shifting measure can be represented as

$$S_2 = \frac{\dfrac{y^d}{y^c} - 1}{\dfrac{1-t_\pi^c}{1-t_\pi^d} - 1} \tag{7.10}$$

where $y^d$ and $y^c$ are the shares of before-tax corporate profits in gross national product in disturbed and control solutions, respectively. Here again $S_2 = 0$ and $S_2 = 1$ imply zero and full tax shifting, respectively. When $0 < S_2 < 1$, there will be a positive degree of shifting. A negative value for $S_2$ implies that corporations bear more than the full burden of the tax. If $S_2$ takes a value of greater than unity, there will be more than 100 per cent shifting of the tax by corporations. [6]

Another aspect of shifting is to determine where the tax is shifted. The corporation income tax is said to be "shifted forward" if the output price increases as a result of a rise in the tax rate. Conversely, the tax is said to be "shifted backward" if the nominal wage rate decreases as a result of an increase in the tax rate. Therefore, by studying the movements in the output price and the money wage rate one could obtain information regarding the forward and backward shifting of the corporation income tax. Below, we shall focus on the GNP price index and the nominal wage rate in the business non-agricultural sector as indicators of the forward and backward shifting, respectively. Furthermore, we examine changes in the real personal disposable income and real wage rate to find out whether or not consumers and wage earners are better off when a particular policy is introduced. Here we wish to emphasize that shifting of the corporate income tax does not have to take place through changes in the output price relative to the money wage rate as is traditionally argued (see Chapter 2). In fact, it is quite possible for shifting to occur even if the real wage rate rises; for example, this could happen if the policy involving the corporation income tax is expansionary, increasing real output and before-tax profits.

In what follows, we first describe the control solution with which the results of other experiments are to be compared. Then, we conduct a standard experiment in which we study the incidence and economic effects of a 10 percentage point increase in the corporation income tax without any other changes to the model. In this experiment the additional tax revenues raised either increase the government budget surplus or decrease the budget deficit. This experiment is somewhat similar to analyses of the existing econometric literature on the short-run shifting of the corporation income tax, in that economy-wide effects of higher tax revenues are ignored.[7] From this experiment, we attempt to draw some a priori conclusions about our main experiments as described above. These experiments will be explained immediately following the standard experiment.

In reporting our simulation results we adopt a standard tabular format. Each table represents a separate experiment, showing the measure of tax effects on a few selected variables in comparison with the control solution for selected years after the introduction of the policy change. The choice of the sample period is based mainly on the availability of actual data in the TRACE data bank. Because estimates of the parameters of the model are based on different time periods, the model can be used for simulation only for the period 1958-75 during which actual data are available for all the variables in TRACE. Furthermore, the starting year of simulation is advanced to 1962 because prior to 1962 some of the important government and personal sectors variables are assumed to be exogenous. These variables include wage rates, prices and so forth, which are central to our incidence analyses.

## VII.2 The Control Solution

As we have stated above, the control solution in this study refers to the solution of TRACE MK IV G. This non-linear model is solved by the Gauss-Seidel method. This method starts with an initial value for the solution and then uses the equations of the model one by one to adjust the solution vector by replacing all its elements with the newly calculated values. The new solution vector is used for the next iteration. This process continues until the solution vector converges to some given absolute difference. Table VII-1 below contains the control values of some key variables which enter one way or another into the discussion of the effects of the above-described policy changes. The values are given for years 1 to 6, 8, 10, 12, and 14 in the simulation period. Definitions of these variables are as follows.

BPC is current account balance of international payments,

| | |
|---|---|
| BPO | is balance of official international reserves, |
| C | is real personal expenditure on consumer goods and services, |
| CG | is real government current expenditure on goods and services, |
| CGV | is nominal government (current) expenditure on goods and services, |
| FLCN | is total long-term capital inflow, |
| FSN | is short-term capital movements, |
| GBAL | is the government balance, |
| GDP | is real gross domestic product at factor cost, |
| IFB | is business gross fixed capital formation, real, |
| IFG | is government gross fixed capital formation, real, |
| IFGV | is government gross fixed capital formation, nominal, |
| IFMB | is real business gross fixed capital formation in machinery and equipment, |
| IFNB | is business gross fixed capital formation in non-residential construction, real, |
| LE | is total civilian labour force employed, |
| LF | is civilian labour force, |
| M | is imports of goods and services, real, |
| PGNP | is the implicit price index of gross national expenditure at market prices, |
| RHON | is the utilization ratio in the business non-agricultural sector, |

Table VII-1

Control Solution

| Variable \ Year in Simulation | 1 | 2 | 3 | 4 | 5 | 6 | 8 | 10 | 12 | 14 |
|---|---|---|---|---|---|---|---|---|---|---|
| BPC ($b) | -1.209 | -1.245 | -1.123 | -1.465 | -1.375 | -1.632 | -1.904 | -2.037 | -1.187 | -2.729 |
| BPO ($b) | 1.690 | 2.230 | 2.177 | 1.880 | 1.800 | 1.223 | -1.226 | 1.022 | -.343 | 8.207 |
| C ($b) | 38.309 | 39.945 | 40.826 | 42.526 | 44.824 | 47.014 | 51.889 | 56.950 | 65.379 | 77.568 |
| CG ($b) | 10.892 | 10.994 | 11.523 | 12.082 | 13.157 | 14.055 | 15.644 | 17.977 | 19.256 | 22.078 |
| CGV ($b) | 6.939 | 7.393 | 8.034 | 8.685 | 9.984 | 11.233 | 14.194 | 18.081 | 22.196 | 33.737 |
| FLCN ($b) | 1.462 | 1.581 | 1.492 | 1.964 | 1.920 | 1.712 | .877 | 2.039 | 1.196 | 5.015 |
| FSN ($b) | 1.436 | 1.894 | 1.808 | 1.381 | 1.254 | 1.142 | -.240 | .901 | -.351 | 5.920 |
| GBAL ($b) | .493 | .519 | .672 | .944 | 1.204 | 1.335 | 3.795 | 1.213 | 4.356 | 1.091 |
| GDP ($b) | 53.667 | 55.154 | 55.642 | 58.850 | 63.742 | 66.915 | 75.295 | 80.639 | 94.316 | 108.052 |
| IFB ($b) | 10.938 | 11.025 | 11.034 | 11.888 | 12.888 | 13.626 | 14.818 | 16.087 | 19.556 | 23.617 |
| IFG ($b) | 2.664 | 2.682 | 2.652 | 3.003 | 3.307 | 3.403 | 3.350 | 3.754 | 3.751 | 4.128 |
| IFGV ($b) | 2.058 | 2.138 | 2.135 | 2.497 | 2.866 | 3.033 | 3.312 | 3.873 | 4.448 | 6.097 |
| IFMB ($b) | 3.522 | 3.842 | 4.089 | 4.502 | 4.966 | 5.386 | 5.989 | 6.580 | 8.314 | 10.532 |
| IFNB ($b) | 3.823 | 3.896 | 4.002 | 4.247 | 4.417 | 4.523 | 4.776 | 5.051 | 5.423 | 6.200 |
| LE (m) | 6.579 | 6.712 | 6.574 | 6.587 | 6.838 | 7.172 | 7.690 | 8.043 | 8.859 | 9.972 |
| LF (m) | 6.684 | 6.873 | 6.996 | 7.204 | 7.542 | 7.695 | 8.190 | 8.699 | 9.309 | 10.378 |
| M ($b) | 11.454 | 12.323 | 13.069 | 14.202 | 15.904 | 17.786 | 21.545 | 24.301 | 28.260 | 31.909 |
| PGNP (index) | .761 | .790 | .814 | .840 | .873 | .897 | .976 | 1.043 | 1.165 | 1.481 |
| RHON (index) | 1.009 | .981 | .936 | .940 | .960 | .966 | .989 | .958 | 1.033 | 1.038 |
| RLBG (%) | 5.633 | 6.050 | 6.368 | 6.683 | 7.189 | 7.077 | 7.024 | 7.022 | 7.485 | 11.058 |
| RTB (%) | 5.517 | 6.372 | 6.458 | 6.118 | 6.704 | 6.052 | 5.846 | 5.147 | 5.771 | 12.008 |
| RTYP (%) | 17.8 | 17.8 | 18.5 | 18.5 | 17.6 | 19.2 | 21.7 | 21.1 | 22.8 | 18.9 |
| RTIES (%) | 15.9 | 15.1 | 15.6 | 14.9 | 14.7 | 15.2 | 15.8 | 15.6 | 15.3 | 17.4 |
| TIES ($b) | 3.481 | 3.767 | 4.100 | 4.495 | 4.941 | 5.455 | 6.631 | 7.509 | 9.430 | 13.422 |
| TRCU ($b) | .006 | .007 | .020 | .023 | .022 | .005 | .004 | .022 | .044 | .160 |
| TYCL ($b) | 2.307 | 2.297 | 2.317 | 2.654 | 3.130 | 3.204 | 4.009 | 4.133 | 6.707 | 10.128 |
| TYP ($b) | 2.946 | 3.227 | 3.571 | 3.952 | 4.223 | 5.352 | 8.513 | 10.032 | 14.391 | 18.922 |
| W ($) | 2.55 | 2.64 | 2.71 | 2.76 | 2.84 | 2.96 | 3.20 | 3.42 | 3.60 | 3.73 |
| WRN ($) | 2.12 | 2.28 | 2.38 | 2.46 | 2.61 | 2.78 | 3.22 | 3.64 | 4.21 | 5.65 |
| X ($b) | 9.911 | 10.696 | 11.365 | 12.152 | 13.812 | 15.562 | 19.291 | 21.841 | 25.977 | 25.625 |
| YC ($b) | 6.322 | 6.290 | 6.354 | 7.412 | 8.905 | 9.138 | 11.334 | 12.069 | 19.258 | 29.763 |
| YDR ($b) | 42.186 | 43.573 | 43.427 | 44.989 | 47.816 | 50.266 | 55.599 | 60.600 | 71.736 | 88.105 |
| ZEPGL (%) | 1.885 | 2.313 | 2.733 | 3.138 | 3.509 | 3.504 | 3.602 | 3.745 | 4.268 | 7.743 |
| ZEPTB (%) | 2.223 | 2.990 | 3.490 | 3.547 | 3.457 | 3.314 | 3.824 | 3.823 | 4.738 | 10.503 |

Note: Year 1 corresponds to 1962.

RLBG is long-term interest rate in Canada, i.e., average wednesday market yield, over the year, on government bonds with 10 years or more to maturity,

RTB is treasury bill rate in Canada; average yield on three-month bills,

RTIES is implicit rate of sales and excise taxes,

RTYP is average personal income tax rate,

TIES is excise, sales, and similar indirect taxes,

TPM is personal other direct taxes,

TRCU is government capital assistance to unincorporated business,

TYCL is corporate income tax liabilities,

TYP is personal income taxes,

W is the real wage rate, defined as the ratio of nominal wage rate to the price of output in the business non-agricultural sector,

WRN is the nominal wage rate in the business non-agricultural sector,

X is total exports of goods and services, real,

YC is corporation profits before taxes and before dividends paid to non-residents,

YDR is personal disposable income, real,

ZEPGL is expected long-term rate of inflation, and

ZEPTB is expected short-term rate of inflation.

## VII.3 Experiment 0: Increase in the Corporation Income Tax Rate

In this experiment we examine the effects of a policy in which the only exogenous change is an increase in the corporation income tax rate. This analysis is somewhat similar to those of the existing econometric studies on the short-run shifting of the corporation income tax reviewed in Chapter 3, in that the effects of the use made of the tax revenues raised are not considered. This policy change either increases the government budget surplus or reduces the deficit. The government budget surplus or deficit is assumed to have no real impact on the system.[8] The real effect of the policy change comes from the rise in the corporation income tax rate. *A priori*, we expect this policy to be contractionary because the higher tax rate raises the rental price of capital goods and hence causes investment expenditures to fall.[9]

To implement the above policy, we raise the high rate of corporation income tax (RTCH) 10 percentage points above its historical path, beginning in 1962. The results of the experiment are given in Table VII-2. This experiment raises corporate tax liabilities (TYCL) by between \$224 million in the first year and \$1062 million by the fourteenth year, with an offsetting increase in the government balance (GBAL) of between \$206 and \$1074 million. As mentioned earlier, unequal changes in TYCL and GBAL are due to the fact that the experiment affects all the endogenous components of the government balance equation. To repeat, TYCL and GBAL are not the only variables changing in this equation.

To explain the results of Table VII-2, we use a simple aggregate demand (AD) - aggregate supply (AS) diagram similar to what was used in Chapter 4. However, the model developed in Chapter 4 dealt with a single short period or a long-run equilibrium with a fixed capital stock.

Figure VII-1

Increase in the Corporate Income Tax Rate

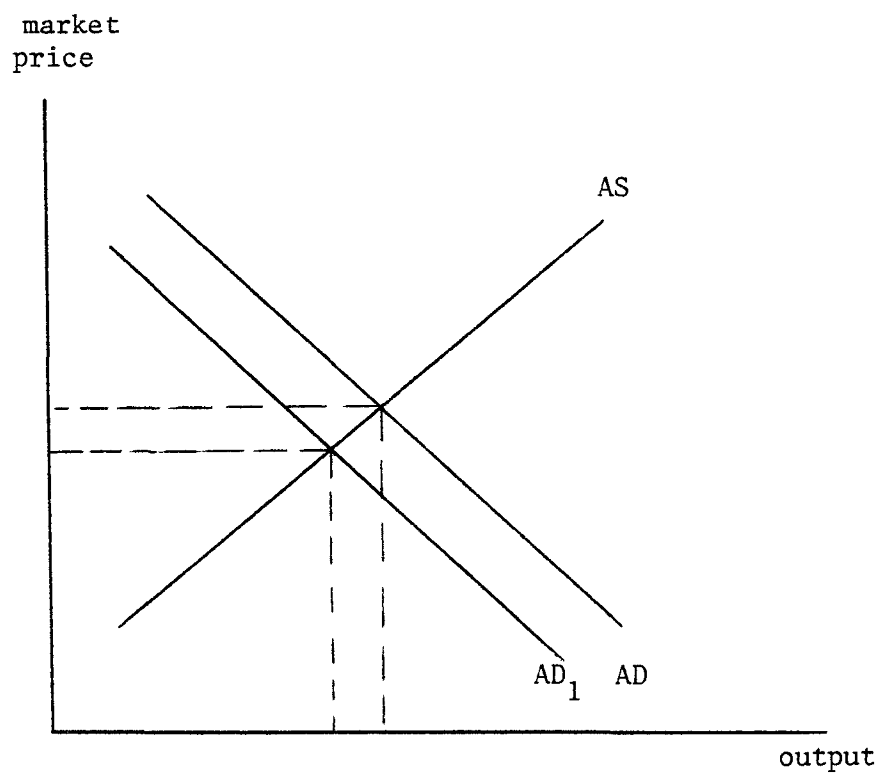


Table VII-2

Experiment 0: An Increase in the Rate of Corporation Income Tax [a]

| Variable \ Year in Simulation | 1 | 2 | 3 | 4 | 5 | 6 | 8 | 10 | 12 | 14 |
|---|---|---|---|---|---|---|---|---|---|---|
| BPC ($m) | 34 | 59 | 80 | 95 | 116 | 135 | 181 | 210 | 256 | 389 |
| BPO ($m) | -29 | -54 | -69 | -52 | -23 | 19 | 85 | 150 | 256 | 425 |
| C ($m) | -79 | -116 | -139 | -140 | -154 | -165 | -187 | -189 | -187 | -274 |
| CGV ($m) | -12 | -28 | -42 | -52 | -65 | -82 | -118 | -151 | -170 | -246 |
| FLCN ($m) | -10 | -25 | -37 | -37 | -34 | -17 | 5 | 23 | 55 | 104 |
| FSN ($m) | -53 | -89 | -112 | -110 | -104 | -98 | -101 | -83 | -55 | -67 |
| GBAL ($m) | 206 | 208 | 210 | 253 | 308 | 313 | 376 | 424 | 646 | 1074 |
| GDP ($m) | -128 | -118 | -103 | -78 | -82 | -72 | -67 | -46 | -46 | -136 |
| IFB ($m) | -89 | -91 | -88 | -80 | -87 | -89 | -99 | -90 | -101 | -152 |
| IFGV ($m) | -4 | -7 | -8 | -10 | -12 | -13 | -15 | -16 | -17 | -24 |
| IFMB ($m) | -32 | -34 | -35 | -35 | -39 | -41 | -46 | -44 | -50 | -66 |
| IFNB ($m) | -33 | -34 | -34 | -35 | -37 | -38 | -42 | -39 | -43 | -51 |
| LE (000's) | -14 | -17 | -14 | -9 | -7 | -4 | 0 | 5 | 9 | 3 |
| LF (000's) | -2 | -4 | -5 | -5 | -6 | -6 | -7 | -7 | -6 | -8 |
| M ($m) | -38 | -64 | -85 | -98 | -116 | -134 | -169 | -191 | -196 | -229 |
| PGNP (%) | -.1 | -.2 | -.3 | -.4 | -.4 | -.5 | -.5 | -.5 | -.5 | -.5 |
| RHON (%) | -.3 | -.2 | -.2 | -.1 | -.1 | 0 | 0 | .1 | .1 | 0 |
| RLBG (% point) | -.03 | -.06 | -.08 | -.10 | -.10 | -.10 | -.07 | -.05 | -.02 | -.01 |
| RTB (% point) | -.09 | -.15 | -.19 | -.18 | -.17 | -.15 | -.15 | -.11 | -.07 | -.07 |
| TIES ($m) | -14 | -22 | -28 | -31 | -36 | -40 | -51 | -52 | -61 | -90 |
| TYCL ($m) | 224 | 228 | 231 | 269 | 321 | 330 | 408 | 437 | 695 | 1062 |
| W (%) | -.1 | -.2 | -.2 | -.3 | -.3 | -.3 | -.3 | -.3 | -.3 | -.3 |
| WRN (%) | -.2 | -.4 | -.6 | -.7 | -.7 | -.8 | -.9 | -.9 | -.9 | -.8 |
| X ($m) | 4 | 10 | 15 | 19 | 23 | 30 | 36 | 40 | 44 | 44 |
| YC ($m) | -35 | -20 | -20 | -22 | -33 | -32 | -43 | -41 | -70 | -141 |
| YDR ($m) | -142 | -202 | -212 | -194 | -209 | -215 | -228 | -206 | -191 | -359 |
| ZEPGL (% point) | -.01 | -.04 | -.06 | -.08 | -.08 | -.08 | -.05 | -.03 | .00 | .02 |
| ZEPTB (% point) | -.03 | -.07 | -.10 | -.09 | -.07 | -.05 | -.04 | -.02 | .01 | .02 |
| $S_1$ | -.09 | .03 | .07 | .09 | .08 | .10 | .12 | .13 | .12 | .10 |
| $S_2$ | -.03 | .02 | .04 | .04 | .02 | .04 | .04 | .04 | .03 | .02 |

(a) The numbers in this table are based on the differences between the solution and control values of the various variables involved.

The TRACE model has a similar structure in the short run but it represents the structure of a dynamic growth model over a sequence of short periods. Therefore, the model in Chapter 4, strictly speaking, can be used to interpret only the first column of results in Table VII-2. After the first period, when dynamic forces take over, the TRACE results have to be thought of in terms of a dynamic growth model.

In the first period, the increase in the rate of corporate income tax raises the rental prices of machinery and equipment and non-residential construction, thus reducing business outlays in these areas and consequently lowering aggregate demand in the economy. This implies a leftward shift in aggregate demand from AD to $AD_1$, in Figure VII-1. The new equilibrium in the economy is attained where AS and $AD_2$ meet.[10] As expected, this new equilibrium produces lower levels of output and price. The contractionary impact of Experiment 0 is not substantial. As shown in Table VII-2, <u>the change</u> in gross domestic product (GDP) is -\$128 million in the first year, it slows down throughout the experiment and reaches -\$46 million in the 12th year, then it increases to -\$136 million by the 14th year. In other words, the rate of decline in GDP is about 2 tenths of one per cent of its control value in the first two years, but it stabilizes about one tenth of one per cent throughout the rest of the period. The rate of decrease in the GNP price index (PGNP) is .1 per cent of its control value in the first year, but it stabilizes about .5 per cent annually starting from the 6th year of the simulation period.[11]

Total business fixed capital formation (IFB) declines throughout the experiment, initially as a result of higher rental prices of machinery and equipment and non-residential construction, and then in response to lower aggregate demand. The decline in IFB is close to $100 million or between 5 and 8 tenths of one per cent of its control value in each period throughout the experiment. Employment (LE) declines too, but only during the first 6 years of the experiment. The increase in LE in the last year of the experiment is due to the substitution effect of a higher rental price of capital induced by the increase in RTCH. As shown in Table VII-2, changes in LE are very modest.

The expected long-run rate of inflation (ZEPGL) decreases for most of the simulation period as a result of a similar trend in the rate of change of actual rate of inflation (PGNP). More specifically, ZEPGL falls between .01 and .08 percentage points in each period during the first 10 years of the experiment, reaches its control value after 12 years and shows an increase of about .02 percentage points in the last year. A very similar pattern is followed by the expected short-run rate of inflation (ZEPTB). In TRACE, expected rates of inflation are positively related to the rate of change in the actual rate of inflation (PGNP).

The long-term and short-term nominal interest rates (RLGB and RTB, respectively) decrease throughout the simulation period in response to lower expected rate of inflation and lower income velocity of money, VEL, defined as the ratio of nominal gross national product to the exogenous money supply. RLGB is related to ZEPGL and VEL through the inverse of the demand-for-money equation. Similarly RTB is a function of ZEPTB and VEL through the inverse of the demand-for-money equation. As shown, the annual decrease in RTB is considerably greater than that in RLBG. This is because the elasticity of the long-term interest rate with respect to the money supply is smaller than that of the short-term interest rate. Both RLBG and RTB decrease by progressively greater amounts in each period during the first 6 years of the simulation, but they level off thereafter and stabilize by the end of the period.

Short-term capital inflows (FSN) show a modest decline throughout the experiment, in response to lower short-term interest rate differentials between Canada and the U.S. Long-term capital inflows (FLCN), however, show a modest decrease only during the first 6 years of the simulation period. Thereafter, FLCN starts to rise progressively. To explain these changes in long-term capital inflows we must note that FLCN varies directly with the rate of change in long-term interest rate differentials between Canada and the U.S. Therefore, during the first 6 years of the experiment when the rate of decrease in the interest rate differentials accelerates, long-term capital inflows decrease; thereafter they increase in response to a slower rate of decrease in the interest rate differentials.

The current account balance of payments (BPC) increases throughout the experiment mainly as a result of lower imports (M) induced by lower domestic prices relative to rest-of-the-world prices. The increase in BPC is between \$34 million in the first year and \$389 million in the last year of the experiment. The corresponding decrease in M is between \$38 million and \$229 million. Lower domestic prices relative to rest-of-the-world prices will also stimulate exports, but in this experiment changes in exports (X) are not substantial. The increase in BPC puts upward pressure on the exchange rate which, under a fixed rate regime, leads to an increase in balance of international reserves (BPO). The increase in BPO is as much as \$425 million in the final year of the experiment. In the first five years, however, the increase in BPC appears to have been more than cancelled out by the deficit in the capital account.

To discuss the distributional impacts (incidence) of the policy change in Experiment 0, we focus on the shifting measures $S_1$ and $S_2$ which were formulated earlier in Section VII.1. Estimated values of $S_1$ and $S_2$, shown in the last two rows of Table VII-2, are negative in the first year. This implies a reduction in both the before-tax rate of return and before-tax share of profits in output; that is, more than the full burden of the tax falls on profits. For the rest of the simulation period, however, both $S_1$ and $S_2$ are positive, but noticeably less than unity. This implies slight increases in both the before-tax rate of return and before-tax share of profits in output and hence some degree of shifting. More specifically, the degree of shifting indicated by $S_1$ ranges from 3 to 13 per cent, but $S_2$ indicates a degree of shifting between 2 and 4 per cent. Furthermore, in the case of $S_1$, the lowest degree of shifting is shown to occur in the second year and the highest degree of shifting takes place 10 years after the introduction of the policy change. In other words, $S_1$ appears to follow a more or less upward trend. This is not as obvious in the case of $S_2$. Overall, $S_1$ and $S_2$ suggest little if any shifting of the corporation income tax. The little shifting that might occur, appears to be due to lower levels of both business capital formation and output in the economy. There also appears to be some degree of backward shifting as the nominal and real wage rates (WRN and W, respectively) decrease throughout the experiment. The decrease in WRN is between .2 per cent in the first year of the experiment and .9 per cent towards the end of the experiment. The corresponding figures for W are .1 and .3.

In summary, it appears that a policy change involving a 10 percentage point increase in the corporation income tax rate would have had a very modest contractionary impact on the Canadian economy over the period 1962-75. Consumers in general, and wage earners in particular, would have been worse off, in that real disposable income (YDR) and the nominal and real wage rates would have decreased. Profit earners (corporations) too, would have been made worse off because they would have paid for almost all the tax increase. The results of this experiment suggest either very small or no tax shifting at all. The small degree of tax shifting indicated would have occurred mainly through lower expenditure on fixed capital formation and lower output in the economy and to some extent through a reduction in the nominal wage rate (backward shifting).

## VII.4 Experiment 1: Differential Incidence Analysis of Substituting Corporate Income Taxes for Personal Income Taxes

In this exercise we examine the incidence and economic effects of a policy in which the high rate of corporate income tax (RTCH) is increased 10 percentage points above its historical path beginning in 1962 and the personal income tax rate (RTYP) adjusts to ensure that the control value of the government balance (GBAL) is attained.[12] This experiment is introduced in the model through the government balance equation as described in Section VII.1. A priori, nothing can be said about the outcome of this experiment because, contrary to Experiment 0, the present experiment initiates two major direct forces which are likely to have opposing effects on aggregate demand. While a higher corporate income tax rate reduces aggregate demand, the accompanying decrease in the personal income tax rate tends to increase the level of disposable income and hence raise aggregate demand in the economy. Therefore, the overall impact of this experiment on aggregate demand depends on the relative strength of these two forces.

The results of Experiment 1 are summarized in Table VII-3. Overall this experiment has an expansionary impact on the economy. To explain the initial effects of this policy change we once again use a simple AD-AS diagram (Figure VII-2). On one hand, a higher rate of corporate income

Figure VII-2

Substitution of Corporate Income Taxes for

Personal Income Taxes

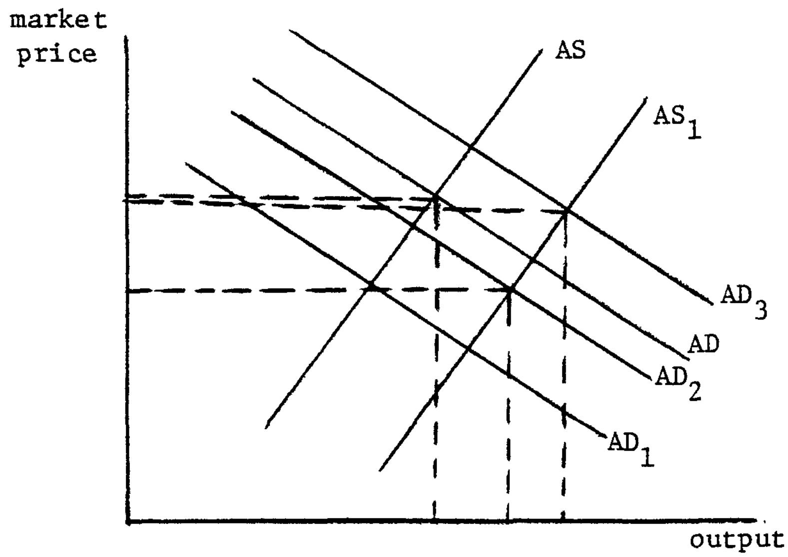


Table VII-3

Experiment 1: Substitution of Corporate Income Taxes for Personal Income Taxes [a]

| Variable \ Year in Simulation | 1 | 2 | 3 | 4 | 5 | 6 | 8 | 10 | 12 | 14 |
|---|---|---|---|---|---|---|---|---|---|---|
| BPC ($m) | -28 | -55 | -72 | -92 | -138 | -183 | -315 | -405 | -689 | -1272 |
| BPO ($m) | 43 | 108 | 176 | 226 | 292 | 301 | 283 | 113 | -27 | -320 |
| C ($m) | 305 | 387 | 421 | 474 | 584 | 647 | 823 | 805 | 1213 | 1539 |
| CGV ($m) | -15 | 20 | 46 | 64 | 102 | 159 | 293 | 452 | 623 | 1249 |
| FLCN ($m) | 28 | 65 | 94 | 118 | 170 | 189 | 199 | 139 | 233 | 240 |
| FSN ($m) | 42 | 99 | 155 | 200 | 259 | 295 | 399 | 380 | 429 | 711 |
| GDP ($m) | 373 | 312 | 250 | 265 | 330 | 284 | 290 | 97 | 408 | 199 |
| IFB ($m) | 102 | 56 | 20 | 25 | 49 | 33 | 49 | -13 | 152 | 64 |
| IFGV ($m) | 1 | 7 | 10 | 14 | 22 | 29 | 44 | 54 | 79 | 138 |
| IFMB ($m) | 8 | -1 | -5 | -1 | 3 | -1 | 0 | -5 | 24 | 3 |
| IFNB ($m) | -9 | -17 | -21 | -19 | -20 | -25 | -31 | -36 | -26 | -56 |
| LE (000's) | 42 | 48 | 40 | 38 | 43 | 39 | 34 | 12 | 34 | 18 |
| LF (000's) | 9 | 15 | 16 | 18 | 22 | 25 | 31 | 31 | 45 | 58 |
| M ($m) | 34 | 61 | 77 | 95 | 136 | 176 | 282 | 350 | 506 | 761 |
| PGNP (%) | -.1 | .1 | .3 | .5 | .7 | .9 | 1.4 | 1.7 | 2.0 | 2.5 |
| RHON (%) | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| RLBG (% point) | .01 | .04 | .08 | .13 | .18 | .24 | .29 | .29 | .25 | .30 |
| RTB (% point) | .07 | .17 | .26 | .33 | .42 | .47 | .57 | .53 | .54 | .74 |
| RTYP (% point) | -1.6 | -1.3 | -1.2 | -1.2 | -1.2 | -1.3 | -1.1 | -1.0 | -1.0 | -1.0 |
| TIES ($m) | 30 | 42 | 50 | 60 | 80 | 95 | 139 | 135 | 242 | 337 |
| TYCL ($m) | 275 | 251 | 249 | 299 | 368 | 372 | 477 | 491 | 865 | 1258 |
| TYP ($m) | -323 | -274 | -253 | -292 | -341 | -301 | -314 | -162 | -474 | -15 |
| W (%) | -.1 | .2 | .3 | .3 | .4 | .6 | .7 | .8 | .9 | 1.3 |
| WRN (%) | -.3 | .3 | .6 | .8 | 1.1 | 1.6 | 2.3 | 2.8 | 3.1 | 4.1 |
| X ($m) | 5 | -6 | -15 | -22 | -35 | -57 | -87 | -117 | -157 | -216 |
| YC ($m) | 109 | 44 | 32 | 60 | 98 | 85 | 146 | 112 | 390 | 394 |
| YDR ($m) | 551 | 667 | 657 | 704 | 869 | 921 | 1123 | 931 | 1606 | 2000 |
| ZEPGL (% point) | -.01 | .01 | .05 | .09 | .14 | .18 | .22 | .22 | .17 | .20 |
| ZEPTB (% point) | -.03 | .04 | .11 | .16 | .19 | .20 | .24 | .20 | .13 | .25 |
| $S_1$ | .40 | .09 | -.01 | .04 | .06 | -.05 | -.06 | -.20 | -.01 | -.43 |
| $S_2$ | .18 | -.01 | -.06 | -.04 | -.03 | -.10 | -.12 | -.18 | -.10 | -.28 |

(a) The numbers in this table are based on the differences between the solution and control values of the various variables involved.

tax increases the rental cost of capital goods and hence causes business investment to fall. As a result, aggregate demand in the economy decreases. This is shown in Figure VII-2 by a leftward shift in AD, to $AD_1$. On the other hand, the offsetting decrease in the personal income tax rate (RTYP) increases personal disposable income and causes consumption (C) to rise. As a result, aggregate demand increases. This increase in aggregate demand may or may not be sufficient to compensate for the initial decline induced by a higher corporate income tax rate. Therefore, the overall effect on aggregate demand could be either negative (shown by the $AD_2$ curve) or positive (shown by the $AD_3$ curve) or it may not change at all (AD will be restored). A lower personal income tax rate also tends to reduce the nominal wage rate, WRN, and hence shifts the AS curve rightward to $AS_1$. Now, the intersection of $AS_1$ and the relevant AD curve produces a new equilibrium which is associated with a higher level of output and a lower price level.

As shown in Table VII-3, gross domestic product (GDP) increases throughout the experiment. The strongest impact of the experiment occurs in the first year following the introduction of the policy change. In this year, GDP rises by \$373 million or .7 per cent of its control value. Thereafter, GDP fluctuates and shows smaller increases as it moves toward its long-term equilibrium path. By the fourteenth year, GDP shows an increase of \$199 million of .2 per cent of its control value.

The GNP price index (PGNP) decreases in the first period of the experiment, but it rises at an increasing rate during the rest of the simulation period. The fall in PGNP in the first year is due to lower unit labour costs induced by the lower rate of personal income tax (RTYP). RTYP falls by a greater amount in the first year than in each of the following years in the simulation period. This is why PGNP falls only in the first year. Recall that in the TRACE model PGNP is estimated as a weighted average of a mark-up on unit labour costs and other prices such as imports and exports prices. The rate of increase in PGNP is between .1 per cent of its control value in the second year of the experiment and 2.5 per cent in the last year.

Total business fixed capital formation in real terms (IFB) shows a modest increase throughout the experiment (except in the tenth year) in response to expansionary forces in the economy. IFB consists of capital formation in machinery and equipment (IFMB), non-residential construction (IFNB), and residential construction (IHB). While IFMB and IFNB respond to their respective rental prices and to the increase in output, IHB depends on variables such as real personal disposable income (YDR) and the long-term real rate of interest. In this experiment the IHB component of IFB appears to dominate throughout the experiment except in the tenth year when the rate of increase in YDR slows down.

Total civilian employment (LE) too increases throughout the experiment in response to higher aggregate demand in the economy. The lowest increase in LE occurs in the tenth year of the experiment when GDP increases the least.

The long-term expected rate of inflation (ZEPGL) decreases in the first year, but it rises at an increasing rate thereafter. ZEPGL is a function of the rate of change in the actual rate of inflation (PGNP). As shown in Table VII-3, patterns of changes in ZEPGL and PGNP are similar. The short-term expected rate of inflation (ZEPTB) too follows a similar pattern. ZEPTB too depends on the rate of change in PGNP. Changes in ZEPTB are generally bigger than those in ZEPGL because the former is more sensitive to changes in PGNP.

The long-term nominal rate of interest (RLBG) rises at an increasing rate throughout the experiment in response to the higher expected rate of inflation (ZEPGL) and higher income velocity of money. A similar pattern is followed by the short-term nominal rate of interest (RTB). Again changes in RTB are bigger than those in RLBG because of higher short-term interest rate elasticity of the demand for money. The increase in RLBG is between .01 percentage points in the first year and .03 percentage points by the fourteenth year in comparison with its control value. The corresponding figures for RTB are .07 and .74. These increases in RTB and RLBG lead to higher interest rate differentials between Canada and the U.S. which, in turn, cause the short- and long-term capital inflows to increase substantially. As shown in Table VII-3, short-term capital inflows (FSN) are more sensitive to the policy change than long-term capital inflows (FLCN) because RTB is more sensitive than RLBG to the policy change.

The current account balance of payments (BPC) declines quite sharply throughout the experiment mainly as a result of higher imports (M) and lower exports (X) induced by higher domestic prices relative to rest-of-the-world prices. The fall in BPC is between $28 million in the first year and $1272 million in the last year of the experiment. Such a significant deficit in the balance of payments puts downward pressure on the exchange rate which, under the fixed rate regime, causes international reserves to deplete. Opposite forces arise from the surplus in the capital account induced by higher interest rates in Canada. While for the first 10 years of the experiment the surplus in the capital account appears to dominate the deficit in the current account, the opposite is true for the last two years. As shown, the balance of international reserve declines by as much as $320 million in the final year of the experiment.

Estimated values of shifting measures $S_1$ and $S_2$, shown in the last two rows in Table VII-3, are mixed in magnitude and in sign. The highest degree of shifting indicated by $S_1$ is about 40 per cent and occurs in the first year following the introduction of the policy change.

The shifting of the corporate income tax appears to have taken place mainly through higher real output (GDP) and before-tax profits (YC). There is also evidence of some backward shifting as the nominal wage rate (WRN) decreases in the first year of the experiment. The estimated values of $S_1$ for years 2, 4, and 5 indicate tax shifting of about 9, 4, and 6 percent, respectively. For the rest of the period, the estimated values of $S_1$ are negative, implying a reduction in before-tax rate of return as a result of the introduction of the policy change. In other words, for these years, corporations bear more than the full burden of the tax because of adverse growth effects. Note that sharp fluctuations in $S_1$ in years 10, 12, and 14 are due to its sensitivity to changes in before-tax profits (YC) and business fixed capital formation (IFB). Both YC and IFB fluctuate sharply for these years. The estimated values of $S_2$ are generally lower than those of $S_1$. More specifically, $S_2$ indicates a tax shifting of about 18 percent in the first year after the introduction of the policy change. For the rest of the period, the estimated values of $S_2$ are negative and imply that corporations bear more than the full burden of the tax. For these years, the share of before-tax corporate profits in output declines. Note that, the patterns followed by $S_1$ and $S_2$ are quite similar. Both $S_1$ and $S_2$ indicate little, if any, shifting, except in the first and last years.

In summary, it appears that a policy involving the substitution of profits taxes for personal income taxes under a constant government balance, would have had an expansionary impact of the Canadian economy over the period 1962-75. Consumers would have benefited from the expansion in that real disposable income (YDR) would have increased. Wage earners would have been made better off, except in the first year, in that both real and nominal wage rates (W and WRN, respectively) would have increased. However, corporations would have been made worse off as their before-tax profits would not have increased by enough to recoup the rise in their tax liabilities, particularly over the longer term. A small degree of tax shifting would have occurred in the short run (first year) mainly through changes in aggregate demand and output, and to some extent through a lower nominal wage rate (WRN); that is, backward shifting of corporation income tax.

## VII.5 Experiment 2: Differential Incidence Analysis of Substitution of Corporate Income Taxes for Sales and Excise Taxes

In this experiment we examine the incidence and economic effects of a policy change in which the corporate income tax rate (RTCH) is raised 10 percentage points above its actual path beginning in 1962 and the rate of sales and excise taxes (RTIES) adjusts to maintain the control value of the government balance. As in Experiment 1, a priori, the present experiment has ambiguous effects because while the decrease in the rate of sales and excise taxes tends to lower prices of consumer goods and hence increase consumption expenditures and aggregate demand in the economy, the increase in the corporate income tax rate tends to decrease aggregate demand. In the present experiment, the increase in aggregate demand is due to lower prices induced by a lower rate of sales and excise taxes. This contrasts with the previous experiment where aggregate demand tends to rise because of a higher level of disposable income induced by a lower rate of personal income tax.

To implement this experiment, it was necessary to endogenize the deflator for indirect taxes (PTIS) so that the real value of indirect taxes would reflect not only nominal changes but also price effects. In TRACE, this is achieved by assigning a value of unity to variable DFOR. However, since DFOR also controls other variables such as withholding taxes, interest payments on the public debt, index of capacity utilization in the business non-agricultural sector, and so on, we create a new control solution based on DFOR=1.0. It is with this control solution that we compare the results of Experiment 2.

The results of Experiment 2 are presented in Table VII-4. It turns out that this experiment is expansionary. To explain the first period results (column one in Table VII-4), we again use the familiar AD-AS diagram (Figure VII-3). On the one hand, the introduction of a higher corporate income tax rate increases the rental cost of capital goods and thus reduces business investment and aggregate demand in the economy. The lower aggregate demand is shown by a leftward shift in the AD curve,to $AD_1$. On the other hand, the offsetting decrease in the rate of sales and excise taxes lowers market prices of durable goods (including machinery and equipment)and hence increases private expenditures and

Figure VII-3

Substitution of Corporate Income Taxes for

Sales and Excise Taxes

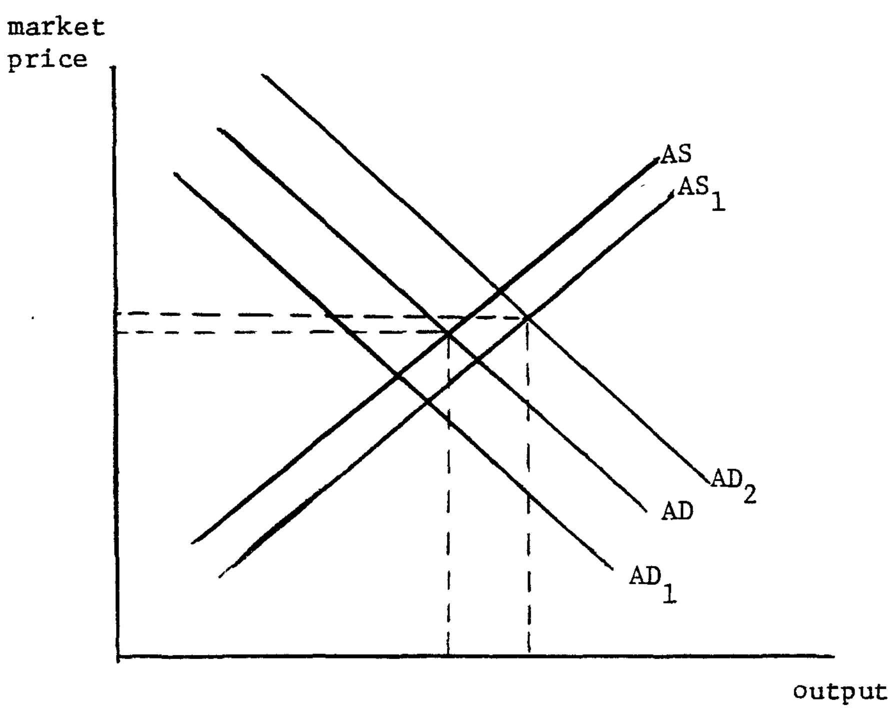


Table VII-4

Experiment 2: Substitution of Corporate Income Taxes for Sales and Excise Taxes [a]

| Variable \ Year in Simulation | 1 | 2 | 3 | 4 | 5 | 6 | 8 | 10 | 12 | 14 |
|---|---|---|---|---|---|---|---|---|---|---|
| BPC ($m) | -115 | -95 | -100 | -105 | -148 | -182 | -287 | -361 | -679 | -1090 |
| BPO ($m) | 12 | 14 | 49 | 61 | 45 | 28 | 7 | -48 | -294 | -766 |
| C ($m) | 329 | 325 | 356 | 381 | 490 | 561 | 733 | 840 | 1282 | 1781 |
| CGV ($m) | 3 | 8 | 17 | 24 | 28 | 45 | 88 | 151 | 204 | 287 |
| FLCN ($m) | 57 | 39 | 57 | 66 | 77 | 78 | 104 | 99 | 143 | 72 |
| FSN ($m) | 70 | 71 | 92 | 101 | 116 | 132 | 191 | 215 | 242 | 252 |
| GDP ($m) | 268 | 181 | 182 | 190 | 284 | 302 | 372 | 386 | 630 | 899 |
| IFB ($m) | 61 | -2 | -13 | -13 | 17 | 16 | 35 | 39 | 158 | 233 |
| IFGV ($m) | 5 | 4 | 6 | 7 | 10 | 13 | 20 | 27 | 38 | 52 |
| IFMB ($m) | -12 | -17 | -16 | -14 | -12 | -12 | -11 | -3 | 14 | 31 |
| IFNB ($m) | -29 | -31 | -32 | -31 | -32 | -34 | -39 | -34 | -33 | -34 |
| LE (000's) | 30 | 30 | 28 | 28 | 37 | 41 | 47 | 46 | 67 | 78 |
| LF (000's) | 9 | 12 | 13 | 13 | 17 | 20 | 27 | 31 | 49 | 71 |
| M ($m) | 127 | 103 | 106 | 109 | 152 | 183 | 269 | 333 | 572 | 778 |
| PGNP (%) | .1 | .1 | .2 | .3 | .3 | .4 | .6 | .8 | .9 | .8 |
| RHON (%) | .5 | .2 | .2 | .2 | .4 | .3 | .3 | .2 | .3 | .2 |
| RLBG (% point) | .03 | .04 | .06 | .07 | .08 | .09 | .11 | .14 | .13 | .08 |
| RTB (% point) | .12 | .12 | .16 | .17 | .19 | .21 | .27 | .30 | .31 | .26 |
| RTIES (% point) | -1.60 | -1.30 | -1.20 | -1.20 | -1.40 | -1.40 | -1.60 | -1.50 | -2.20 | -2.90 |
| TIES ($m) | -322 | -285 | -280 | -311 | -403 | -433 | -619 | -634 | -1250 | -2068 |
| TYCL ($m) | 266 | 241 | 241 | 274 | 352 | 366 | 469 | 488 | 809 | 1329 |
| TYP ($m) | 58 | 53 | 62 | 70 | 90 | 122 | 239 | 287 | 579 | 797 |
| W (%) | 0 | 0 | 0 | 0 | 0 | .1 | .1 | .2 | .1 | .2 |
| WRN (%) | 0 | .1 | .2 | .3 | .3 | .4 | .7 | 1.0 | 1.0 | 1.0 |
| X ($m) | -1 | -3 | -7 | -10 | -12 | -18 | -31 | -46 | -61 | -64 |
| YC ($m) | 76 | 28 | 32 | 43 | 82 | 80 | 121 | 133 | 286 | 549 |
| YDR ($m) | 558 | 493 | 499 | 531 | 683 | 759 | 996 | 1051 | 1709 | 2431 |
| ZEPGL (% point) | .01 | .02 | .04 | .05 | .06 | .06 | .08 | .10 | .08 | .03 |
| ZEPTB (% point) | .02 | .04 | .06 | .07 | .06 | .06 | .09 | .10 | .06 | .01 |
| $S_1$ | .25 | .08 | .06 | .08 | .15 | .11 | .10 | .06 | .09 | .11 |
| $S_2$ | .10 | 0 | -.01 | 0 | .02 | 0 | -.01 | -.03 | -.02 | .01 |

(a) The numbers in this table are based on the differences between the solution and the control values of the various variables involved. Note that the control solution used in constructing this table is different from that of other tables.

aggregate demand in the economy. This increase in aggregate demand more than compensates for the initial decrease caused by a higher corporate income tax rate. As a result, AD shifts rightward from $AD_1$ to $AD_2$. A lower rate of sales and excise taxes also tends to reduce the money wage rate, causing aggregate supply to shift rightward from AS to $AS_1$.[13] A new equilibrium is attained where $AD_2$ and $AS_1$ meet. At this equilibrium, output must be higher and as indicated by simulation results in Table VII-4, the market prices of goods increase. The overall change in aggregate demand referred to above has often been assumed to be negligible in the context of a differential incidence analysis.[14] However, from our discussion here, it would appear that such an assumption is ill-founded. That aggregate demand is important is shown by <u>any</u> of the experiments individually; that it matters what the government does with the tax revenues is shown by comparing the results of Experiment 0, on the one hand, and Experiments 1 and 2, on the other.

As shown in Table VII-4, gross domestic product (GDP) increases throughout the experiment in response to higher aggregate demand and supply. The increase in GDP in the first year is about \$268 million or about .5 percent of its control value. The rate of increase in GDP drops slightly in the second year of the experiment, but it rises steadily thereafter. The increase in GDP is between \$181 million (.4 percent) in the second year and \$899 million (.8 percent) in the fourteenth year.

The GNP price index (PGNP) increase steadily throughout the experiment due to higher aggregate demand. The increase in PGNP is between .1 percent of its control value in the first year and almost one percent in the fourteenth year. A higher PGNP in an experiment involving a reduction in the rate of sales and excise taxes (RTIES) may seem unlikely, but it is quite consistent with the structure of the TRACE model. Recall that in TRACE consumption expenditures are disaggregated into those on durable goods (CD) and those on non-durable and semi-durable goods and services (CNDS), where the former are about one fifth of the latter. It is only the price index of durable consumer goods (PCD) that is directly affected by RTIES. The price index of CNDS (PCNDS) is related to PGNP, where PGNP is a weighted average of price indexes of gross domestic product, imports,exports, and so on. Thus, even though PCD decreases as a result of a lower RTIES, the overall consumer price index and all other prices in the system will increase as a result of higher aggregate demand in the economy. By way of contrast with the TRACE model, in a one sector macro model, such as the one used in Chapter 4, a reduction in the sales tax rate will necessarily reduce the consumer price index. This is what we observed in the experiment that involved the substitution of corporate income taxes for sales taxes (Case 3) in Chapter 4.

Total business fixed capital formation in real terms (IFB) increases throughout most of the experiment in response to expansionary forces in the economy. Recall that IFB is made up of capital formation in machinery and equipment (IFMB), non-residential construction (IFNB), and residential construction (IHB). While IFMB and IFNB are related negatively to their respective rental prices and positively to gross domestic product, IHB depends positively on real personal disposable income and negatively on the long-term real rate of interest. As shown in Table VII-4, in this experiment both IFMB and IFNB decrease except for the last two years where IFMB shows an increase. Thus, the increase in IFB suggests that the IHB component increases and dominates throughout the experiment except for years 2,3, and 4 when the rate of increase in real disposable income (YDR) slows down.

Total employment (LE) also rises throughout the experiment in response to higher aggregate demand in the economy. The increase in LE is between 30 thousand persons in each of the first four years and 78 thousand persons in the last year of the experiment.

The long-term expected rate of inflation (ZEPGL) rises throughout the experiment in response to a higher actual rate of inflation in PGNP. A similar pattern is followed by the short-term expected rate of inflation (ZEPTB). Inflationary expectations in TRACE are modelled to respond to the rate of change in the actual rate of inflation in PGNP.

The long-term nominal rate of interest (RLBG) rises throughout the experiment in response to increases in both the income velocity of money (the ratio of nominal GNP to the money supply) and the expected rate of inflation. The increase in RLBG is about .03 percentage points of its control value in the first year and climbs to .14 percentage points in the tenth year of the experiment. Thereafter, it levels off and shows an increase of about .08 percentage points by the fourteenth year. Similarly, the short-term nominal rate of interest (RTB) rises throughout the experiment in response to increases in both the income velocity of money and the short-term expected rate of inflation. The rise in RTB is about .12 percentage points of its control value in the first year, but it levels off in the fourteenth year where it shows an increase of about .26 percentage points.

Short-term capital inflows (FSN) increase steadily throughout the experiment as a result of higher short-term interest rate differentials between Canada and the U.S.. The decrease in FSN is about $70 million in the first year and $252 million in the fourteenth year. Long-term capital inflows (FLCN) rise too throughout the experiment, showing minor fluctuations. The rise in FLCN is as low as $39 million in the second year and as high as $143 in the twelveth year following the introduction of the policy change. In TRACE, long-term capital inflows respond to the rate of change in long-term interest rate differentials.

The current account balance of payments (BPC) declines throughout the experiment mainly due to a steady increase in imports (M) and decrease in exports (X) induced by higher domestic prices relative to rest-of-the-world prices. The fall in BPC is between about \$100 million in each of the first three years and \$1090 in the fourteenth year. The increase in M is \$127 million (about one percent) in the first year, drops slightly to \$103 million (about .8 percent) in the second year, and increases steadily thereafter. The rise in M is \$778 million or about 2.6 percent in the fourteenth year. The decline in X is between \$1 million in the first year and \$64 million or .2 percent in the fourteenth year following the introduction of the policy change.

The continuing decrease in the current account balance of payments causes the balance of international reserves (BPO) to deplete, given the fixed exchange rate regime assumed here. However, this negative impact on BPO will be offset by the positive effects of higher capital inflows induced by higher interest rate differentials between Canada and the U.S. This latter effect on BPO appears to be dominant for the first eight years of the experiment, but the opposite is true for the rest of the period. BPO falls by as much as \$766 million in the fourteenth year.

Turning to the incidence (distributional effects)of the policy change in Experiment 2, we now examine the estimated values of the shifting measures $S_1$ and $S_2$. As shown in the last two rows of Table VII-4, these values reveal little or no shifting of the tax. Again, the highest degrees of tax shifting indicated by both $S_1$ and $S_2$

occur in the short run (first year) and are about 25 and 10 percent, respectively. While the lowest degree of tax shifting indicated by $S_1$ is about 6 percent (in years 3 and 10), $S_2$ takes a negative value for some years in the experiment. A negative value for $S_2$ implies a reduction in the before-tax share of corporate profits in output, indicating that corporations bear more than the full burden of the tax. The small degree of shifting of the corporation income tax indicated by either $S_1$ or $S_2$ appears to take place through higher levels of output and before-tax profits and not through higher prices relative to wages as suggested traditionally. As shown in Table VII-4, neither the money wage rate (WRN) nor the real wage rate (W) shows a decline throughout the experiment.

To summarize, it appears that a policy change involving the substitution of corporate profits taxes for sales and excise taxes, under a constant government balance, would have had an expansionary impact on the Canadian economy over the period 1962-75. Consumers and wage earners would have benefited from the expansion in that real disposable income (YDR) and the real wage rate (W) would have increased. Corporations, however, would have been made worse off in that their before-tax rate of return or before-tax share of profits in output would have either decreased or not increased sufficiently to allow them to recoup the rise in their tax liabilities. The maximum degree of tax shifting would have occurred in the first year (short run) after the introduction of the policy change. The shifting of the corporation income tax that would have occurred would have been made possible by higher levels of real output and pre-tax profits and not through higher prices relative to wages as it is argued traditionally.

## VII.6 Experiment 3: Budget Incidence Analysis of a Simultaneous Increase in Corporate Income Taxes and Government Expenditures on Fixed Capital Formation

In this experiment, we examine the incidence and economic impacts of a policy change in which corporate income taxes (TYCL) are raised and government expenditures on fixed capital formation (IFG) adjust to maintain the control value of the government balance. Once again, the rise in TYCL is achieved through a 10 percentage point increase in the high rate of corporation income tax (RTCH) above its historical path, beginning in 1962. As with the previous two experiments, _a priori_, nothing can be said about the outcome of this experiment because of the opposing effects on aggregate demand it generates.

The results of this experiment are summarized in Table VII-5. This experiment is generally expansionary. Again, we use the familiar AD-AS diagram (Figure VII-4) to explain the short-period (first year) results. On one hand, the initial impact of a higher corporate income tax is to increase the rental price of capital goods and hence reduce business investment and aggregate demand in the economy. As a result,

Figure VII-4

A Simultaneous Increase in Corporate Income Taxes and Government Expenditures on Fixed Capital Formation

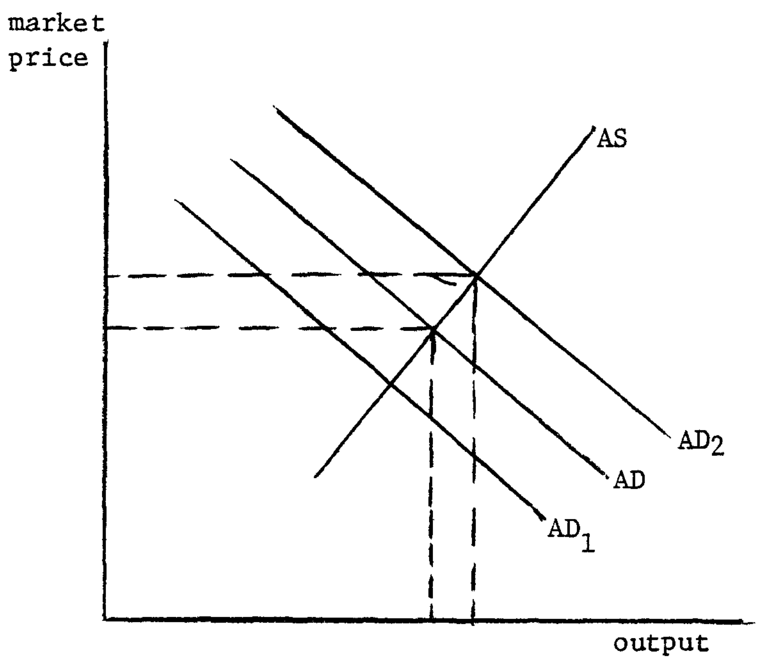


Table VII-5

Experiment 3: Simultaneous Increase in Corporate Income Taxes and Government Expenditures on Fixed Capital Formation [a]

| Variable \ Year in Simulation | 1 | 2 | 3 | 4 | 5 | 6 | 8 | 10 | 12 | 14 |
|---|---|---|---|---|---|---|---|---|---|---|
| BPC ($m) | -170 | -260 | -296 | -336 | -390 | -450 | -666 | -738 | -1146 | -2177 |
| BPO ($m) | 578 | 713 | 765 | 719 | 563 | 324 | 228 | -32 | -141 | -540 |
| C ($m) | 578 | 691 | 638 | 617 | 660 | 710 | 917 | 748 | 1105 | 1666 |
| CGV ($m) | 102 | 200 | 264 | 309 | 367 | 449 | 675 | 902 | 1190 | 2325 |
| FLCN ($m) | 300 | 330 | 358 | 386 | 362 | 224 | 208 | 127 | 298 | 347 |
| FSN ($m) | 448 | 646 | 702 | 669 | 591 | 550 | 686 | 578 | 707 | 1291 |
| GDP ($m) | 1047 | 698 | 312 | 239 | 304 | 265 | 529 | -224 | 756 | 88 |
| IFB ($m) | 169 | 87 | -18 | -38 | -23 | -23 | 30 | -108 | 96 | 61 |
| IFG ($m) | 586 | 446 | 316 | 335 | 387 | 400 | 667 | 300 | 1056 | 649 |
| IFGV ($m) | 449 | 395 | 363 | 420 | 504 | 550 | 852 | 655 | 1605 | 1732 |
| IFMB ($m) | 24 | 8 | -7 | -6 | -2 | -5 | 8 | -19 | 36 | 1 |
| IFNB ($m) | -29 | -39 | -44 | -46 | -48 | -53 | -60 | -67 | -66 | -103 |
| LE (000's) | 118 | 117 | 68 | 44 | 42 | 38 | 58 | -11 | 59 | 39 |
| LF (000's) | 17 | 27 | 25 | 22 | 22 | 24 | 31 | 27 | 37 | 66 |
| M ($m) | 182 | 275 | 301 | 329 | 370 | 421 | 583 | 621 | 824 | 1279 |
| PGNP (%) | .9 | 1.7 | 2.2 | 2.5 | 2.6 | 2.9 | 3.4 | 3.7 | 4.0 | 5.1 |
| RHON (%) | 2.5 | 1.6 | .6 | .4 | .6 | .5 | .9 | -.4 | 1.0 | 0 |
| RLBG (% point) | .24 | .42 | .56 | .64 | .64 | .56 | .41 | .35 | .33 | .47 |
| RTB (% point) | .80 | 1.12 | 1.20 | 1.12 | .96 | .87 | .99 | .80 | .90 | 1.34 |
| TIES ($m) | 78 | 103 | 102 | 105 | 117 | 135 | 205 | 172 | 320 | 510 |
| TYCL ($m) | 340 | 275 | 258 | 321 | 407 | 414 | 562 | 503 | 1035 | 1330 |
| TYP ($m) | 119 | 169 | 185 | 205 | 227 | 306 | 573 | 599 | 1103 | 1830 |
| W (%) | .8 | 1.2 | 1.2 | 1.1 | 1.1 | 1.2 | 1.4 | 1.4 | 1.5 | 2.1 |
| WRN (%) | 1.7 | 3.0 | 3.6 | 3.9 | 4.0 | 4.3 | 5.1 | 5.4 | 5.8 | 7.5 |
| X ($m) | -35 | -69 | -92 | -110 | -127 | -163 | -203 | -234 | -295 | -393 |
| YC ($m) | 291 | 113 | 56 | 122 | 207 | 203 | 379 | 145 | 849 | 590 |
| YDR ($m) | 1033 | 1152 | 889 | 762 | 785 | 824 | 1132 | 677 | 1324 | 2224 |
| ZEPGL (% point) | .13 | .31 | .45 | .53 | .52 | .43 | .25 | .23 | .17 | .28 |
| ZEPTB (% point) | .28 | .55 | .67 | .58 | .36 | .25 | .25 | .21 | .10 | .43 |
| $S_1$ | .65 | -.11 | -.42 | -.17 | -.03 | -.02 | .12 | -.38 | .29 | -.73 |
| $S_2$ | .29 | -.22 | -.34 | -.24 | -.17 | -.22 | .10 | -.40 | .11 | -.57 |

(a) The numbers in this table are based on the differences between the solution and control values of the various variables involved.

AD shifts leftward, to $AD_1$. On the other hand, the offsetting increase in government investment expenditures (IFG) causes aggregate demand to increase. This increase in aggregate demand more than compensates for the initial decrease caused by a higher corporate income tax rate. Thus, the overall impact on demand is positive, as shown by $AD_2$ in Figure VII-4. Now, the intersection between AS and $AD_2$ establishes a new equilibrium in the economy and higher levels of output and price follow.

The strongest expansionary effect takes place immediately after the introduction of the policy change. In the first year of the experiment, gross domestic product (GDP) rises by about $1047 million or close to 2 percent of its control value. The increase in GDP in subsequent years becomes smaller as it moves toward its long-term equilibrium path. As shown, GDP increases by about $88 million or less than one tenth of one percent in the final year of the experiment.

The GNP price index (PGNP) shows a steady increase throughout the experiment as a result of higher unit labour costs induced by a higher nominal wage rate (WRN). The rise in PGNP is between .09 percent of its control value in the first year of the experiment and 5.1 percent in the end. In turn, higher PGNP (which represents the actual rate of inflation) leads to a higher expected rate of inflation both in the short run and in the long run (ZEPTB and ZEPGL, respectively). The increases in ZEPTB and ZEPGL are not steady as is the case for PGNP. This is because expected rates of inflation are positively related to the rate of change in PGNP.

The long-term nominal rate of interest (RLBG) increases on the average by close to half a percentage point in each period in comparison with its control value. The rise in RLBG is due to higher levels of income velocity of money and long-term expected rate of inflation. Similarly, the short-term rate of interest (RTB) increases throughout the experiment as a result of higher levels of income velocity of money and short-term expected rate of inflation. The rise in RTB is more noticeable than that in RLBG and is on the average close to one percentage point higher in each period in comparison with its control value. Higher RLBG and RTB, in turn, result in higher levels of long-term and short-term capital inflows, respectively. Recall that, in TRACE, capital inflows respond positively to interest rate differentials between Canada and the U.S. The rise in long-term capital inflows (FLCN) is on the average close to $300 million in each period, in comparison with its control value. The rise in short-term capital inflows (FSN) is more noticeable and is between $448 million in the first year of the experiment and $1291 million in the end.

The current account balance of payments (BPC) shows a steady and noticeable decline throughout the experiment mainly as a result of a steady increase in imports (M) and a steady decrease in exports (X) induced by higher domestic prices relative to the rest-of-the-world prices. The rise in imports is between $182 million in the first year of the experiment and $1279 million by the fourteenth year. The corresponding decrease in exports is between $35 million and $393 million.

The continuous decrease in the current account balance of payments causes the balance of international reserves (BPO) to deplete under the fixed rate regime. This negative impact on BPO, however, is more than offset by the positive effect of higher capital inflows in the first 8 years. For the rest of the period the deficit in the current account dominates and international reserves deplete by between \$32 million in the tenth year and \$540 million by the fourteenth year.

Turning to the incidence results, we now examine the estimated values of the shifting measures $S_1$ and $S_2$. Once again, the estimated values of these measures are mostly negative, implying a reduction in either before-tax rate of return or before-tax share of profits in output (the rate of increase in real corporate profits is less than that of capital formation or output); that is, corporations bear more than the full burden of a higher tax rate. This is not true, however, for years 1, 8, and 12 where the estimated values of $S_1$ and $S_2$ are positive. The estimated values of $S_1$ and $S_2$ in the first year of the experiment imply shifting of 65 and 29 per cent, respectively. The corresponding values of $S_1$ and $S_2$ for year 8 are 12 and 10 per cent. In the twelveth year of the experiment, $S_1$ and $S_2$ indicate shifting of about 29 and 11 per cent, respectively. In this experiment too, the shifting of the tax takes place through an expansion of real output (GDP) and before-tax profits (YC). As shown in Table VII-5, in years 1, 8, and 12 output (GDP) and before-tax corporate profits (YC) show noticeable increases. By the same token, sharp fluctuations in

$S_1$ and $S_2$ for years 2, 10, 12, and 14 are due mainly to drastic changes in before-tax profits. As mentioned earlier in the discussion of the results of Experiment 1, shifting measures $S_1$ and $S_2$ are quite sensitive to changes in GDP, YC, and business fixed capital formation (IFB).

In summary, it appears that a policy involving simultaneous increases in corporate income taxes and government expenditures on fixed capital formation would have had expansionary effects on the Canadian economy over the period 1962-75. The strongest impact takes place immediately after the introduction of the policy change. Consumers and wage earners would have benefited from the expansion in that real disposable income (YDR) and the real wage rate (W) would have increased. Profit earners (corporations), however, would have been made worse off throughout the experiment in that their before-tax rate of return or their before-tax share of profits in output would have decreased or not increased by enough to recoup the rise in their tax liabilities. For years 1, 8, and 12 corporations would have succeeded in recouping some of the increase in their tax liabilities (shifting) through a higher rate of economic growth; that is, higher levels of real output and before-tax profits.

The results of Experiment 3 just summarized are clearly different from those of the previous experiment. This experiment indicates that the incidence and economic effects of policies involving a higher corporate income tax rate depend on how the extra tax revenues raised are appropriated, a point which has been made throughout this thesis.

## VII.7 Experiment 4: Budget Incidence Analysis of a Simultaneous Increase in Corporate Income Taxes and Government Transfer Payments to Unincorporated Business

In this experiment we analyze the incidence and economic effects of a policy in which corporate income taxes are raised and government expenditures on capital assistance to unincorporated business (TRCU) adjust so that the control value of government balance (GBAL) is attained. Again, the increase in corporate income taxes is achieved by increasing the high rate of corporate income tax (RTCH) 10 percentage points above its actual path beginning in 1962. This experiment, too, is conducted through the government balance equation (1) as explained in Section VII.1 above. *A priori*, we do not know whether or not this policy will be expansionary, because the offsetting increase in government transfer payments to unincorporated business may not cancel out the negative impact of a higher rate of corporate income tax rate on aggregate demand.

The results of Experiment 4 are provided in Table VII-6. This experiment increases corporate income taxes (TYCL) between $224 million in the first year and $1065 million at the end, with an offsetting rise in government capital assistance to unincorporated business (TRCU) of between $206 and $1079 million. Once again, to explain the first-period results shown in column one in Table VII-6, we use a simple AD-AS diagram (Figure VII-5). Initially, a higher corporate income tax rate increases

Figure VII-5

A Simultaneous Increase in Corporate Income Taxes
and Government Transfer Payments to Unincorporated Business

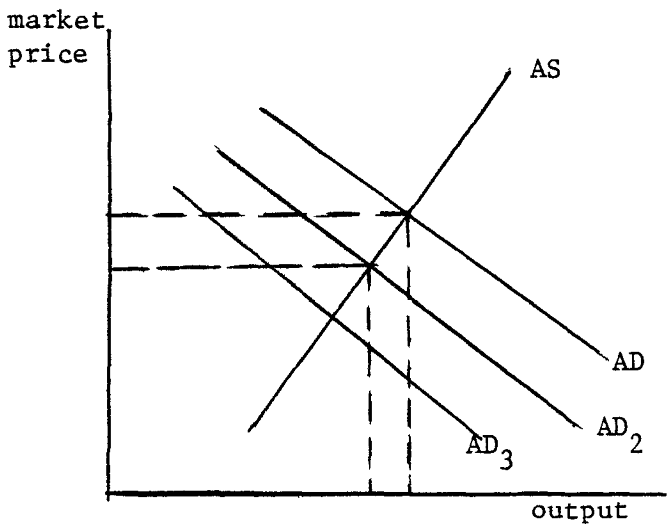


Table VII-6

Experiment 4: Simultaneous Increase in Corporate Income Taxes and Government Transfer Payments to Unincorporated Business [a]

| Variable \ Year in Simulation | 1 | 2 | 3 | 4 | 5 | 6 | 8 | 10 | 12 | 14 |
|---|---|---|---|---|---|---|---|---|---|---|
| BPC ($m) | 34 | 59 | 80 | 95 | 116 | 135 | 181 | 210 | 252 | 377 |
| BPO ($m) | -29 | -54 | -69 | -52 | -23 | 19 | 85 | 150 | 257 | 426 |
| C ($m) | -79 | -116 | -139 | -140 | -154 | -165 | -187 | -189 | -177 | -258 |
| CGV ($m) | -12 | -28 | -42 | -52 | -65 | -82 | -118 | -151 | -169 | -239 |
| FLCN ($m) | -10 | -25 | -37 | -37 | -34 | -17 | 5 | 23 | 57 | 108 |
| FSN ($m) | -53 | -89 | -112 | -110 | -104 | -98 | -101 | -83 | -52 | -59 |
| GDP ($m) | -128 | -118 | -103 | -78 | -82 | -72 | -67 | -46 | -37 | -127 |
| IFB ($m) | -89 | -91 | -88 | -80 | -87 | -89 | -99 | -90 | -97 | -148 |
| IFGV ($m) | -4 | -7 | -8 | -10 | -12 | -13 | -15 | -16 | -16 | -22 |
| IFMB ($m) | -32 | -34 | -35 | -35 | -39 | -41 | -46 | -44 | -49 | -65 |
| IFNB ($m) | -33 | -34 | -34 | -35 | -37 | -38 | -42 | -39 | -43 | -52 |
| LE (000's) | -14 | -17 | -14 | -9 | -7 | -4 | 0 | 5 | 9 | 3 |
| LF (000's) | -2 | -4 | -5 | -5 | -6 | -6 | -7 | -7 | -6 | -8 |
| M ($m) | -38 | -64 | -85 | -98 | -116 | -134 | -169 | -191 | -193 | -222 |
| PGNP (%) | -.1 | -.2 | -.3 | -.4 | -.4 | -.5 | -.5 | -.5 | -.5 | -.4 |
| RHON (%) | -.3 | -.2 | -.2 | -.1 | -.1 | 0 | 0 | .1 | .1 | 0 |
| RLBG (% point) | -.03 | -.06 | -.08 | -.10 | -.10 | -.10 | -.07 | -.05 | -.02 | 0 |
| RTB (% point) | -.09 | -.15 | -.19 | -.18 | -.17 | -.15 | -.15 | -.11 | -.07 | -.06 |
| TIES ($m) | -14 | -22 | -28 | -31 | -36 | -40 | -51 | -52 | -59 | -86 |
| TRCU ($m) | 206 | 208 | 210 | 252 | 307 | 313 | 375 | 424 | 651 | 1079 |
| TYCL ($m) | 224 | 228 | 231 | 269 | 321 | 330 | 408 | 437 | 696 | 1065 |
| TYP ($m) | -16 | -27 | -36 | -40 | -46 | -62 | -102 | -114 | -156 | -221 |
| W (%) | -.1 | -.2 | -.2 | -.3 | -.3 | -.3 | -.3 | -.3 | -.3 | -.3 |
| WRN (%) | -.2 | -.4 | -.6 | -.7 | -.7 | -.8 | -.9 | -.9 | -.9 | -.8 |
| X ($m) | 4 | 10 | 15 | 19 | 23 | 30 | 36 | 40 | 43 | 43 |
| YC ($m) | -35 | -20 | -20 | -22 | -33 | -32 | -43 | -41 | -66 | -133 |
| YDR ($m) | -142 | -202 | -212 | -194 | -209 | -215 | -228 | -206 | -182 | -342 |
| ZEPGL (% point) | -.01 | -.04 | -.06 | -.08 | -.08 | -.08 | -.05 | -.03 | -.00 | .02 |
| ZEPTB (% point) | -.03 | -.07 | -.10 | -.09 | -.07 | -.05 | -.04 | -.02 | .02 | .03 |
| $S_1$ | -.09 | .03 | .07 | .09 | .08 | .10 | .12 | .13 | .13 | .10 |
| $S_2$ | -.03 | .02 | .04 | .04 | .03 | .04 | .05 | .05 | .05 | .04 |

(a) The numbers in this table are based on the differences between the solution and control values of the various variables involved.

the rental price of capital goods and hence causes investment and aggregate demand to fall. This implies a leftward shift in AD, to $AD_1$. At the same time, the offsetting increase in government transfer payments to unincorporated business has the effect of increasing private disposable income and hence aggregate demand in the economy. This increase in aggregate demand is not sufficient to cancel out the initial negative impact induced by a higher corporate income tax rate. As a result, the overall impact of the policy change on aggregate demand is negative as shown by $AD_2$ in Figure VII-5. The intersection between $AD_2$ and AS results in an equilibrium which is consistent with lower levels of price and output. As shown in Table VII-6, this experiment appears to have a mild recessionary impact on the economy. These results may be puzzling as one might expect them to be similar to those of Experiment 1 where a higher corporate income tax rate is accompanied by a lower personal income tax rate. However, these differences in results are quite consistent with the structure of the TRACE model. In TRACE higher government transfer payments to unincorporated business influence aggregate demand indirectly by increasing personal income and hence consumption. A lower personal income tax rate, on the other hand, will not only increase aggregate demand by reason of higher personal disposable income, but also leads to a higher aggregate supply as it lowers the nominal wage rate.

Therefore, it appears that a policy involving simultaneous increase in corporate income taxes and government transfer payments to unincorporated business, under a constant government balance, would have had a modest contractionary impact on the Canadian economy over the period 1962-75. Consumers and wage earners would have been made worse off as a result of lower real disposable income (YDR) and the wage rate (W), respectively. Corporations, too, would have been made worse off in the sense that their before-tax profits (YC) would have decreased.

Note that the estimated values of shifting measures $S_1$ and $S_2$ in this experiment and in Experiment 0 are all positive with the exception of those for the first year following the introduction of the policy change. Positive values of $S_1$ and $S_2$ indicate that the before-tax profits in GNP would have increased as a result of the policy change, respectively. Although negligible, the increase in the rate of return and the share of before-tax profits would be mainly due to reductions in business capital formation and GNP, respectively. In other words, the little tax shifting indicated by $S_1$ and $S_2$ would have been due mainly to the resulting recession in the economy.

## VII.8 Sensitivity of Results to the Business Cycle

In this section we examine the question of whether or not the results of our experiments depend on the phase of the business cycle in which they are introduced. In so doing we focus on Experiment 1 which involves substitution of corporate income taxes for personal income taxes. When we introduce this experiment in a boom year (1966) the results turn out to be very similar to those obtained when the experiment is introduced in a recession year (1962).[15] This can be seen by comparing Table VII-3 (starting year 1962) and Table VII-7 (starting year 1966). Both tables suggest that a policy involving the substitution of corporate profits tax for personal income taxes, under a constant government balance, would be expansionary. Wage earners and consumers would benefit from the expansion due to a higher real wage rate and higher real personal disposable income. Corporations, however, would be worse off as their before-tax profits would not increase sufficiently to allow them to recoup the rise in their tax liabilities. The estimated values of shifting measures $S_1$ and $S_2$ are slightly lower in Table VII-7 than those in Table VII-3, but they have the same implications; that is, corporations would not succeed in substantial shifting of the tax. The maximum degree of tax shifting would be close to 40 percent and would occur in the short run (first year). In both experiments, shifting would take place largely through higher levels of real output and before-tax profits and not through higher prices relative to wages as argued traditionally.

Table VII-7

Experiment 5: Substitution of Corporate Income Taxes for Personal Income Taxes [a]
(Simulation starting in 1966)

| Variable \ Year in Simulation | 1 [b] | 2 | 3 | 4 | 5 | 6 | 8 | 10 |
|---|---|---|---|---|---|---|---|---|
| BPC ($m) | -28 | -43 | -57 | -97 | -136 | -165 | -383 | -893 |
| BPO ($m) | 31 | 70 | 140 | 220 | 260 | 230 | 196 | 38 |
| C ($m) | 301 | 357 | 365 | 467 | 517 | 529 | 903 | 1305 |
| CGV ($m) | -21 | 12 | 48 | 84 | 141 | 189 | 344 | 874 |
| FLCN ($m) | 28 | 52 | 88 | 131 | 151 | 152 | 238 | 279 |
| FSN ($m) | 30 | 62 | 110 | 186 | 244 | 244 | 340 | 652 |
| GDP ($m) | 376 | 303 | 212 | 270 | 254 | 198 | 440 | 343 |
| IFB ($m) | 109 | 52 | 5 | 30 | 19 | 2 | 122 | 92 |
| IFGV ($m) | 1 | 5 | 9 | 14 | 19 | 23 | 45 | 99 |
| IFMB ($m) | 7 | -2 | -10 | -6 | -5 | -6 | 15 | 6 |
| IFNB ($m) | -9 | -17 | -23 | -23 | -24 | -25 | -19 | -43 |
| LE (000's) | 37 | 41 | 32 | 34 | 32 | 26 | 45 | 28 |
| LF (000's) | 9 | 16 | 17 | 21 | 23 | 24 | 38 | 56 |
| M ($m) | 33 | 46 | 56 | 89 | 121 | 144 | 283 | 540 |
| PGNP (%) | -.1 | 0 | .2 | .4 | .6 | .7 | 1.1 | 1.8 |
| RHON (%) | .8 | .5 | .3 | .4 | .4 | .3 | .5 | .3 |
| RLBG (% point) | .00 | .02 | .05 | .10 | .15 | .19 | .23 | .32 |
| RTB (% point) | .00 | .10 | .16 | .27 | .34 | .34 | .43 | .68 |
| RTYP (% point) | -1.5 | -1.2 | -1.0 | -1.0 | -1.0 | -1.0 | -1.2 | -1.0 |
| TIES ($m) | 40 | 45 | 47 | 69 | 79 | 81 | 171 | 292 |
| TYCL ($m) | 344 | 332 | 350 | 624 | 417 | 447 | 768 | 1176 |
| TYP ($m) | -406 | -365 | -347 | -408 | -352 | -336 | -591 | -387 |
| W (%) | -.1 | .1 | .2 | .3 | .4 | .4 | .6 | 1.1 |
| WRN (%) | -.3 | .1 | .4 | .7 | 1.0 | 1.2 | 1.8 | 3.0 |
| X ($m) | 7 | -3 | -13 | -24 | -37 | -48 | -86 | -153 |
| YC ($m) | 115 | 50 | 25 | 68 | 63 | 61 | 236 | 329 |
| YDR ($m) | 608 | 684 | 679 | 829 | 847 | 820 | 1432 | 1959 |
| ZEPGL (% point) | -.01 | 0 | .03 | .07 | .12 | .15 | .18 | .25 |
| ZEPTB (% point) | -.03 | .01 | .07 | .14 | .18 | .17 | .18 | .31 |
| $S_1$ | .34 | .10 | -.03 | .02 | -.04 | -.08 | -.01 | -.30 |
| $S_2$ | .15 | .01 | -.05 | -.03 | -.07 | -.09 | -.07 | -.20 |

(a) The numbers in this table are based on the differences between the solution and the control values of the various variables involved. Note that the control solution used in constructing this tables is different from those used in other tables.

(b) Year 1 corresponds to 1966.

## VII.9 Conclusions

In this chapter we have attempted to demonstrate empirically that the incidence and economic impacts of a policy involving a higher corporate income tax rate depend on how the extra revenues are used by the government. In so doing, we first implemented a policy in which the only exogenous change was an increase in the corporate income tax rate. This policy was conducted in a way such that the extra tax revenues raised were withdrawn from the system. This experiment was found to be contractionary and consumers, wage earners, and corporations were all made worse off. Against this background then, we implemented four additional policy changes involving a higher corporate income tax rate and either of (1) a lower rate of personal income tax , (2) a lower rate of sales and excise taxes, (3) higher government expenditures on fixed capital formation, or (4) higher government transfer payments to unincorporated business. Generally, the results of all these experiments were found to differ and thus to support out view that the incidence and economic effects of a policy change involving the corporate income tax rate depend on what the government does with the extra tax revenues. More specifically, we found that the main mechanism by which pre-tax profits respond to changes in corporate income taxes (shifting takes place) is through changes in aggregate demand and output, not through changes in prices relative to wages as suggested in the conventional approach to the corporate income tax (see Chapter 2). This is one of the points that we have been making throughout this thesis. In almost all the experiments we conducted, shifting was found to be consistent with a higher real wage rate and higher real personal disposable income. A very small degree of tax shifting can also take place if a policy involving the corporation income tax is contractionary and leads to lower corporate expenditures on fixed capital formation. This was observed in Experiment 4. In this experiment, we also found weak evidence of backward shifting. Generally speaking, the estimated values of shifting measures do not exhibit a consistent upward trend as suggested by dynamic studies of the effects of the corporate income tax reviewed in Chapter 2. In fact, in most of our experiments (1,2,and 3) the highest degree of tax shifting occurs in the first year (short run) following the introduction of the policy change. Finally, the results of our experiments do not appear to depend on the phase of the business cycle in which they are introduced. This is specifically shown to be true for Experiment 1 which involves substitution of corporate income taxes for personal income taxes.

# FOOTNOTES

1. Recall that in our incidence analyses in Chapter 4, we assumed a balanced budget because this is the conventional assumption in general-equilibrium tax incidence analyses. However, this is quite unconventional for a real-world government such as the Canadian government to maintain a balanced budget. For this reason, in our empirical analysis here we assume that the government balance remains constant at its pre-policy-change level.
2. We could also conduct another budget incidence analysis in which the corporate income tax rate is raised and government expenditures on goods and services adjust to maintain the control value of the government budget balance. However, since these expenditures are treated in exactly the same way as government expenditures on fixed capital formation, we expect the results of this experiment to be similar to those generated by the budget incidence analysis involving the corporate income tax rate and government expenditures on fixed capital formation.
3. This increment in the tax rate is chosen to be big enough to generate significant effects in the system, but it is small enough to be consistent with our theoretical analysis of Chapter 4.
4. The historical path of RTCH is given in Table V-2 in Chapter 5.
5. Capital stock in the business non-agricultural sector is chosen because there is no corporate capital stock variable in the TRACE model.

6. Note that the use of the shifting measures $S_1$ and $S_2$ in a dynamic simulation analysis such as ours is somewhat limited. Such limitation is due to the fact that these measures for the second year and beyond in the experiment may not be independent. In other words, the values of the variables on which $S_1$ and $S_2$ are based in any particular year depend on the values that these variables take in the previous years. Thus, $S_1$ and $S_2$ in a particular year may reflect not only changes in that year but also in the previous years. Under these circumstances, only the first year (short-period) estimated values of $S_1$ and $S_2$ truly represent the extent of shifting in that year. To obtain the longer-term shifting measure, it may be reasonable to examine the cumulative values of $S_1$ and $S_2$ over the simulation period. Nevertheless, in our discussions here we intend to view the estimated values of $S_1$ and $S_2$ for each year to represent the extent of shifting of the corporation income tax for that year.

7. The government budget deficit could influence the money supply and interest payments on the public debt. Both these variables, however, are assumed exogenous in the TRACE MK IV G model.

8. See footnote 7.

9. This contractionary effect will even be stronger if we allow interest payments on government debt to adjust to the level of the government budget deficit. Higher government surplus or lower deficit means lower interest payments and hence lower aggregate demand.

10. The AS curve is also likely to shift in response to changes in, say, labour force participation rates. In TRACE, these rates are influenced

by the level of economic activity; that is, labour force participation rates increase during periods of high economic growth and fall during periods of low growth. Throughout this chapter, however, we ignore these shifts in the AS curve because labour force participation rates do not change substantially.

11. Note that the magnitude of changes in price and output may depend on the state of the business cycle (1962 was a slack year in the Canadian economy). We shall present further discussion of this issue later in this chapter when we conduct an experiment in which the policy change is introduced in a boom year.

12. In TRACE, it is assumed that labour income is taxed at the rate RTYP because data on payroll taxes are not available. Therefore, the present experiment could be viewed to loosely represent Cases 1 and 2 in Chapter 4.

13. Recall that in the TRACE model the ratio of the rate of change in the money wage rate to the rate of change in standard labour productivity is positively related to the price index for consumer goods and services (PC). As PC decreases in response to a lower rate of sales and excise taxes, the labour productivity increases relative to the nominal wage rate.

14. See for example Break (1974), p. 126.

15. For a discussion of business cycles in Canada see White (1967).

# CHAPTER EIGHT

## Summary and Conclusions of the Thesis

In this thesis we have attempted to demonstrate that the existing econometric studies of the short-run shifting of the corporation income tax have resulted in misleading conclusions. These studies suffer from the lack of a well-defined underlying theory. On the one hand, the authors seem to have followed the traditional full-employment framework of the classical economists. On the other hand, they use Keynesian cyclical variables in their regression equations for the rate of return. In examining the lengthy controversy between Krzyzaniak and Musgrave and Goode, Gordon, Slitor, Cragg, Harberger, and Mieszkowski we showed that the authors strongly support the use and importance of Keynesian cyclical variables in their regression equations. If so, then we argued that consistency requires one to examine the shifting and economic effects of the corporation income tax in a Keynesian model where the economy can rest at less than full employment. We also argued that in a Keynesian model the incidence and economic effects of the tax depend on what the government does with the extra tax revenues, for these revenues are large enough to influence the level of aggregate demand substantially.

The point that the incidence and economic effects of the corporation income tax depend on what the government does with the revenues raised was demonstrated in a conventional Keynesiam IS-LM model in Chapter 4. In the pursuit of this goal and in an attempt to verify it empirically, we conducted several differential and budget incidence analyses in the context of TRACE, an annual econometric model of the Canadian economy. From the results obtained we draw the following conclusions. First, the incidence and economic effects of a policy involving the corporation income tax may differ from one policy to another, depending on how the government uses the higher tax revenues. Experiments in which higher profits taxes are used to finance (1) lower personal income taxes, or (2) lower sales and excise taxes, or (3) higher government expenditures on fixed capital formation are found to be expansionary (although with different intensity) and to improve the positions of consumers and wage earners by increasing real disposable income and the real wage rate. The opposite occurs when corporate profits taxes are used to finance government transfer payments to unincorporated business. In none of these experiments did we find evidence of full tax shifting by corporations. The maximum degree of tax shifting is about 65 percent and takes place in the first year (short run) in Experiment 3 where corporate profits taxes are used to finance higher government expenditures on fixed capital formation. Second, shifting of the corporate income tax appears to take place through higher aggregate demand and real output rather than through higher prices relative to money wages as argued traditionally. In most of our experiments, shifting of the corporate income tax is found to be compatible with higher real disposable income and real wages. Third, a small degree of tax shifting (maximum of 13 percent as in Experiment 4) can also take place if the policy change lowers aggregate demand and leads to lower corporate expenditures on fixed capital formation. Fourth, the estimated values of shifting measures do not exhibit a consistent upward trend as dynamic studies of the corporation income tax lead one to expect. In fact, in most of our experiments, the highest degree of tax shifting occurs in the short run; that is, immediately following the introduction of the policy change. Finally, the incidence and economic impacts of a policy involving the corporation income tax do not appear to depend on the phase of the business cycle in which the policy change is introduced. More specifically, for a particular policy change, the degree of shifting of the corporation income tax is quite robust regardless of whether the policy change is introduced in a boom year or in a recession year.

As a final note, it is appropriate to observe that the TRACE model has been subject of numerous seminars and articles in the past and is viewed to be at least as good as any comparable econometric model of the Canadian economy. Having accepted this, we believe that our conclusions here are as reliable as they could be, at least to those who believe in the usefulness of large scale econometric models. If there is any improvement to be made with regard to our approach in this study, it is by conducting a similar analysis in the context of another model of the Canadian economy and comparing the results obtained with ours.

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