TAX INCENTIVES AND INVESTMENT IN TWO CANADIAN MANUFACTURING INDUSTRIES

by

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Abstract

Canada has pursued during the postwar period a policy of accelerated capital cost allowances to stimulate private investment. Faster write offs increase a firm's cash flows and hence internal funds available for investment. These allowances reduce government revenues since taxes are deferred. These deferred taxes have grown rapidly and now more attention is being paid to the effects of tax incentive devices on investment and on government revenues.

In the thesis non-neoclassical models of investment are employed for an analysis of investment in two manufacturing industries. One model emphasizes the interdependence of the investment and financing decisions of firms. Both sales and external finance are significant determinants of investment expenditures. The main conclusion of the thesis is that accelerated write offs have played a limited role in financing investment. Instead, firms relied more on external borrowing and other financing methods which confer larger tax benefits than faster write offs.

Résumé

Le Canada a entrepris durant la période d'après-guerre une politique d'accélération de dépréciation des coûts du capital. Une dépréciation accélérée des capitaux d'une firme entraîne un accroissement de liquidités et augmente donc les fonds d'investissements. Cette politique réduit toutefois les revenus gouvernementaux puisque les taxes sont différées. Ces taxes différées ont augmenté rapidement et maintenant l'attention s'est fixée sur les effets de certains mécanismes d'incitations fiscales sur l'investissement et sur les revenus du gouvernement.

Dans cette thèse les modèles non néoclassiques d'investissement sont utilisés pour une analyse de l'investissement dans deux industries manufacturières. Un des deux modèles met l'emphase sur l'interdépendence de l'investissement et les décisions financières des firmes. Le chiffre d'affaires aussi bien que la finance externe sont d'importants déterminants des dépenses d'investissement. La conclusion principale de la thèse est que l'accélération des dépréciations a joué un rôle limité dans le financement de l'investissement. Au contraire les firmes ont préféré l'emprunt externe et d'autres moyens de financement qui confèrent un avantage fiscal supérieur à l'accélération des dépréciations.

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CHAPTER ONE

INTRODUCTION

In a capitalist economy, investment expenditures play a dual role. They are components of aggregate demand and they result in additions to productive capacity. Unlike the consumption component of aggregate demand, investment is relatively unstable. Governments, concerned with maintaining high levels of employment as well as growth, see the need to smooth out cyclical fluctuations in investment activity. In the postwar period, most Western governments have pursued a policy of trying to stimulate economic growth by promoting investment expenditures.

One of the policies followed for this purpose is the use of tax incentives to alter the level and the timing of investment spending. These tax incentives take many different forms: liberal depreciation allowances, tax credits and direct grants. In Canada the Federal Government has concentrated its incentive programs on policies which provide liberal depreciation allowances. Changes in depreciation policy are employed to allocate resources between economic regions and for stabilization purposes as well.[1] In 1975 the Federal Government introduced a 5% investment tax credit[2] for investment in new buildings or machinery and equipment in the manufacturing sector. Since 1977 certain regions in Canada have enjoyed a higher rate of tax credit than other regions.

Many studies[3] cast doubts on whether tax incentives have succeeded in increasing investment spending in Canada. Any assessment of tax incentive policy raises the question of the determinants of investment. A theory of the investment behaviour of firms is needed to provide direct or indirect assessments of tax incentive policies. Interviews and surveys[4] have been used to assess the effectiveness of specific tax incentives. The survey technique yields answers which are of a general nature; survey respondents outline broad categories of variables which affect their investment decisions, but in many instances the variables are difficult to quantify. But while the method provides useful answers, interviews and surveys do not reveal which variables dominate the investment decision. A properly specified investment function is needed to obtain direct or indirect tests of the effectiveness of tax incentive policy. The properly specified investment equation demonstrates the channels through which variables affect investment activity. An analysis of the empirical parameters of the equation determines whether tax policy has any influence on investment behaviour. In this thesis an attempt is made to examine the effects of tax incentives within such a framework.

Before some of the possible approaches to investment behaviour are considered the literature on tax incentives is reviewed in Chapter Two. Special consideration is given to accelerated depreciation, the common form of tax incentives which governments adopt.

Theories of investment behaviour identify a number of variables as determinants of investment. Some of the variables are output, sales, prices of capital goods, cost of capital, profits, stock prices and leverage. Chapter Three reviews three main theories of investment behaviour--the neoclassical theory, the flexible accelerator and liquidity theories. The final section explores the link between theories of investment and theories of finance and valuation. The subject of financial structure and valuation of the firm has been the focus of much controversy and this section is an introduction to the topic.

Chapter Four discusses the choice of a theory of investment appropriate to the Canadian manufacturing sector. The choice is based on theoretical and institutional grounds; the choice of an investment model must be determined by characteristics which approximate as closely as possible the relevant economic reality. Despite its widespread popularity the neoclassical model of investment is inappropriate for representing Canadian manufacturing investment. One reason for the popularity of the neoclassical model is its apparent ability to generate firm quantitative conclusions on the effects of tax incentive policy. One of the two models explored in Chapter Five is a simultaneous equation model. The simultaneous equation model makes no such claim about the effects of tax policy. Instead, the two models which form the basis of the empirical analysis emphasize different but complementary aspects of investment spending.

In Chapter Five, the investment models are applied to firms in the Canadian iron and steel and pulp and paper industries. The approach to the empirical work is essentially a micro one. Micro studies allow one to concentrate on the determinants of investment within particular subsectors of manufacturing. There is no reason to believe that each manufacturing sector has the same investment function. The empirical work throws light on the following: how well the investment model explains the behaviour of the sample firms; whether the determinants of investment are related in any way to the model implicit in policymakers' minds; whether tax changes succeeded in increasing the level of investment spending.

Chapter Six provides supplementary evidence on the effects of tax incentive policy. The chapter explores the reasons why changes in depreciation policy have had limited success. The regression results indicate that investment is simultaneously determined with two decisions. The other decisions are the debt-equity and dividend-retention decision. The Canadian Government attempts to influence investment by increasing cash flows with increments to depreciation allowances. The additions to a firm's cash flow are relatively small compared to the size of major investment budgets. One section of the chapter considers the impact of inflation on depreciation allowances. The statistical evidence suggests that faster write offs had the unintended effect of compensating firms for depreciation allowances based on historic costs.

Another section examines estimates of the costs of tax incentives to the Federal Government. The chapter concludes with suggestions for further study.

The thesis provides three main contributions to the study of investment behaviour in the Canadian manufacturing sector. The first contribution is the estimation of investment equations for two groups of firms in the Canadian manufacturing industry. Published studies of investment behaviour in Canadian manufacturing concentrate on an aggregative approach, e.g. total investment in structures and equipment in all industries or total investment in the manufacturing sector. In certain circumstances the aggregative approach is desirable, but the approach requires too many heroic assumptions. Micro studies have much to offer by highlighting the contrasting behaviour of firms in different industries. The micro studies provide direction for selective tax incentives rather than global incentives to all manufacturing.

Another contribution is the use of a non neoclassical model of investment to assess the effects of tax incentive policy. Non neoclassical models of investment are demonstrated here to be good alternatives for investigating Canadian investment behaviour. Most of the previously published studies utilize the neoclassical model of investment which is inappropriate for the Canadian reality. The neoclassical model has been shown elsewhere[5] to yield misleading results if its assumptions are not modified to fit the particular economic environment under study.

The third and most important contribution is the attempt to integrate real and financial aspects of the investment process in a simultaneous equation model. Published studies on Canadian investment are all single equation models. Single equation models fail to capture all the elements in the investment decision. The simultaneous approach is a better approximation to the real world behaviour of firms.

FOOTNOTES

[1]See Cohen (1974) for a discussion on the variety of uses the Federal Government makes of capital cost allowances.

[2]See Chapter Two below for definitions of an investment tax credit and accelerated depreciation allowances.

[3]See recent studies by Johnson and Scarth (1979); Mendelsohn and Beigie (1976); Bird (1980).

[4]See Helliwell (1966), Tax Measures Review Committee (1975).

[5]See McFetridge and May (1976) who have to modify the neoclassical model to fit the Canadian manufacturing sector. See also Loranger (1976); Schramm (1972) shows the neoclassical model to be unsuitable for investigating investment in the French manufacturing sector.

CHAPTER TWO

A BRIEF SUMMARY OF TAX INCENTIVES

I. INTRODUCTION

Tax incentives to stimulate private investment have been in use in many countries for a considerable period of time. These incentives are introduced for two main reasons: to alter the level of investment spending and to stabilise cyclical fluctuations of investment. Over this period, numerous writers have presented a fair amount of theoretical arguments to justify the use of tax incentives. This chapter attempts to review the main contributions to this body of literature.

Sections II and III present the arguments in a qualitative manner. The sections concentrate almost entirely on accelerated depreciation and tax credits. Section IV outlines tax incentives within a Canadian setting and Section V presents some empirical results on the effects of tax incentives. The remainder of this introduction is devoted to a brief description of tax incentives.

Tax incentives can be defined as specific provisions in the Income Tax which allow taxpayers who do certain things to reduce their taxable income or to qualify for lower rates of taxes. Tax incentives are part of a broad category of subsidies which can be described as tax expenditures.[1] The incentives are introduced into the tax system to achieve some stated goal. The goals are: to raise the level of investment expenditures, to ensure a reallocation of investment spending between sectors; and to stabilise fluctuations in investment activity. The underlying rationale for the use of investment tax incentives is based on the distributional[2] effects of the corporate income tax. Pigou[3] (1952) distinguishes two effects of a tax, an announcement effect and an income effect. The announcement effect arises because most taxes are tied to a particular base. When a tax is imposed, the government makes it expensive to be associated with the base. Thus taxpayers are induced to change the size of the base. The income effect leads to a reduction in private disposable income and an increase in government revenues. Tax incentives are designed to reduce the income and announcement effects of the corporate income tax.

Tax incentives are based usually on output, inputs or profits. The most common forms of tax incentives, accelerated depreciation allowances and investment tax credits, are related to the inputs of a firm. The investment tax credit allows a firm to receive a credit against taxes equal to a specified amount of the cost of new capital equipment acquired. A system of accelerated depreciation permits a firm to claim depreciation allowances in excess of actual depreciation and hence reduce its taxable income. These two incentives are linked to the purchase of capital equipment used by the firm.

A second class of incentives is based on the profits of the firm. In this case the reduction of the firm's tax bill is achieved notwithstanding the amount of expenditure the firm undertakes. Reductions in corporate taxes or a full exemption from taxes (tax holidays) are both examples of this type of policy measure. Canada has reserved the use of tax holidays to stimulate investment in specially designated areas. Tax holidays are usually given for regional development purposes. An example of an incentive based on output is the so-called "production incentive" employed in Canada in the early 1960's. The incentive provided for a tax reduction based on the level of sales--and hence output--of a firm. See Bird (1965) for a discussion of the Canadian experience with the tax incentive for sales.

At this point, it is convenient to define a number of terms which are discussed in the next section. Accelerated depreciation is considered as "any method of deliberately speeding the rate at which the original cost of assets (less any salvage value) may be deducted from taxable income."[4] The usual methods of computing depreciation allowances are the straight line method, the declining balance method and the sum of the years' digits method.[5] One way of accelerating depreciation allowances is to shorten the life of an asset for tax purposes. For example, consider a building which has an expected economic life of 40 years; for tax purposes a firm is allowed to depreciate the building in five years.

During the postwar period, the United Kingdom introduced programs of initial allowances and investment allowances.[6]

With an initial allowance, a firm is able to deduct an amount over and above normal allowances during the first year of acquisition of an investment good. The amount reduces deductions made in later years. In the case of the investment allowance, the firm is permitted to claim an extra proportion of the cost of the investment in the first year. For the investment allowance, there is a net addition to depreciation allowances and for tax purposes a firm can write off an amount greater than normal allowances. These changes in depreciation policy help to reduce net income for tax purposes and thus tax liabilities for a firm.

The investment tax credit allows a firm to reduce taxes payable by an amount equal to a specified proportion of investment undertaken. When the investment tax credit was introduced in Canada in 1975 the rates were initially set at 5%. Usually there is an upper limit to the amount of tax credit which can be claimed in any one year. Taxpayers are allowed to carryforward unused tax credits and in Canada the carryforward period is five years. In Canada the investment tax credit reduces the cost of the investment that may be used for purposes of capital cost allowances.[7]

Other types of tax incentives are for example direct grants, reductions in sales taxes on machinery and equipment and special incentives to retain earnings in a firm. Bird (1980: Chapter 3) provides a taxonomy which summarises the major categories of tax incentives. Generally however most writers and policymakers concern themselves with depreciation policy and tax credits.

II. ACCELERATED DEPRECIATION

Economists have recognised for a fairly long time[8] the effect of changing depreciation policy on investment expenditures. Kalecki (1944)[9] suggested the use of accelerated depreciation to stimulate private investment; he considered the approach as one way of achieving and maintaining full employment in a capitalist society. Kalecki felt that the pressure of the income tax could be reduced by allowing firms to deduct immediately from taxable income all investment in fixed capital. The deductions would be applicable for both expansion and replacement investment expenditures. Kalecki's proposal is equivalent to the depreciation method known as expensing.[10] He also suggested the need for loss carryforward provisions in cases where taxable income could not absorb the deductions. Kalecki outlines the expensing proposal as one among other proposals for attaining full employment. He does not give a formal statement of the assumptions needed for the proposal to work. Instead Brown (1948) combines the Kalecki proposal with earlier work by Domar and Musgrave (1944) into a more formal approach.

Brown (1948) considers a number of questions: what happens to investment incentives when a proportional tax is levied? Can these effects be neutralized by changing depreciation guidelines? Brown assumes conditions of certainty of future income and perfect loss offset[11] by the government. Firms engage in profit maximising behaviour so that an entrepreneur invests up to the point where the cost of a marginal addition to investment equals the yield from this additional investment. This condition requires that the present value of a stream of net receipts from the marginal addition to investment be equal to the cost of this investment. As a rate of discount the entrepreneur uses the rate of interest he must pay on borrowed funds. In the absence of an income tax, the following conditions must hold:

$$C = RA \tag{2.1}$$

where

C = cost of a marginal investment

R = prospective annual net receipts per year where R is constant over the life of the investment

A = present value of a dollar a year for n years discounted at the rate of interest "i"

n = economic life of the investment

The introduction of a proportional tax will reduce the yields from the investment and make some unprofitable. When a proportional tax is imposed equation (2.1) is altered:

$$C = RA - t(R - \frac{C}{d})A \tag{2.2}$$

where

t = rate of the proportional tax

d = number of years over which the investment can be depreciated for tax purposes

d = n[12]

Rewriting equation (2.2)

$$C(1 - \frac{At}{d}) = RA(1 - t) \tag{2.2a}$$

Using equation (2.2a) one can compare the cost of the investment less the present value of depreciation deductions with the present value of expected net receipts less tax. For the proportional income tax to have a neutral effect on investment incentives, the present value of depreciation deductions should reduce the cost of the investment by an amount proportionate to the rate of the tax. In terms of equation (2.2a) this occurs if $At/d = t$ or if $\frac{A}{d} = 1$.[13] Given equation (2.2a), the smaller is $\frac{AC}{d}$ (the present value of the depreciation deductions), the greater is the disincentive to investment. The disincentive arises because both depreciation deductions and tax deductions are spread over the life of the investment. Discounting the deductions into the present reduces the present value of the annual amounts. For a given rate of discount, $\frac{AC}{d}$ is smaller the longer the life of the investment; for a given d, the present value of the depreciation deductions is smaller, the higher the rate of discount. If the depreciable life of the investment is shortened the disincentive effect of the proportional tax is reduced.

In the limit, an investment can be written off in a year--the expensing method. For the limiting case

$$n = d = 1$$

and

$$A = 1$$

Thus

$$C(1 - \frac{At}{d}) = RA(1 - t) \qquad (2.3)$$

becomes

$$C(1 - t) = RA(1 - t) \qquad (2.3a)$$

or

$$C = RA \qquad (2.3b)$$

In the limiting case, the pretax equalities of equation (2.1) are maintained and the proportional tax is neutral in its effect on investment.[14] In practice, firms are rarely[15] allowed to write off their investments in one year. At present in Canada manufacturing firms write off new machinery and equipment in two years.

In his analysis Brown distinguishes new and replacement investment; unlike new investment, replacement investment involves the retirement of an existing capital asset when the investment is made. In the absence of an income tax, there is no difference between the decision to carryout new or replacement investment. Once taxes are introduced, the undepreciated cost of the old investment affects the investment decision. Consider a firm which decides to replace a capital asset before it is fully depreciated. The firm can claim the undepreciated deductions immediately; the firm can also claim the depreciation deductions for the new capital asset. Brown shows that under certain conditions, the present value of the depreciation deductions from the old asset plus the present value of depreciation deductions from the new asset can reduce the cost of the replacement in proportion to the tax. His hypothetical examples illustrate that the present value of the depreciation deductions from the old asset is higher, the higher the percentage of the asset which is undepreciated and the greater its length of life.

In practice the distinction between new and replacement investment is not as simple as Brown describes it. Much of new investment contains elements of replacement investment. Brown makes no assumptions about the capacity and efficiency of the replacement; in many instances however when one capital asset is discarded, a new and better one replaces it. To the extent that one can distinguish the two categories, a firm which makes more replacement investment has an advantage over the firm with less replacement expenditure. Similarly the well established firm has a relative advantage over the new firm because the investment expenditures of the former consist of large amounts of replacements.

A major assumption of the analysis so far is the existence of perfect certainty; once uncertainty is introduced into the analysis, the results obtained depend on how the uncertainty is incorporated into the analysis. Brown discusses a number of possible outcomes and concludes that under a situation of economic life depreciation, incentives to invest are more adversely affected, the greater the uncertainty of future income. Similarly the new firm is more adversely affected than the already established firm.

In his analysis Brown recognises that a policy of liberal depreciation allowances would involve substantial revenue losses for the government. He argues correctly that a choice between accelerated depreciation and other tax incentives must take into account the revenue losses. One should weigh the revenue losses against other forms of tax reductions which would yield a similar stimulus to private investment.

There is one implicit assumption which underlies the previous analysis. The assumption is that no variables are affected by the imposition of a proportional income tax. In Pigou's terminiology (see p. 9 above), the announcement effects of the tax are small enough to be neglected. The assumption may be true for small tax changes. When tax changes are large however, the assumption is no longer valid. This is a criticism which is applicable to most tax incidence studies. See Sumner (1973a) and Kraus (1972) for a different approach.

Brown's analysis examined the case of a single investment for a single firm. Domar (1953a; 1953b) and Eisner (1952a; 1952b) extended the analysis to include growing firms[16] and more than one investment. The Domar studies concentrate on the relationship between accelerated depreciation and normal depreciation. For a growing firm, normal depreciation allowances are more than adequate to finance replacement investment. On the basis of data for United States, Domar shows that normal depreciation allowances will finance generally about 50% to 60% of the investment in fixed capital of a growing firm. This result depends on the rate of growth of investment (r) and the length of life of the investment (m).[17] Another result which follows from his analysis is that if retained profits and investment grow at the same rate, a growing firm can finance its own investment program. For given values of r and m, the ratio of accelerated depreciation allowances to normal depreciation allowances (D'/D) also leads to interesting results. For example if $r = 5\%$ and $m = 30$, but an investment now has a tax life of five years, m' = 5, then accelerated depreciation is 70% above normal depreciation. The relationship is stabilised at the end of the period m' = 5 and continues provided that the firm grows at the rate r = 5%. The D'/D ratio is higher for a given m and m' and a higher rate of growth of investment; the ratio is also higher if the tax life is shortened for a given r and m. Thus increased funds from liberal depreciation allowances make it easier for a firm to finance its investment needs. Firms must have the necessary taxable income to absorb the depreciation deductions otherwise liberal depreciation policy is of little value to them. Domar makes a strong case for the importance of accelerated depreciation for new firms. Yet new firms may take a long time before they have sufficient taxable income to be able to take advantage of accelerated depreciation. Only the existence of long loss carryover periods can make accelerated depreciation important for new firms. Otherwise, accelerated depreciation may lead to the growth of existing large firms; further, there can be no assurance that liberal depreciation allowances will ensure the survival of new firms.

Eisner's 1952 studies are in the spirit of the Domar studies, but Eisner is not as optimistic as Domar is on the role of faster writeoffs. Eisner does not believe that the <u>rate</u> of investment necessarily will increase because of a policy of liberal depreciation allowances. Eisner recognises that accelerated writeoffs postpone taxes and lead to an increase in the level of investment for some firms. However he believes that accelerated depreciation would increase the rate of growth of investment <u>only if</u> depreciation allowances are important for a firm's investment decision.[18] This point is extremely important because the subsequent discussions in the next chapter show that depreciation allowances are relatively unimportant in the firm's investment decision.

Later work on accelerated depreciation consists of minor additions and elaborations of the main points. Brown (1955) examines different methods of accelerating depreciation and finds only a negligible advantage for the sum of the years' digits method.[19] Brown is also concerned about the large revenue losses which the government experiences with a system of liberal depreciation allowances. He questions whether investment expenditures would grow at a rate high enough to recover the loss in the tax base.

Goode (1955) provides a systematic statement on accelerated depreciation and investment incentives. He favours accelerated depreciation because of its "selectiveness." Accelerated depreciation is comparable to a selective reduction in tax rates. Nevertheless a change in depreciation policy is superior to changes in tax rates because the policy can be confined to new investment. Similarly accelerated depreciation is superior to changes in interest rates. For interest rate changes will affect many other variables apart from investment--in particular the bond market, real estate values and possibly foreign exchange flows.

Liberal depreciation policy has one attractive feature for most of its proponents. Liberal allowances represent as it were a "legitimate method of tax avoidance."[20] One cannot overemphasize this feature of such a policy. From the viewpoint of the firm the costs of the accelerated allowances, a hidden subsidy, are not revealed to the average taxpayer. There are enormous political advantages to be gained here. Liberal allowances are a substitute for the reduction of taxes of the more profitable firms which claim them; at the same time the firms do not encounter the adverse publicity associated with corporate handouts.

This brief review of the literature on accelerated depreciation is by no means an exhaustive one. There is some neglect of special depreciation schemes adopted in particular countries: the Swedish scheme (Shelton and Ohlin: 1952); the British experience with initial and investment allowances (Black: 1959) and the West German experience (We rtheimer: 1957). Similarly there is no discussion of accelerated depreciation and incentives for innovative investment. Perhaps the most important omission is the relationship between depreciation and price changes. Given the double digit inflation of the 1970's, there is some evidence that inflation makes normal depreciation allowances, based on historic costs, inadequate. Further, the taxation of net income calculated on the basis of such allowances is in part a tax on capital. Accelerated depreciation may be viewed as a device for compensating firms for the rising prices of capital goods. This aspect of depreciation allowances is taken up in Chapter Six.

III. TAX CREDITS

The literature on investment tax credits is less extensive than that on accelerated depreciation. The literature grew as a result of changes in the United States Tax Laws in 1962. At that time a 7% investment tax credit was introduced. An investment tax credit provides for a reduction in taxable income based on a proportion of the cost of the investment.[21] The rate of the investment tax credit generally ranges from 5% to 20%. Chase (1962) outlines the effects of the tax credit for investment outlays.

Chase distinguishes incentive[22] effects and income effects of tax credit. A tax credit on all new investment would reduce the cost of new capital goods for any firm with the necessary taxable income. The incentive effect of the tax credit changes the after tax rate of return on the particular investment. The income effect is very small and depends on the rate of the tax credit. If one assumes that the investment tax credit will be a permanent feature of the tax system, then a tax credit on all new investment has a greater effect on short term than on long term investment. This is because over a given period of time a number of short lived investments will earn the credit oftener than a series of long lived investments.

A further distinction is made between a tax credit for all new investment and a tax credit for net investment. Net investment is defined as investment over and above current depreciation. In the case of net investment, the effect of the tax credit will be less than a credit on all investment. Here the base of the credit is smaller than in the previous case.

One problem with the net tax credit is the possibility of "bunching of investment." For firms could alter their investment timing to take full advantage of the credit, in the years in which depreciation is low. At the same time if firms are allowed to expense their investments, net investment is zero. In such a situation a net tax credit is of little value.

On the basis of diagrammatic analysis, Chase shows that tax credits will increase aggregate investment. For each firm the increased investment will depend on whether they are growing, stable or marginal firms. Chase uses numerical examples to show that tax credits and accelerated depreciation are substitutes rather than complements for each other.

The tax credit is similar to accelerated depreciation because of the hidden subsidy element in both of them. As a subsidy linked to taxable profits, only firms which have tax liabilities can take advantage of the credit. In a system with differential tax rates, the subsidy means more to firms with higher marginal tax rates. And firms with higher marginal tax rates are generally the ones with substantial profits. Just as is the case with accelerated depreciation, the tax credit appears to favour corporate giants.

The investment tax credit also reduces government revenues. Brown (1962) demonstrates that the tax credit is a more efficient method of increasing rates of investment than accelerated depreciation. His criteria is maximum stimulus per dollar of revenue lost. The assertion is proved[23] best with hypothetical examples based on assumptions about the rate of growth of investment, the rate of the tax credit, the discount rate and the durability of the investment. The revenue loss for the government from the tax credit is permanent; similarly the revenue loss from accelerated depreciation is permanent as long as the rate of investment is growing. Brown shows that given certain assumptions, the loss from accelerated depreciation is greater than that from an investment credit given the same rate of investment. He concludes that if tax incentives are to be employed, the tax credit should be maintained.

Not all writers are favourably disposed towards tax incentives, even though they accept the use of tax incentives in principle. Bird (1965) is concerned that very little testing is carried out concerning unintended distortions which might result from new incentives; Edelstein and Bernstein (1961) object to accelerated depreciation because it leads to a reduction in the free play of the market; Slitor (1953) cautions against undue dependence on generous depreciation rates to achieve increased investment. Such a policy leads to inequities in the treatment of small versus large firms;[24] those firms who benefit from the policy are generally large profitmaking firms; Kierans (1960; 1972) insists that tax incentives have contributed to Canada's ownership and unemployment problems. Governments rely on tax incentives (in Eisner's view) primarily because "it is politically more expedient to affect the incidence of taxation...by this subtle method...about which the average voter cannot be expected to be well informed, than to alter existing tax rates in favour of corporate income."[25]

IV. TAX INCENTIVES IN CANADA 1945-1978

Table 1 below provides a chronology of Canada's experience with tax incentives in the postwar period. The table indicates the almost exclusive reliance on accelerated depreciation[26] to obtain changes in different categories of investment expenditures--changes in innovative investment, changes in expenditures on pollution equipment and changes in regional investment. During this period, one can distinguish three phases in Canadian tax incentive policy.

Between 1960 and 1966 the Federal Government introduced many incentives to stimulate investment. Most of the programs of accelerated write offs were introduced for initial two year periods. However the programs were generally extended for longer periods. In the 1960-1969 period, deferred capital cost allowances were imposed on certain sectors of the economy as a means of restraining investment spending.[27] Since 1974 tax incentives have been extended indefinitely beyond their original expiry dates. This is the case with the investment tax credit and accelerated capital cost allowances. Both tax incentives have continued uninterrupted for almost six years, unaffected by sudden fiscal policy changes. It remains to be

TABLE 1

Chronology of Tax Incentives in Canada

1945-1978

Date	Incentive
22-3-49	Introduction of system of Capital Cost Allowances
10-4-51	Deferred Capital Cost Allowances on certain classes of assets
20-12-60	(i) Two year programme of double depreciation allowances for certain classes of assets
	(ii) 100% write off for Research and Development expenditures of a capital nature
20-6-61	Reequipment and modernization allowance for manufacturing and processing firms
10-4-62	(i) Production incentive
	(ii) Extension of double depreciation allowance for another year
	(iii) For Research and Development Expenditure an additional deduction of 50% of the <u>increment</u> of total expenditures over a specified base year (1961)
13-6-63	(i) Faster write off for certain classes of assets for manufacturing and processing firms, located in specially designated areas
	(ii) Three year tax holiday for firms located in specially designated areas
	(iii) Accelerated write offs for buildings, machinery and equipment

The three provisions replaced the 1961 provision and (ii) of 1962. These provisions were extended continually until April 1st 1967 when they were allowed to expire.

Date	Incentive
26-4-65	(i) For Research and Development expenditures: A tax credit of 25% of capital expenditures plus the amount by which current expenditure is greater than that of a base period. This replaced (iii) of 1962.

Date	Incentive
	(ii) Two year write off for assets acquired primarily for the reduction of water pollution.
29-3-66	(i) Deferred capital cost allowances on certain classes of assets for an 18 month period.
3-6-69	Two year deferral of capital cost allowances on commercial buildings in selected areas.
3-12-70	(i) 115% valuation of new machinery and equipment for capital cost allowances for the period 4-12-70 to 31-3-72.
	(ii) Two year write off for assets acquired primarily to reduce air pollution
18-6-71 TAX REFORM YEAR	(i) A small business incentive for Canadian controlled corporations: 25% tax rate on first $50,000 of taxable income. [Compared to general corporate tax rates of 21% on first $35,000 of taxable income and 50% on the excess.]
	(ii) Reduction in top marginal corporate tax rates by 1 percentage point annually to 46% between 1972 and 1976.
14-10-71	7% cut in corporate taxes effective 1/7/71-31/12/72
8-5-72	(i) Two year write off for new machinery and equipment to replace (i) of 1970. This measure has been extended indefinitely beyond the original December 1974 expiry date.
	(ii) Cut in top marginal corporate tax rate for manufacturing and processing firms to 40% and to 20% for firms eligible for small business deductions.
23-6-75	5% Investment Tax Credit to manufacturing and other sectors for investment made between 24-6-75 and 30-6-77. There is an upper limit to the amount that can be deducted in any one year.
31-3-77	The investment tax credit is extended for a further three years to 1980. The rate of the tax credit is increased to 7½% in some areas and 10% in others.

Date	Incentive
10-4-78	Taxpayers are allowed an additional allowance of 50% of any increase in their current and capital expenditures on Research and Development in a year that exceeds average Research and Development expenditure over the previous three year period.
28-11-78	The tax credit is extended indefinitely beyond its June 1980 expiry date. The basic rate is now increased to 7%; the rates are also set at 10% and 20% in special areas.

Note: The table presented above details the main tax incentives introduced by the Federal Government; the listing is not an exhaustive one. Matziorinis et al (1980a; 1980b) tabulate corporate income tax changes and tax depreciation rules applicable at Federal and Provincial levels in Canada between 1949 and 1979. In their tabulations close attention is paid to the following: the date of announcement of the tax changes; the date on which the tax changes became effective and the expiry date.

Source: Budget Speeches, House of Commons Debates 1949-1978, Ottawa.

seen whether the certainty of the allowances will have affected investment spending.

The details outlined in the table show that policymakers have a certain vision of the investment process. Those who dictate the direction of economic policy in Canada appear to view the investment process in a different light from the theorists in the next chapter. Despite changes[28] in governments over the postwar decades the views on investment and its determinants have remained relatively consistent. One can identify at least three assumptions in the policymakers' view of the investment process. Each assumption is substantiated by references to the Budget Speeches[29] and Financial Statements during the period. The assumptions are as follows:

(a) Profitable investment opportunities exist; but the deleterious effects of the corporate income tax must be mitigated to improve a firm's cash flow position.[30] This assumption implies that the factor restraining investment spending is inadequate retained earnings.

(b) Lags in the investment process are almost non existent. If firms make any adjustments to maintain an optimal investment policy, the adjustment is instantaneous.[31] In one instance[32] there was some recognition that time may elapse before a policy begins to take effect. However all other speeches stress the immediate impact of the particular policy.

Budget speeches leave the impression that economic policies go into effect immediately, the reality is quite different. The lags in fiscal policy are not as long as those experienced in the United States, but delays do in fact take place.[33] Delays may occur from three to six months. Consider the case of the 1972 tax changes[34] which were a reaction to the United States Legislation on Domestic International Sales Corporations. The changes were introduced on 8 May 1972; final regulations were passed by Order in Council on 30 August 1973. The delays experienced are one aspect of a growing dissatisfaction with tax changes and the legislative process. Tax practitioners are becoming more concerned[35] about delays in final wording and interpretation of tax changes.

(c) The relationship between investment expenditures and cash flows is symmetrical: Increased cash flows stimulate investment expenditures, reduced cash flows will lead to a decline in investment.

The policy of deferred depreciation has been used on a number of occasions[36] as a stabilization tool. "It does not necessarily follow that removing the allowances in a boom would deter investment <u>much</u> since many firms will go ahead if they can get funds elsewhere at a reasonable cost."[37] Although there is little empirical evidence to support the symmetry between falling cash flows and investment, policymakers believe the symmetry exists.

Canadian policymakers also believe that investment should remain at a certain level of Gross National Product. At no time is there any explicit expression of what that level is; yet careful reading of Budget Speeches leave the impression that the 1956-1957 investment levels are the benchmark to compare with other periods.[38] The 1956-1957 investment levels average 26% of Gross National Product. The tax measures of the 1960's were directed primarily at maintaining the high investment levels of the mid 1950's. Despite the attempts, investment has fluctuated (at) around 22% of Gross National Product.[39]

Policymakers also believe that faster write offs will stimulate <u>all</u> categories of investment spending e.g., investment for regional development, expenditures on pollution control equipment, expenditures on innovative investment (R and D). Since 1961 Canadian firms have been allowed a 100% write off for R and D expenditures of a capital nature; and a 25% tax credit since 1965. Despite the generous treatment, R and D as a percentage of GNP between 1961 and 1975 totalled approximately 1%.[40] In 1978 the Federal Government found it necessary to allow further generous treatment for innovative investment.

The main characteristics of the model described above are: the positive relationship between internal cash flows and investment and the short time lag over which investment responds to changes in its determinants. The model is a fair representation of the words and actions of policymakers. It bears, however, little resemblance to the theoretical models discussed in the next chapter.

V. OTHER ASPECTS OF TAX INCENTIVES.

A number of problems are immediately apparent when one considers the quantitative aspects of tax incentive policy. To answer questions on the impact of tax incentives, one could use hypothetical results or discuss actual cases. Musgrave (1959), Goode (1955), Brown (1962)--all based their agruments for and against tax incentives on hypothetical examples. In one example Goode compares different depreciation methods. He makes assumptions about the depreciable life of an investment, the discount rate and the marginal tax rate. Goode then compares the different depreciation methods paying close attention to: the length of the pay-off period, the type of investment favoured (short or long lived). Hypothetical examples are poor substitutes for actual case studies and real examples are preferable.

Some studies employ interview and questionnaire techniques to analyse the effectiveness of tax incentives. Corner and Williams (1965), Helliwell (1966) and the Corporate Tax Measures Review (1975) are examples of this method of approach. Ture (1967) investigated the extent and use of accelerated depreciation methods introduced in United States Internal Revenue Code of 1954. Ture made a comprehensive survey of: the amount of depreciable property which qualified for the accelerated methods; the amount of depreciation generated by each method; the number of taxpayers who elected to use the method. He found that over 45% of depreciable property acquired after 1954 and in use in 1959 were in accelerated depreciation accounts. The largest sector which used the new methods was the manufacturing sector. Ture concluded that accelerated depreciation methods had considerable effects on outlays for depreciable property.

The 1976 Supplementary Budget Papers contained a first official survey of the depreciation practices of corporations in Canada.[41] The corporations included large and small corporations; most of Canada's corporations were included in the small corporations. More than half the large corporations surveyed used the straight line method of depreciation for their financial depreciation accounts. The objectives of the corporations were "to match costs and revenues based on useful lives." The small corporations used the declining balance rates which corresponded to those of the capital cost allowance system. The small corporations found it a matter of convenience to use the declining balance rates.

Although there are limitations to the survey approach, this type of study gives insight into the direction of change after tax policy changes. The Tax Measures Review Committee (1975) asked numerous questions relating to investment, employment, sales, improved ability to secure external finance. The Committee concluded that the 1972 tax measures were generally successful. They pointed to a direct increase in investment of $2.5 billion between 1972 and 1975 because of changes in tax policy.

Another method of investigation is to examine the determinants of investment behaviour. Eisner (1952a) for example recognised the need for an investment model in stating a case for accelerated depreciation.[42] In its work, the Tax Measures Review Committee found it necessary to employ an econometric model. The Committee used the Bank of Canada's RDX-2 model to determine the general impact on the economy of the 1972 tax changes. The estimates given above were based on this model. However the Committee found great difficulty in separating the investment due to tax changes from those of normal replacement investment.

A large number of factors impinge upon the investment process and isolating the influence of tax variables may be difficult. A first approximation is to investigate the determinants of investment behaviour. The models discussed in the next chapter provide a useful starting point for the investigation.

VI. SUMMARY

Chapter Two examined the nature of tax incentives used by governments to effect tax policy changes. The tax incentives discussed were accelerated depreciation and the investment tax credit. These tax incentives are used because they alter the level and timing of investment spending. Accelerated depreciation shortens the time needed to recover the cost of an investment; the investment tax credit derives its benefits from the number of times it can be taken. A listing is provided of the main incentives introduced in Canada by the Federal Government.

The chapter contained an outline of an investment model which captures policymakers' vision of the investment process. Annual Budget Speeches and Supplementary Budget Papers provided evidence for the formulation of the policymakers' model. Other topics considered in the chapter were interview and questionnaire studies; also the quasi-empirical studies which employ hypothetical examples in their discussion of tax incentives.

FOOTNOTES

[1]The concept of "tax expenditures" originates with Surrey. He defines a system of tax expenditures as one "under which government financial assistance programs are carried out through special tax provisions rather than through direct government expenditures. The system is grafted onto the Income Tax system and has no relation to that system." S. Surrey in The Economics of Federal Subsidy Programs, Part 3--Tax Subsidies, Joint Economic Committee, U.S. Government Printing Office, Washington, D.C., 1972. See also Surrey (1973) for a tax expenditure budget for the United States in 1972. Criticism has been levelled against the concept and the use of tax expenditures. These criticisms are discussed briefly in Chapter Six.

[2]The traditional view of tax incidence theory is the neoclassical theory [See Harberger (1962)]. The neoclassical theory argues that the short period legal and economic incidence of the corporation tax is borne by the firm. The post Keynesian theory of tax incidence [See Asimakopulos and Burbidge (1974)] shows that the legal and economic incidence can be different in some cases. The writers who advocate the use of tax incentives rely implicitly on the view that the legal and economic incidence of the corporation tax is the same.

[3]A. Pigou, A Study in Public Finance. Macmillan, London, 1952 (especially pp. 55-71).

[4]R. Goode, "Accelerated Depreciation Allowances As A Stimulus To Investment," Quarterly Journal of Economics, vol. 69, May 1955, p. 192.

[5]Under the straight line method, the cost of an investment is written off in equal amounts over its expected economic life. For example if a machine costs $100 and is expected to last 10 years with no salvage value, the annual charge for depreciation will be $10. Under the declining balance method, a constant fraction of the unamortized balance of the investment is written off each year. This is a declining fraction of the original cost of the investment. The rate chosen is usually not more than twice the rate which would have been used under the straight line method. Under the sum of the years' digits method a varying fraction of the total depreciation is taken each year. The denominator of the fraction is the sum of all the numbers representing the years of life; the numerator is the number of years remaining in the service life. For a machine with a 5 year life the denominator is 1 + 2 + 3 + 4 + 5 = 15; in the first year the fraction of depreciation charges is 5/15; in the second year 4/15; the third 3/15, the fourth 2/15 and the last 1/15.

Algebraic Formulas:	Annual Depreciation Charges in Year t
(a) Straight Line	$[1/d]C$
(b) Declining Balance (double the straight line rate)	$2/d\left[1 - \frac{2}{d}\right]^{t-1} C$
(c) Sum of the Years' digits method	$2/d\left[1 - \frac{t}{(d + 1)}\right] C$

where

d = depreciable life
t = no. of years for which depreciation is deducted
C = cost of the investment

Source: E. Cary Brown (1955).
See Davidson and Drake (1961) for a discussion of which method is the "best" tax depreciation method.

[6] For detailed analysis of the British experience with these allowances see Black (1959); Bird (1963) and Corner and Williams (1965).

[7] In the United States the investment tax credit enacted in 1962 contained such a provision. This provision was later repealed.

[8] See H. Hotelling, "General Mathematical Theory of Depreciation." Journal of the American Statistical Association, vol. 20, Sept. 1925, pp. 340-353. See E. Cary Brown and G. Patterson, "Accelerated Depreciation: A Neglected Chapter in War Taxation," Quarterly Journal of Economics, vol. 57 (1942-1943), pp. 630-646. Brown and Patterson look at accelerated depreciation as an aspect of war taxation. During the period the objective of liberal depreciation allowances was to secure the expansion of war-needed facilities. The economic objectives in wartime are clearly different to those existing in an economy at peace. For brevity, the discussion is confined to the literature of the period following the Second World War.

[9] See M. Kalecki, "Three Ways to Full Employment," pp. 39-58 in The Economics of Full Employment, Basil Blackwell, Oxford, 1944.

[10] This approach is also similar to the Jorgenson First Year Plan--one of many depreciation proposals which are being considered as part of the plan to cut business taxes in the United States in 1981. The Jorgenson Plan requires that tax deductions for depreciation of equipment and buildings be taken entirely in the first year instead of being spread over the life of the investment. A counter proposal is the 10-5-3 plan--this plan

allows for the following economic lives: 10 years for buildings, 5 years for equipment, 3 years for vehicles. See the New York Sunday Times, August 10, 1980, Business and Finance Section, p. 14.

[11]In such a system, if revenues are less than expenditures (for tax purposes), the government pays the entrepreneur for the loss at the rate of the tax.

[12]In the original article Brown considered only the case of n=d. In a reprint in the AEA Readings in the Economics of Taxation an adjustment is made and equation (2.2a) is re-written:

$$C(1 - \frac{B}{d}t) = RA(1 - t)$$

where

B = present value of $1 per year for d years discounted at "i".

For a given i $\quad \frac{tCB}{d} < \frac{tCA}{n} \quad$ if $\quad d < n$.

[13]If $\frac{A}{d} < 1$ the marginal investment is less profitable. If $\frac{A}{d} > 1$, the marginal investment is more profitable.

[14]Very many articles have been written on the subject of tax neutrality. Apart from the short discussion in footnote 15 of Chapter Three below the neutrality topic is not analysed in this thesis. For one of the early articles on the subject See P. Samuelson, "Tax Deductibility of Economic Depreciation to Insure Invariant Valuation," Journal of Political Economy, vol. 72, December 1964, pp. 604-606.

[15]One exception is the case of Sweden. In 1938 Sweden introduced a system of "free depreciation" of machinery and equipment. Under this system, the only constraint taxpayers faced was that tax depreciation and book depreciation had to coincide. The system of "free depreciation" was introduced primarily for administrative purposes--to reduce conflicts between taxpayers and tax authorities. The incentive aspect of the scheme was of secondary importance. See L. Mutén and K. Faxén, "Sweden" in Foreign Tax Policies and Economic Growth, NBER and Brookings (1966).

[16]A growing firm is defined as a firm which has a growing stream of investment.

[17]Domar works with the following values which are the averages for the American economy (at that period of time). The rate of growth of investment, r, is taken to be 4-5%; m=25-30 years is the average time that fixed assets remain

on accounting books. For a given m, if r > 5% depreciation allowances finance less than 50-60% of total investment. Note that in all these calculations, Domar assumes that the firm starts with no fixed capital.

[18]See Eisner (1955). In addition Eisner suggests that a liberal depreciation policy must be in force for a long enough period of time for firms to take it into their calculations.

[19]Under the sum of the years' digits method /See footnote 5 above/, depreciation deductions are larger in the first half of the life of the investment and lower in the second. Changes in the United States Internal Revenue Code of 1954 allowed taxpayers to use the declining balance method (of charging depreciation deductions), the sum of the years' digits method or any method which allowed taxpayers to charge more in the early years of the life of the investment than under the straight line method.

[20]See Domar (1953b), p. 509; also Ken Woodside, "Considerations in Governmental Choice," Canadian Public Policy, vol. V, no. 2, Spring 1979, pp. 248-256.

[21]The investment credit is not the same as the investment allowance used in Great Britain (see p. 11 above). With the investment allowance the firm can write off more than 100% of the cost of the investment. Canada experimented for a short time with a type of investment allowance. Between 4-12-1970 and 31-3-1972 firms were allowed a 115% valuation of new machinery and equipment for capital cost allowances.

[22]The incentive effect is essentially Pigou's announcement effect.

[23]See Brown (1962), especially pp. 341-345.

[24]The West Germans experienced similar problems with their postwar system of tax incentives. This led to a removal and restructuring of some of the incentives. For a good discussion of the West German system see Wertheimer (1957).

[25]R. Eisner, "Accelerated Depreciation: Some Further Thoughts," Quarterly Journal of Economics, vol. 69, 1955, pp. 285-296, especially pp. 294-295.

[26]In Canada depreciation allowances are called capital cost allowances. The system of capital cost allowances was introduced in 1949; D. Abbott (1954), "Corporation Tax Policy" Canadian Tax Journal, vol. II, no. 1, Jan.-Feb. 1954, pp. 20-25, discusses some of the important features of capital cost allowances.

[27]A similar situation occurred in 1951--See M. Sharp,

"Deferred Depreciation--A Canadian Anti-Inflationary Measure," Journal of Finance, May 1952, pp. 331-346, and M. Sharp, "Deferred Depreciation: A Further Assessment," Canadian Tax Journal, vol. I, no. 3, May-June 1953, pp. 277-283. A policy of deferred capital cost allowances will have at best only limited success. Once investment projects are underway, apart from labour unrests, only supply shortages can act as an effective break on investment spending.

[28]Governments changed power during the period; yet key public servants, who translate the philosophy of a political party into concrete economic policies may not have changed.

[29]"The day is long past when the major preoccupation of the budget was confined to items of customs and excise and the rates of tax. The budget is now seen as the major tool of the government for implementing social and economic policies, and may involve decisions of national and international significance." The Tax Legislative Process Committee, "The Tax Legislative Process," Canadian Tax Journal, vol. XXVI, no. 2, March-April 1978, pp. 157-182, especially p. 164.

[30]Two examples are illustrative: "Frequently the most difficult aspect for an individual business to undertake unaided is the financing of expensive new captial installations, including machinery, equipment and buildings. The government has decided to give help at this point by introducing an allowance for reequipment and modernization." Hon. Donald Fleming, House of Commons Debates, 1960-61 Session, Vol. VI, p. 6639 et seq. esp. p. 6658, Ottawa. And, "These measures will serve to increase substantially the cash flow of manufacturing and processing firms. Until the present, manufacturing and processing companies in Canada have borne a considerable weight of the corporate income tax. The ratio of tax paid to the value of their output has been much higher for corporations in this field, than for other goods-producing companies. The changes proposed tonight will, I believe put them in a more equitable position." Hon. John Turner, House of Commons Debates, 1972 Session, p. 2002, Ottawa.

[31]"It is intended that the measures I have mentioned so far should provide an immediate impetus to increased activity. Accordingly, new assets must be purchased...in the period of 24 months following the initial date of these measures if they are to qualify." Hon. Walter Gordon, House of Commons Debates, 1963, Vol. II, p. 1004, Ottawa.

[32]See House of Commons Debates 1962, Vol. III, p. 2707, Ottawa.

[33]For example on 3-6-69 the budget introduced measures to institute deferred depreciation. By 1-10-69 the Order in Council to amend the Income Tax Act was finally passed. For examples of delays experienced in amending tax legislation

between 1971 and 1977, see D. Hugget, "The Budget Process and Income Tax Changes," Proceedings of the Twenty-Ninth Tax Conference, Canadian Tax Foundation, Toronto, 1977, pp. 20-40, especially pp. 20-22.

[34]The tax changes referred to here are the accelerated capital cost allowances for machinery and equipment and the investment tax credit to reduce the top marginal corporate tax rate for manufacturing and processing firms. In one sense the example is not typical of the time path of the legislative process of most tax changes. The government was defeated and faced an election before the measures were reintroduced. Yet it is fair to say that "in the limbo that exists between budget night and the date the amendments are passed, the taxpayer has the worst of both situations." Tax Legislative Process Committee, op. cit., p. 172.

[35]See for example Huggett (1977) op. cit., and the references cited there; Tax Legislative Process Committee (1978), op. cit.; M. Cohen, "The Budget Process and Income Tax Charges," Proceedings of the Twenty-Ninth Tax Conference, Canadian Tax Foundation, Toronto, 1977, pp. 6-20.

[36]"What we need is a stiff financial deterrent that will affect particularly the businessman who is considering the kind of investment which is attractive, not because of its long term soundness, but because it can be written off out of the expected high profits of the next few years at a time when he expects the rate of corporate income tax to be abnormally high." Hon. Douglas Abbott, House of Commons Debates, 1951 Session, Vol. II, p. 1808, Ottawa.

[37]Bird (1963), p. 358. The success of deferred depreciation policy in Canada is doubtful. On each occasion the measures were removed before the original time had elapsed. On April 10, 1951, the right to charge depreciation on certain classes of assets was deferred for a period of four years. By 31-12-52 the measures were no longer in force.

[38]"In Canada capital expenditures in 1961 constituted 22% of Gross National Expenditure, a figure which is high by international comparison but below the levels and proportions of the period of the mid 1950's." Budget Paper, April 10, 1962, presented with the 1962 Budget. House of Commons Debates 1962, Vol. III, p. 2739, Ottawa. And, "In order to encourage employment by reviving capital expenditures which have lagged so conspicuously for the past six years, I shall propose important new tax concessions." Hon. Walter Gordon, House of Commons Debates, 1963, Vol. II, p. 1004, Ottawa.

Table 2 below shows ratios of investment to Gross National Product. These data were available to the various Finance Ministers at budget date.

TABLE 2

Investment Expenditures As A Percentage of

Gross National Product (current dollars)

1950-1965

1950	21.9%	1955	23.0%	1960	22.8%
1951	22.4	1956	26.3	1961	21.8
1952	22.9	1957	27.3	1962	21.5
1953	23.9	1958	25.4	1963	21.8
1954	23.0	1959	24.1	1964	23.0
				1965	24.9

Source: Supplementary Budget Papers, presented at the same time as the Budget Speeches 1950-1965, Ottawa.

[39] TABLE 3

Ratios of Investment Expenditures to

Gross National Expenditures

(1971 constant dollars), 1962-1979

1962	21.0%	1968	21.9%	1974	22.9%
1963	20.9	1969	21.9	1975	23.3
1964	22.2	1970	21.4	1976	22.8
1965	23.2	1971	21.8	1977	22.3
1966	24.1	1972	21.7	1978	21.6
1967	23.2	1973	22.4	1979	21.6

Source: Ratios based on data from National Income and Expenditure Accounts, Vol. I, 1926-1974: Statistics Canada, Cat.: 13-531 and Public and Private Investment in Canada, Statistics Canada, Cat.: 61-205.

[40] See Chart I of Research and Development Expenditures in Canada, 1963-1975. Statistics Canada, Cat.: 13-403.

[41] See Murphy (1972) for a short survey of the influence of taxation on corporation depreciation practices.

[42] Domar (1953b) also acknowledged this factor; but he felt that the existing state of economic theory prevented an investigation of the effects of accelerated depreciation.

CHAPTER THREE

THEORIES OF INVESTMENT BEHAVIOUR

This chapter consists of a review of the main theories of investment behaviour. The theories considered are the neoclassical theory of investment, the flexible accelerator and the liquidity theories of investment. All theories reviewed are primarily demand oriented theories. Our review is not an exhaustive[1] one but it concentrates on the main elements of each theory. Its purpose is to arrive at an investment function that can be used to test the effects of tax incentives in the Canadian manufacturing industries.

I(a). THE NEOCLASSICAL MODEL--JORGENSON

Jorgenson (1963)[2] outlines a neoclassical theory of investment, which builds on the work of Fisher (1930) and later extensions by Hirschleifer (1959). One basic feature of the neoclassical theory is the utility maximising behaviour of individual firms. To maximise utility, firms maximise net worth or the present value of receipts over time.

Jorgenson (1963) makes the following assumptions: the individual firm has one variable input (L) and one durable input (I) which are combined to produce a level of output (Q). At any period of time (t) net receipts of the firm are given by the following equation:

$$R(t) = p(t)Q(t) - w(t)L(t) - q(t)I(t) \qquad (3.1)$$

where R = flow of net receipts

p = price of output

Q = level of output

L = level of variable input

w = price of variable input

I = level of durable input[3]

q = price of durable input

The net worth of the firm or the present value of net receipts is defined as:

$$W = \int_0^\infty e^{-rt} R(t)\, dt \qquad (3.2)$$

r = rate of discount

Firms maximise net worth subject to two constraints:

$$F(Q, L, K)^4 = 0 \qquad (3.3)$$

$$\dot{K}(t) = I(t) - \delta K(t) \qquad (3.4)$$

where K = capital stock

$\dot{K}$ = time rate of change of the capital stock

δ = rate of depreciation

The first constraint is the production function; the second means that the increase in capital stock is equal to gross investment less replacement investment. Replacement investment is assumed to be a constant proportion (δ) of the capital stock.

When firms maximise[5] net worth subject to (3.3) and (3.4) two marginal conditions emerge:

$$\frac{\partial Q}{\partial L} = \frac{w}{p} \tag{3.5}$$

and

$$\frac{\partial Q}{\partial K} = \frac{q(r+\delta) - \dot{q}}{p} = \frac{C}{p} \tag{3.6}$$

where $C = q(r+\delta) - \dot{q}$ (3.7)

and $\dot{q}$ = time rate of change of the price of the durable input

Jorgenson defines "C" as the user cost of capital or an implicit rental price of capital, if one considers that the firm rents capital services to itself. The user cost of capital "C" and the price of the durable input differ from each other because of the nature of the durable input.[6]

Once the production function is specified, the level of output, the level of the variable input and the demand for the durable input are all determined. For the Cobb-Douglas production function

$$Q = AK^{\alpha} L^{\beta} \tag{3.8}$$

where A = shift parameter

α = elasticity of output with respect to the capital input

β = elasticity of output with respect to the variable input

and

K, L and Q are defined above

$$\frac{\partial Q}{\partial K} = \alpha \frac{Q}{K} \tag{3.9}$$

Equating (3.6) and (3.9)

$$\alpha \frac{Q}{K} = \frac{C}{p}$$

or

$$K = \alpha \frac{pQ}{C} \qquad (3.10)$$

The level of the capital stock determined by (3.10) is taken to be the desired level of the capital stock: "We assume that...the desired level of capital stock is determined by the marginal productivity condition for capital input."[7] [Jorgenson, (1965), p. 47]

Rewriting (3.10) gives

$$K^* = \alpha \frac{pQ}{C} \qquad (3.11)$$

where K^* = desired level of the capital stock.

Equation (3.11) shows that the desired capital stock depends on output, the price of output and the user cost of capital. The parameter α is the elasticity of output with respect to capital. K^* has two important characteristics: firstly the desired capital stock does not equal the actual level of the capital stock; the desired capital stock equals the actual capital stock "plus a backlog of uncompleted investment projects for the expansion of the capital stock."[8] Secondly the desired capital stock moves from one equilibrium position to another over time. The backlog of investment project is written in the form of a distributed lag[9] relation, for expansion investment; replacement investment is assumed to be a constant proportion of the capital stock.[10] Using the two characteristics one can write an equation for gross investment:

$$I_t^{gross} = \sum_{s=0}^{\infty} \mu_s \, \Delta K^*_{t-s} + \delta K_t \qquad (3.12)$$

where the μ_s represent the distributed lag[11] sequence.

Now

$$I_t^{net} = I_t^{gross} - \delta K_t = \sum_{s=0}^{\infty} \mu_s \, \Delta K^*_{t-s} \qquad (3.13)$$

Substituting for K^*_t yields:

$$I_t^{net} = \alpha \gamma_0 \frac{\Delta p_t Q_t}{C_t} + \alpha \gamma_1 \frac{\Delta p_{t-1} Q_{t-1}}{C_{t-1}} + \omega I^n_{t-1} \qquad (3.13a)$$

where γ_0, γ_1 and ω are parameters of the distributed lag sequence.

Equation (3.13) is derived without reference to taxes. When taxes are introduced into the model, Jorgenson assumes that "tax policy has no effect on before tax rate of return or on the price of capital goods."[12] When taxes are introduced firms maximize net worth, but net worth is now:

$$W^T = \int_0^{\infty} e^{-rt} [R(t) - T(t)] dt \qquad (3.14)$$

and

$$T(t) = u(t) [pQ - wL - \{ v(t) \delta q + w(t) rq - x(t) \dot{q} \} K] \qquad (3.15)$$

and
- u = rate of direct taxes
- v = proportion of depreciation
- w = proportion of interest
- x = proportion of capital loss

} charged against income for tax purposes

When taxes are taken into account[13] the user cost of capital becomes

$$C^{T^{14}} = q\left[\frac{1-uv}{1-u}\delta + \frac{1-uw}{1-u}r - \frac{1-ux}{1-u}\frac{\dot{q}}{q}\right] \quad (3.16)$$

In Jorgenson's neoclassical theory of investment, tax policy has no effect on the price of capital goods, but on the user cost of capital. Changes in tax policy work from the user cost of capital, to the desired capital stock K^* and finally to an investment demand equation. A fall in the user cost of capital[15] increases the demand for desired capital K^* An increase in the demand for capital causes at first an increase in expansion investment and eventually increases in replacement investment.

Hall and Jorgenson (1967) measure the impact of tax changes as follows:

Let $$\hat{I}_t^{net} = \hat{\gamma}_0 \Delta K_t^* + \hat{\gamma}_1 \Delta K_{t-1}^* + \hat{\omega} I_{t-1}^{net} \quad (3.17)$$

represent estimates of net investment under actual tax policies. Suppose the government sector introduces a tax credit, then any changes which occur in investment as a result of the tax credit will be captured by equation (3.17) through their effects on ΔK_t^* and ΔK_{t-1}^*. Let $\bar{C}_t$ represent the user cost of capital in the absence of the tax credit. Then equation (3.18) is the demand for capital services appropriate for $\bar{C}_t$

$$\bar{K}_t^* = \frac{\alpha p_t Q_t}{\bar{C}_t} \quad (3.18)$$

and equation (3.19) is an estimate of the change in investment resulting from the change in tax policy.[16]

$$\hat{I}_t^{net} - \bar{I}_t^{net} = \hat{\gamma}_0 (\Delta K_t^* - \Delta \bar{K}_t^*) + \hat{\gamma}_1 (\Delta K_{t-1}^* - \Delta \bar{K}_{t-1}^*) + \hat{\omega} (I_{t-1}^{net} - \bar{I}_{t-1}^{net}) \quad (3.19)$$

There are numerous problems with the neoclassical model of investment and the Hall-Jorgenson procedure for measuring[17] the impact of tax changes. One such problem is the possible feedback between "C^T" and "Q" in the demand for capital services equation. According to the neoclassical theory of the firm, a fall in the price of a factor of production leads to an increase in the level of output.[18] In Jorgenson's model, output is predetermined and fixed and changes in C^T have no effect on output.[19]

Much more serious problems arise over the role of the coefficient "α" in equation (3.18). "α" measures the elasticity of the capital stock with respect to output and to relative prices (the ratio of the price of output to the rental price of capital). Hall and Jorgenson use the Cobb-Douglas production function and consider "α" as a parameter with a value of unity.[20] There are no independent estimates of the value of "α," instead Hall and Jorgenson appeal to empirical studies of production.[21] The value of "α" is important in the determination of the effects of tax policy. Eisner and Nadiri (1968) have shown that the Hall and Jorgenson results depend critically on a value of unity for "α." Hall and Jorgenson (1967) claim the effects of tax incentives "are very substantial especially for investment in structures." However a number of researchers[22] have demonstrated that once the assumption of unitary elasticity is relaxed, the effects of tax incentive are meagre.

Hall and Jorgenson do not provide independent estimates of "α" nor do they provide independent estimates of the components of "C" and their effects on investment.[23] A fall in the rental price of capital caused by either depreciation changes or lower corporate taxes, leads to identical effects on K^*. There are no ways of distinguishing which tax incentive yields greater investment stimulus.

Another criticism of the Hall-Jorgenson approach is that it is partial equilibrium analysis. The researchers do not take into account the multiplier effects which are important at the level of industry aggregates.[24] A more important criticism is that Hall and Jorgenson ignore the costs of tax incentive policy. The costs must not be ignored especially if tax incentives are financed by higher tax rates.[25]

In the neoclassical model replacement investment is assumed to be a constant proportion of the capital stock. The so-called "proportionality hypothesis" requires a geometric method of depreciation. Jorgenson argues that the assumption is internally consistent and the assumption plays an important role in his model.[26] There is little empirical[27] evidence to support the assumption in the annual year to year changes. Feldstein and Foot (1971) find substantial short run variations in the ratio of replacement investment to the capital stock.

In addition their evidence suggests that replacement investment is related to cash flows and capacity utilization ratios.

The above discussion deals with only some of the problems of the neoclassical model of investment. The problems discussed are the ones which generated the most controversy. Other problems are: the distributed lags and the justification for the lags,[28] and the role of financial variables.[29] Detailed criticisms of the neoclassical model of investment are found in Lund (1976) and Brechling (1975).

This section examined the main elements of the basic neoclassical model of investment outlined by Jorgenson and his associates. The questions which are raised about some of the model's assumptions are important because of the policy conclusions which flow from the model. These questions cast serious doubts on the appropriateness of the model to measure effects of tax incentive policy. In the next section Coen's model provides an alternative approach for measuring the effects of tax policy.

I(b). AN ALTERNATIVE APPROACH--COEN[30]

Coen (1968, 1971) measures the impact of tax incentive policy, but his approach is less controversial than the Hall-Jorgenson approach. The novelty of Coen's procedure lies in the explicit inclusion in the model of two effects of tax incentives--the cash flow effect and the rate of return effect.[31] Using a stock adjustment model[32] Coen theorizes that the cash flow variable[33] determines the speed with which firms reduce the gap between the desired capital stock and the actual capital stock; the after tax rate of return is one of the determinants of the desired capital stock.

Algebraically the model is as follows:

$$I_t^g = \beta (K_t^* - K_{t-1}) + \delta K_{t-1} \qquad (3.20)$$

where I_t^g = gross investment in period t

K_t^* = desired capital stock in period t

K_{t-1} = actual capital stock at the end of period t-1

β = adjustment rate

δ = rate of replacement

There are two ways in which the adjustment rate "β" behaves. In one situation β is a constant and equation (3.20) reduces to the simple stock adjustment model. In another formulation the level of internal funds (cash flows) relative to the amount of gross investment needed to attain K^* determines the adjustment rate. Hence:

$$I_t^g = \left\{\beta_1 + \beta_2 \frac{F_{t-1}}{K_t^* - (1-\delta)K_{t-1}}\right\}\left\{K_t^* - (1-\delta)K_{t-1}\right\} \qquad (3.20a)$$

where F_t = level of internal funds in period t.

If F_{t-1} is small relative to $K_t^* - (1 - \delta)K_{t-1}$ then (3.20a) approaches (3.20); if F_{t-1} is approximately equal to $K_t^* - (1 - \delta)K_{t-1}$ then the adjustment rate $\beta_1 + \beta_2$ could be fairly high depending on the values of β_1 and β_2, but higher than previously.

In Coen's model of investment, the determinants of the desired capital stock are: new orders (a proxy for demand),

and the ratio of the user cost of capital to the price of labour.[34]

$$K_t^* = a_0 + a_1X_t + a_2c_t' \qquad (3.21)$$

where X_t = new orders in period t w = wage rate

$$c_t' = c/w$$

where

$$c = \frac{q(r + \delta)(1 - uB)}{1 - u}$$

= user cost of capital.[35]

where w = tax rate

q = cost of an unit of capital

B = discounted value of depreciation from a current dollar of capital expenditures

r = interest rate at which firms may borrow

δ = rate at which capital depreciates

Substituting for K* in equation (3.20a) gives the following:

$$I_t = \beta_1\delta a_0 + \beta_1a_1 \Delta X_t + \beta_1a_2 \Delta c_t' + (1- \beta_1)(1- \delta)I_{t-1} + \beta_2\Delta F^*_{t-1} \qquad (3.22)$$

where

$$\Delta X_t = X_t - (1 - \delta)X_{t-1}$$

$$\Delta c_t' = c_t' - (1 - \delta)c_{t-1}'$$

$$\Delta F_{t-4} = F_{t-1} - (1 - \delta)F_{t-2}$$

Coen's model is similar to Jorgenson's in some respects, but Coen has a more flexible approach. Coen includes the price of labour in the determination of the desired capital stock; the "F" variable explicitly recognises the cash flow effect of tax incentive policy and hence internal funds available to the firm. The Coen model yields direct estimates of the costs of a particular tax incentive policy to the government sector. The Hall-Jorgenson approach ignores this type of analysis.[36] In comparing the two approaches, Coen presents a superior and more realistic approach to measuring tax incentive policy than Jorgenson.

The Coen model discussed in this section provides a direct contrast to the Hall-Jorgenson model. One of the interesting features of the Coen model is the role given to the cash flow variable. What is missing in Coen's model is a close link between financial markets and real investment. The liquidity models discussed in the next section provide some indications of the relationship between the two sectors.

II. THE ACCELERATION PRINCIPLE

An early statement on the accelerator principle is to be found in Clark (1917). Clark states that "the demand for enlarging the means of production...varies, not with the demand for the finished production, but rather with the acceleration of that demand." In the simplest form the accelerator principle relates investment to a change in output. Firms have an optimal relation between output and the capital stock. Changes in demand for the firm's output require changes in the capital stock needed to produce the new level of output. Firms are assumed to act immediately and automatically to invest in the new capital goods needed to maintain the optimal capital stock. Algebraically the principle can be written as:

$$K_t = \alpha O_t \qquad (3.23)$$

and,

$$K_{t-1} = \alpha O_{t-1} \qquad (3.24)$$

Thus

$$K_t - K_{t-1} = \alpha (O_t - O_{t-1}) \qquad (3.25)$$

But

$$K_t - K_{t-1} = I^n_t \qquad (3.25a)$$

and

$$I^n_t = \alpha (O_t - O_{t-1}) \qquad (3.26)$$

where

K_t = capital stock in period t

O_t = level of output in period t

α = capital output ratio or the accelerator coefficient

I^n_t = net investment in period t.

Equation (3.26) is the simple accelerator and there are a number of assumptions which underlie this equation: firms combine labour and capital in an optimal manner to produce a level of output; both the capital-output ratio and the labour-output ratio are fixed by the firm;[37] firms experience no shortage of money capital for investment expenditures.

However the simple accelerator is subject to much criticism. One of the most important criticisms is that the existence of excess capacity is ignored. The model assumes that increases in the demand for output lead immediately to additions to existing capacity. The simple accelerator ignores the fact that when demand increases, firms may alter their rates of capacity utilization. The simple accelerator also ignores the existence of possible lags in the investment process. Another criticism is the assumption of an elastic supply of money to firms to finance investment. The assumption is not realistic in the face of imperfections in the capital market. Details of these and other criticisms are to be found in Knox (1952) and Eckaus (1953).

Goodwin (1948), Chenery (1952) and Koyck (1954) present modifications of the simple accelerator. The modifications are designed to deal with criticisms levelled at the simple accelerator. Chenery and Goodwin introduce changes which allow for less than full capacity situations. For example net investment in any period is proportional to the gap between the desired capital stock (the optimum level of capacity) and the actual capital stock. Algebraically:

$$I_t^n = \mu(K_t^* - K_{t-1}) \qquad (3.27)$$

where

K_t^* = desired level of capital stock in period t

μ = a proportion[38]

Substituting $K_t^* = \alpha O_t$ (3.28)

Then

$$I_t^n = \mu(\alpha O_t - K_{t-1}) \qquad (3.29)$$

and

$$\frac{I_t^n}{K_{t-1}} = \mu\left[\frac{\alpha O_t}{K_{t-1}} - 1\right] \qquad (3.29a)$$

Equation (3.27) is known as the stock adjustment model, while the form (3.29a) is considered the capacity principle.[39]

Koyck's approach (1954) takes into account many reasons why the capital stock does not adjust instantaneously to changes in demand.

> ...An immediate full adjustment is neither technically necessary nor considered possible ...from an economic point of view. There may be checks from the side of finance...the high level of output may be expected to be temporary ....Apart from these factors, causing lags between changes in output and decisions to adjust capacity, there is a lag between a decision to expand capacity and the actual enlargement of the productivity capacity of a plant.
>
> --Koyck (1954), p. 68

He assumes that the weights given to past output changes in the determination of investment decline geometrically. Thus the stock of capital can be written as:

$$K_t = \alpha \left\{ \beta \left[O_t + (1-\beta) O_{t-1} + (1-\beta)^2 O_{t-2} + \ldots \right] \right\} \qquad (3.30)$$

where $0 < \beta < 1$.

Making use of the Koyck transformation and other manipulations[40] net investment is written as:

$$I_t^n = \alpha\beta\, O_t + (1-\beta) K_{t-1} - K_{t-1} \qquad (3.31)$$

If one assumes that replacement investment is given by the following:

$$D = \delta\, K_{t-1} \qquad (3.32)$$

where

D = depreciation

δ = rate of depreciation (usually assumed to be constant)[41]

Then gross investment equals:

$$I_t^g = \alpha\beta\ O_t - \beta K_{t-1} + \delta K_{t-1} \tag{3.33}$$

There is a similarity between the flexible accelerator of equation (3.31) and both the stock adjustment principle equation (3.27) and the capacity principle equation (3.29a). Comparisons of equations (3.27) and (3.31) indicate that $\mu = \beta$. Both equations recognize the existence of lags in the investment process and suggest reasons why investment does not expand automatically to changes in its determinants. Evans (1969)[42] provides a detailed discussion of the similarity between the three equations.

Eisner (1960, 1963, 1967) also explains investment behaviour in terms of the flexible accelerator. His theoretical rationale for the use of the accelerator principle is as follows: in a world of risk and uncertainty, firms maximize expected future profits subject to a production function with decreasing marginal returns to each factor of production.[43] A firm in an initial equilibrium position will increase its stock of capital only if increases in the demand for output are expected to be permanent.[44] Changes in the capital stock do not occur automatically: increases in demand may be considered transitory; there may be lags in the decision to invest or in the implementation of the decision; output can be increased without adding to the capital stock. For these reasons Eisner suggests that "we can write the change in the capital stock in one period...(as) the sum of changes induced by output changes of a number of past periods."[45] Essentially this approach is the same as Koyck's which yields the flexible accelerator of equation (3.31).[46]

In his empirical work, Eisner generally works with an investment equation of the form:

$$I_t^g = b_o + \sum_{j=1}^{7} b_j \, \Delta S_{t+1-j} + \sum_{j=8}^{9} b_j \, p_{t+8-j} + b_{10} d_t \qquad (3.34)$$

where

I_t^g = gross investment in period t

ΔS = sales changes

d = depreciation

p = profits

The b_j's are the distributed lag coefficients whose values sum to unity. Eisner uses sales changes as a proxy for changes in output (or demand). He argues that investment occurs in response to the expected future profitability of output because of changes in demand. In the absence of data on expected future values of variables, one must fall back on current and past values of variables. The past values of variables as observations "will be as meaningful and stable as the relations among those past variables and the true arguments of the investment function."[47] Eisner prefers to work with sales data instead of profits data; and in fact the high correlation between sales and profits implies a reduced role for profits in equations such as equation (3.34).[48]

One weakness of the accelerator model is the extent to which financial variables are neglected. For example the model implicitly assumes that available finance is obtainable at fairly low cost.[49] Accelerator and capacity variables cannot provide complete explanations of investment because of this neglect. Financial variables--such as the cost of borrowing, leverage, external borrowing--are of some importance to the investment decision.[50] Financial markets have developed to such an extent that firms have a wide spectrum of financial options open to them. Firms can lease capital equipment, borrow or issue shares to finance investment. Financial assets are much more sophisticated with many attractive features.[51] The methods of finance available to the firm also affect the investment decision. Investment models cannot capture every nuance of particular financial assets. At a minimum however the models should differentiate between internal and external finance. The liquidity models of the next section emphasize the role of finance in the investment decision.

III. LIQUIDITY MODELS

A. Meyer-Kuh and Meyer-Glauber

Liquidity models of investment focus on the flow of funds as a major determinant of investment. Accelerator relationships are less crucial than financial variables for the investment decision in these models. The work of Meyer and Kuh (1957), Duesenberry (1958) and Lintner (1956) form the building blocks of liquidity models of investment.

The Meyer-Kuh study on investment behaviour emphasized the liquidity and profitability positions of individual firms. The financial variables are important for the firm's investment decision in the short run. Over the long run, the accelerator provides a good explanation of the relation.

between changes in output and the capital stock.

Meyer and Kuh build up the analysis from a micro base. Firms maintain an optimal relation between output and available capacity. The typical firm has a reverse L shaped cost curve up to capacity and is faced with a demand curve for its output. Changes in demand disturb the output-capacity relation and firms behave differently depending on a number of factors.

In general firms make short run quantity adjustments rather than instantaneous price adjustments. How firms make their quantity adjustments depend on market structure and their financial options. If firms belong to an industry with low barriers to entry, it is to their advantage to increase output. Failure to do so will permit new entrants to gather the benefits of an increase in demand. In general already established firms will have an edge over newcomers.

Meyer and Kuh also distinguish between the behaviour of tight oligopolies and those that are more competitive. For the more competitive group, with lower profit margins, there is a greater need to obtain external finance for any needed expansion of output.[52] For the tightly organized group, with higher profit margins, the expansion can be financed from internal funds. Even if firms do not make immediate quantity adjustments over the long run they must increase capacity to cope with the higher demand for their output.

In the short run, financial variables are very important for the firm. On the basis of Lintner's hypothesis[53] Meyer and Kuh suggest that once prior claims on funds are met, firms utilise residual funds to finance capital investment. The rate of investment is affected by the finance available. Given the dividend behaviour of firms, the greater the amount of internal funds, the greater the rate of investment.

Duesenberry (1958)[54] focusses on the costs associated with sources of finance and the importance of these costs for the investment decision. The higher costs associated with **external** borrowing explains the preference most firms have for using internally generated funds. The costs of using internally generated funds is an opportunity cost, the opportunity cost of not repaying debt; in terms of a market rate of interest, the cost will be approximately equal to the yield on bonds. As retained earnings rise the opportunity cost increases at first slowly and then more steeply. Duesenberry hypothesizes a positively sloping supply schedule of investment funds. The schedule is positively related to the imputed costs of funds and some sections are steeper than others. For example the curve has a perfectly elastic section which relates to depreciation allowances and retained earnings. As a firm acquires debt the curve rises slowly and then more steeply. However Duesenberry recognises that in some situations the cost of funds variables are less important than accelerator variables.[55] For example in periods of high capacity utilization, the accelerator will determine the rate of investment.

These three strands of theory--the Lintner dividend hypothesis, the Duesenberry cost of funds analysis and the Meyer-Kuh study on the importance of internal finance--are the underpinnings of liquidity models. The models are a (loose) collection of investment models which emphasize financial variables. Of these models[56] only Meyer-Glauber (1964) and Dhrymes and Kurz (1967) are discussed.

In the Meyer-Glauber (1964) model, the determinants of investment are: capacity utilisation, retained earnings (after tax profits less dividends plus depreciation) and changes in the price of common stock (a measure of business confidence). Meyer and Glauber distinguish between two situations--at full capacity and at less than full capacity.

$$I = f_1(C,\ p/ATC,\ D,\ \overline{S}',\ \overline{E}') \qquad (3.35)$$

$$I = f_2(P-V,\ D,\ \overline{S}',\ \overline{E}') \qquad (3.35a)$$

where I = investment

C = measure of capacity

p/ATC = measure of market competition

D = depreciation

$\overline{S}'$ = average increase in sales over a period of time

$\overline{E}'$ = percentage increases in the firm's equity prices

$P-V$ = after tax profits less dividend payments

The two equations characterize investment behaviour over the business cycle. In periods of boom when capacity is fully utilised, investment depends on demand conditions. Financial constraints do not affect investment to the extent that firms will forego investment opportunities because of lack of finance. Equation (3.35) is relevant during periods of booms in activity.

In times of economic downturns, internal sources of funds are sufficient for firms' investment needs. These funds determine the level of investment. The pattern of behaviour is in direct contrast to the boom periods; then the investment decision is taken as given and financing is arranged accordingly. Firms will try to finance their projects at minimum risk; firms may even abandon the traditional reluctance to use outside sources of finance. Meyer and Glauber feel that the asymmetry of finance is an important characteristic of their model.

The two equations also suggest that the accelerator and internal funds determine investment, but at different stages of the business cycle. Meyer and Glauber insist that "no two periods of time have been or are likely to be exactly the same in terms of the weights placed on different determinants of business investment decisions."[57] The Meyer-Glauber model is more flexible than the neoclassical model in this respect. The model easily adapts itself to empirical investigations of investment at different phases of the business cycle.

The earlier Meyer-Kuh (1957) study found sufficient evidence of financial conservatism by firms between 1946-1950 in the United States. Firms were reluctant to use borrowed funds to finance their projects. The financial conservatism continued all through the 1950's.[58] This is one reason why Meyer and Glauber emphasize the role of internal finance. Within recent times, changes have occurred in the relative importance of external and internal sources of finance.[59] There have been changes also in the mix[60] of external finance, as firms consider alternative methods of financing large investment projects.

B. Dhrymes and Kurz

Dhrymes and Kurz (1967) introduce an interesting model of investment, which takes account of different sources of investment capital for the firm. The model's contribution is the recognition that for the individual firm, the decisions to invest, pay dividends and use external finance are mutually determined. Dhrymes and Kurz present a model in which the three decisions are determined simultaneously.

In implicit form the model is as follows:

$$D^V = f_1(I, EF; X_1, X_2, X_3 \ldots X_n) \quad (3.36)$$

$$I = f_2(D^V, EF; X_1, X_2, X_3 \ldots X_n) \quad (3.37)$$

$$EF = f_3(D^V, I; X_1, X_2, X_3 \ldots X_n) \quad (3.38)$$

where

D^V = dividends

I = investment

EF = external finance

$X_1 \ldots X_n$ = predetermined variables which include profits, depreciation, sales, long term debt, leverage.

The Dhrymes-Kurz model is in the spirit of Duesenberry's analysis where investment is determined by the demand for and the supply of investment funds. The origins of the model lie primarily in the following: the basic accelerator-capacity model of investment; the work of Meyer and Kuh and the classic Lintner study of dividend behaviour.[61]

Dhrymes and Kurz argue as follows: a firm faces an outflow of funds composed of production costs, taxes, dividend payments and investment outlays. Inflows consist of sales and the proceeds from stocks or bond sales. The firm has as one of its objectives--growth over time. However, competition between dividend payments and investment spending as well as an imperfect capital market imply the following--investment spending, dividend decisions and external borrowing must be determined simultaneously.

The theoretical base of the investment equation is the accelerator principle (measured here by a sales change variable and the level of profits). The presence of the two jointly dependent variables in equation (3.37) is rationalized as follows: Investment and dividends are competitive forms of expenditure for the firm. Firms weigh new projects, while at the same time they try to maintain a stable dividend policy. Dividends are expected to have a negative impact in equation (3.37). External finance however will be positively related to investment; by gaining access to capital markets, the firm is able to finance its investment program without significant reductions in dividends. The limits placed on external borrowing would be the cost of financing and the need to maintain an optimal debt-equity ratio.

Equation (3.36) the dividend equation describes the behaviour of firms which maintain a steady dividend per share ratio; and firms adjust the ratio only when permanent changes in income take place.[62] Dividends per share depend on the rate of profits, investment and external finance. When investment expenditures are rising relative to net income, the ability to borrow from outside sources allows the firm to maintain its dividend commitments.

Given the other two equations, external finance can be viewed as a budget constraint. External finance is positively related to investment, but negatively related to depreciation, profits and the market rate of interest. Investment expenditures are expected to be the prime determinant of the external finance equation.

The choice of a simultaneous[63] equation model of investment reflects some institutional features in the real world. Decision makers in modern corporations evaluate investment plans and the financing of these plans at the same time.[64] At this stage managers evaluate sources of finance and choose methods appropriate to their particular firm. The Dhrymes-Kurz model is flexible enough to incorporate a mixture of internal and external sources.

IV. A DIGRESSION[65]

Modigliani and Miller (1958) examined the cost of capital and corporation finance under highly specialized assumptions.[66] Modigliani and Miller outlined three propositions which are stated here without proof.

Proposition 1: The average cost of capital to any firm in a given risk class is completely independent of its capital structure and is equal to the capitalization rate of a pure equity stream of its class.

Proposition 2: The expected rate of return on the stock of any company belonging to a given risk class is equal to the appropriate rate of capitalization for a pure equity stream in its risk class.

Proposition 3: The cut off point for investment in the firm will be the capitalization rate for an unlevered stream of income in the risk class to which the firm belongs. [See Modigliani and Miller (1958), pp. 268 <u>et seq</u>]

One implication of the propositions is that for a given investment policy, the market value of the firm is independent of its capital structure. This means that the real decisions of the firm (how much it should invest) and the financial decisions (how it should finance its investment and distribute its revenues) are independent of each other.

One way of looking at the financial structure of a firm is financial leverage--that is the mixture of debt and equity capital of the firm. The "traditional"[67] theory implies that for a given investment policy the cost of capital is a U-shaped function of leverage. The Modigliani-Miller propositions suggest that the cost of capital is a horizontal straight line when plotted against a measure of leverage.

The Modigliani-Miller paper created much controversy.[68]

as theorists pointed out the shortcomings of the analysis. There are at least three ways in which one could criticize the Modigliani-Miller results. First, there are the special assumptions on which the analysis depends; next one can test the empirical validity of the cost of capital propositions; finally the Modigliani-Miller results can be shown to be invalid within their specialized framework.

The special assumptions of the Modigliani-Miller results are not compatible with the behaviour of real capital markets. In reality, capital markets are imperfect, transactions costs cannot be assumed away nor are individuals and firms able to borrow at the same rate. When taxes are introduced into the analysis, the tax deductibility of debt interest makes debt financing advantageous to the firm. Institutional constraints prevent firms from relying totally on this method of finance. Stigilitz and others[69] show that the propositions hold in a world without the possibility of default on loans.

Modigliani and Miller present empirical tests of their propositions, but as Weston (1961) notes their tests are "highly suspect." The propositions rest on the concept of the same risk class for firms, for which very few firms are suited. Empirical tests[70] of proposition 1 present evidence in support of an U-shaped cost of capital curve. And Westen (1961) concludes that a proper rereading of their empirical results yields no evidence to support the horizontal cost of capital schedule. Nickell (1978)[71] has a simple discussion of the factors which determine the slope and position of the cost of capital curve.

Theorists insist that it is not enough to argue that market imperfections disprove the Modigliani-Miller results. One must show that these imperfections in the market are systematic.[72] Instead the perfect-market results must be ~~proved inconsistent within the same specialized framework.~~ Stigilitz (1973; 1976), King (1974, 1977) and extensions by Kollintzas and Rowley (1980b) take this approach. Stigilitz showed that in a world of perfect certainty, the financial decisions of firms are affected by the individual, corporate and capital gains taxes. However Stigilitz outlines the conditions[73] under which real and financial decisions are independent of each other. His results break down when there exists at least one binding constraint on the firm. King corrects Stigilitz's analysis to show that firms are always faced with legal and institutional constraints.[74] Thus financial and real decisions are closely linked to each other. In addition, King shows that there is no optimal debt-equity ratio[75] for the firm, instead there are only "acceptable ratios." Finally Kollintzas and Rowley extend King's analysis to some cases he did not consider. One interesting result from their analysis is that there is no unique expression for the real rental cost of capital. The expression depends on the method of finance which the firm chooses as well as other tax parameters.

The one important fact which emerges from all the studies is the clear theoretical evidence of the integration of real and financial decisions. This position is also taken by Kuh

(1971), Vickers (1968)[76] and Dhrymes and Kurz (1967). However the papers discussed in this section are set firmly in the neoclassical tradition. Future studies on investment must take into account the interdependence of decisions to invest and financial decisions. Chapter Five below contains an investment model which applies the interdependence approach to Canadian data. The model is the Dhrymes-Kurz model and the justification for this model is given in the next chapter.

The King and Kollintzas-Rowley papers demonstrate that the cost of capital expressions are not unique. The cost of capital variable plays different roles in models of investment behaviour. In Jorgenson's model, the cost of capital has a dual role; it is a discount rate applied to future income streams as well as a component of the user cost of capital. The cost of capital variable enters directly into the user cost (or implicit rental price) of capital. By incorporating the cost of capital variable into the implicit rental price, Jorgenson places little emphasis on financial factors.[77] In his empirical work, Jorgenson uses many measures of the cost of capital. The measures range from the long term rate on government bonds to an after tax rate of return.[78] Kollintzas and Rowley (1980b) show that there are no unique expressions for this variable--instead the variable must take account of all sources of finance. Any future work which follows the Hall-Jorgenson approach must incorporate these amendments.

In contrast to Jorgenson for example Resek (1966) employs the cost of debt and equity capital in his model of investment.

In the model, the cost of capital is a direct determinant of investment expenditure. There is no direct link between the cost of capital funds and a rate to discount future income streams.[79]

Recent studies[80] compare trends in the cost of capital with trends in the after tax rates of return. Despite conceptual difficulties,[81] the studies yield measures of relative profitability which determine incentives for firms to invest. These studies take a market value approach to investment which is essentially Tobin's[82] q ratio approach. The "q" ratio is defined as the ratio of the market value of installed capital to the replacement cost of capital. Investment is positively related to q--firms invest when the market values new capital highly relative to their replacement cost. The q ratio (also known as the valuation ratio) has an equilibrium value of 1. Deviations from the ratio are possible; an individual industry's q may be greater than 1, while an average for the economy is less than 1.

These recent studies do not employ the valuation ratio directly in models of investment. Instead the ratios are examined closely to provide evidence in support of declining (or increasing) incentives to invest. There are some measurement problems in calculating the valuation ratio especially when inflation is taken into account. Once the difficulties are dealt with the market value approach[83] will provide another way of linking financial markets and real investment.

This digression serves the useful purpose of an introduction to the finance and valuation aspects of investment behaviour. The role of capital markets and the importance of financial factors in the investment decision must be emphasized. The questions raised by the Modigliani-Miller controversy are relevant because their answers provide additional support for the use of simultaneous equation models of investment.

V. SUMMARY

Chapter Three reviewed three theories of investment behaviour--the neoclassical, flexible accelerator and liquidity theories. The neoclassical theory emphasizes the role of relative prices in the determination of investment behaviour; Eisner's version of the flexible accelerator stresses the importance of expected sales and the liquidity theories the rôle of finance.

The neoclassical model of investment was criticized because of the problems which arise with many of its assumptions. Despite these theoretical problems the neoclassical approach has been employed in many empirical studies. The non neoclassical theories are seen as essentially complementary and not competing theories of investment. Finally the simultaneous equation model is chosen to be used for further analysis in Canadian manufacturing.

FOOTNOTES

[1]Other reviews can be found in Eisner and Strotz (1963); Evans (1969); Bridge (1971); Jorgenson (1971); Rowley and Trivedi (1975); Lund (1976) and Helliwell (1976). Each of these reviews concentrates on different aspects of investment e.g. Helliwell (1976) clarifies many theoretical issues while Evans (1969) stresses the empirical results.

[2]Jorgenson (1963) gives a concise statement of the modern neoclassical theory of investment. In other papers Jorgenson (1965, 1967) and associates (Jorgenson and Siebert, 1968a; Jorgenson and Stephenson, 1969) provide further elaborations of the theory. The discussion which follows draws on all of the papers.

[3]Jorgenson defines the level of durable input (I) interchangeably as investment in durable goods (Jorgenson, 1967); rate of investment (Jorgenson, 1963); investment in capital stock (Jorgenson, 1965). Jorgenson uses investment here in a special sense.

[4]Jorgenson uses "K" to represent both the capital stock and the services of the capital stock. The use of "K" for the services of the capital stock is justified as follows: capital stock is multiplied by a factor which represents the rate of service per period of time. In equation (3.3) above the factor is normalized at unity. See Jorgenson (1965), p. 44.

[5]The maximisation of net worth is a problem in the calculus of variations. The function "L" to be maximised is assumed to be twice differentiable, but only first order conditions are stated.

$$L = \int_0^{\infty} \left[e^{-rt}R(t) + \lambda_1(t)F(Q, L, K) + \lambda_2(t)\left\{ \dot{K} - I + \delta K \right\} \right] dt$$

$$= \int_0^{\infty} f(t)\,dt$$

where $f(t) = e^{-rt}R(t) + \lambda_1(t)F(Q, L, K) + \lambda_2(t)\left\{ \dot{K} - I + \delta K \right\}$

and λ_1 and λ_2 are the Lagrangian multipliers.

[6]The user cost of capital services must contain elements to account for: physical deterioration of the durable good over its lifetime (δ); the opportunity cost of tying up financial capital in durable goods (rq); expected capital gains ($\dot{q}$); other institutional features which can affect the user cost of capital are: changes in depreciation policy or changes in corporate taxation. See equation (3.16b) below for example.

[7]See also Jorgenson and Siebert (1968b): "We take the level of capital determined by the maximisation of the market value of the firm as the desired level." p. 1124.

[8]See Jorgenson (1965), p. 42.

[9]See Jorgenson (1965), pp. 47-50 for the rationale which underlies the distributed lag formulation.

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[10]The assumption (that replacement investment is a constant proportion of the capital stock) is justified by an appeal to renewal theory. See Jorgenson (1974). Also Jorgenson (1965). "It is a fundamental result of renewal theory that the distribution of replacements for such an infinite stream approaches a constant fraction of capital stock for (almost) any distribution of replacements over time and for any initial age distribution of capital stock. This result holds for a constant stock and for a growing stock as well." p. 51.

[11]Jorgenson uses the general Pascal distributed lag function. See D.W. Jorgenson, "Rational Distributed Lag Functions," Econometrica, vol. 32, no. 1, 1966, pp. 135-148. This family of distributed lags has a number of interesting characteristics. One characteristic is: for any arbitrarily chosen distributed lag, one can obtain a good approximation by a member of the general Pascal functions.

[12]Hall and Jorgenson (1967), p. 404. This is the usual result obtained from short period neoclassical theory of tax incidence.

[13]With the introduction of direct taxes only the marginal product of capital is affected. Hence,

$$\frac{\partial Q}{\partial K} = \frac{q\left[\frac{1-uv}{1-u}\delta + \frac{1-uw}{1-u}r - \frac{1-ux}{1-u}\frac{\dot{q}}{q}\right]}{p}$$

[14]Coen (1969) shows equation (3.16) to be a special case of the user cost of capital. Equation (3.16) holds true if and only if: (1) the depreciation formula is of the declining balance form, with the depreciation rate equal to the economic rate of depreciation; (2) policymakers stipulate that the depreciable base of new investments must be a proportion "v" of the cost. If one ignores ($\dot{q}$) capital gains, and interest deductions related to the cost of capital, C^T becomes:

$$C^T = \frac{q(r + \delta)(1 - uZ)}{1-u} \qquad (3.16a)$$

where Z = present value of depreciation deductions allowed for tax purposes.

If tax credits are allowed on new investment

$$C^T = q(r + \delta)\left\{\frac{(1 - k)(1 - uZ)}{1-u}\right\} \qquad (3.16b)$$

where k is the rate of the tax credit. In (3.16b) the tax credit is deducted from allowable depreciation. If the tax credit is not deducted:

$$C^T = \frac{q(r + \delta)(1 - k - uZ)}{1-u} \qquad (3.16c)$$

[15]Using 3.16a and 3.16b of footnote 14 above, a fall in C^T can occur because of: a reduction in the corporate tax rate; more liberal depreciation policies or the introduction of a tax credit. See Hall and Jorgenson (1971) for different variations of these changes. However Sumner (1973a; 1973b) has argued that there is a possibility of a "perverse" result when the tax rate changes. That is, a rise in the corporate tax rate may lower the implicit rental cost of capital. The results depend on the sign of $\frac{\partial C^T}{\partial u}$. Sumner shows that under certain circumstances $\frac{\partial C^T}{\partial u} < 0$, if as Hall and Jorgenson assume $\frac{\partial r}{\partial t} = 0$. Sumner (1973b) illustrates that the "perverse" result occurred in the United Kingdom on one occasion. Using 3.16c above Sumner shows that:

$$\frac{\partial C^T}{\partial u} = \frac{q}{(1-u)^2}\left[(r + \delta)(1 - k - Z)\right] < 0$$

if $k + Z > 1$. See also Break (1974), pp. 209-211. The above discussion is a short excursion into the subject of tax neutrality.

[16]"...our procedure is to calculate the rental price of capital on the assumption that the change in policy did not take place. We then calculate the changes in desired capital and investment for the resulting rental price of capital. Desired capital and investment depend on the parameters of the investment function; in our calculations, these parameters are replaced by the estimates." Hall and Jorgenson (1967), p. 404.

[17]One general criticism of the Hall and Jorgenson approach (and other studies which measure the impact of tax incentives) is that researchers measure the shift of an investment demand curve and not net changes in investment. Net changes in investment depend on the supply of investment funds as well as the demand for investment. See Harberger (1971) for a discussion of these issues.

[18]See for example: C.E. Ferguson and J.P. Gould, Microeconomic Theory, Richard Irwin, Inc., 4th edition, 1975, chapter 6.

[19]Coen (1969) presents an interesting discussion on the exogeneity and endogeneity of Q in equation (3.11). Coen is correct in stating that in a profit maximising world, firms determine "Q" and "K*" jointly. See also J. Gould, "The Use of Endogenous Variables in Dynamic Models of Investment," Quarterly Journal of Economics, vol. 83, Nov. 1969, pp. 580-599. Note that Brechling (1975) considers the criticisms by (Coen and Gould) to be far more "devastating" than any of the other criticisms. Indeed too much attention has been paid to the problems inherent in the choice of a Cobb-Douglas production function, and not enough on the question of endogenous variables.

[20]Hall and Jorgenson choose the Cobb-Douglas production function because of its useful properties: constant returns to scale; an elasticity of substitution equal to one. Under assumptions of perfect competition and marginal productivity Hall and Jorgenson obtain a demand equation whose elasticity equals one. That is in equation (3.11)

$$K^* = \alpha \frac{pQ}{C}$$

the elasticity of the capital stock with respect to "Q" and "p/C" is assumed to be unity. The choice of the Cobb-Douglas production function and the results which flow from the choice created much controversy. See Eisner and Nadiri (1968; 1970); Coen (1969) and Jorgenson and Stephenson (1969). Coen (1969) and Rowley (1970) suggest the use of the more general C.E.S. production function. Rowley argues that the use of th Cobb-Douglas function exaggerates the importance of relative prices.

[21]Hall and Jorgenson cite only those production studies which support their claim of an unitary elasticity of substitution. Nerlove (1967) reports diverse evidence from studies on the elasticity of substitution. There is no conclusive evidence to support the assumption that the elasticity of substitution in a production function is unity. Eisner and Nadiri (1968) used Jorgenson's data for the United States manufacturing sector and estimated the elasticities under different assumptions. The best fit obtained yielded elasticities of the capital stock with respect to output and relative prices of 0.8158 and 0.1576 respectively. [See Table 2 of Eisner and Nadiri (1968)]

[22]Coen (1969); Eisner (1969); Eisner and Nadiri (1968). In a related way Thurow (1969) casts doubt on the role of the "C/p" variable. Thurow's paper is interesting because he examines the neoclassical investment function in a disequilibrium world. The disequilibrium arises because the cost of capital diverges from the marginal product of capital. [In terms of the equations above for eq (3.6)

$$\frac{\partial Q}{\partial K} \neq \frac{C}{p}].$$

In a disequilibrium world firms invest to eliminate the divergence between $\frac{\partial Q}{\partial K}$ and C/p. Thurow fits the disequilibrium investment function to data for the United States. He finds that "as in the Jorgenson investment function,..., the cost of capital variable is receiving a free ride....In Jorgenson's model the accelerator carries the cost of capital and in the disequilibrium model profitability carries it." p. 433. In short, when the Jorgenson neoclassical model of investment is stripped to its bare essentials, the model is no more than a crude accelerator.

[23]See Feldstein and Flemming (1971) who show the importance of allowing variations in the components of the "C/p" variables.

[24]At the level of the individual firm, the multiplier effects can be ignored.

[25]See Harberger (1971), esp. pp. 264-267.

[26]The assumption is needed for a derivation of net investment and as a part of the formula for the implicit rental cost of capital. Jorgenson claims that the proportionality hypothesis is internally consistent and requires a measure of exponential decay of capital goods. Recently, Kollintzas and Rowley (1980a) have shown that the assumption is not necessary for the derivation of net investment nor the implicit rental cost of capital.

[27]See Feldstein and Foot (1971); Eisner (1972); also Feldstein and Rothschild (1974) for an important theoretical discussion of Jorgenson's replacement investment function.

[28]There is a wider dimension to the problem of lags in the neoclassical model of investment. Nerlove (1972) argues that Jorgenson correctly recognises the role of lags in the investment process, but he superimposes them on a static theory.
In the model described above, the marginal conditions obtained in equations (3.6) and (3.7), represent a comparative static equilibrium position. In a dynamic world, firms are not able to adjust instantaneously to their desired capital stock; there are usually constraints during the adjustment process. Jorgenson adds the constraints after deriving equation (3.7), but the constraints should have been added into the profit maximisation procedure. Gould and Waud (1973) characterize this approach as a mixture of "optimality conditions from comparative statics with what in optimal in a dynamic setting.", p. 33. Later writers have attempted to introduce adjustment costs explicitly into their models. See for example B. Treadway, "On Rational Entrepreneurial Behaviour and the Demand for Investment," Review of Economic Studies, vol. 36, 1969, pp. 227-259 and R. Lucas, "Optimal Investment Policy and the Flexible Accelerator," International Economic Review, vol. 8, 1967, pp. 78-85.

[29] Some aspects of the role of financial variables in the neoclassical model of investment are dealt with in Section IV below.

[30] In a strict sense, Coen's model of investment belongs to the discussion of accelerator and related models. However Coen's model includes elements common to the basic neoclassical model of investment. One such element is the user cost of capital variable. Coen derives the term using an incremental approach, while Jorgenson derives the expression using optimization techniques.

[31] See Goode (1955) for an excellent discussion of these effects.

[32] See equation (3.27) below. In Coen's approach the speed of adjustment depends on financial factors. Other sources of adjustment costs are: supply constraints; changes in labour conditions. See Brechling (1975), Chp. IV for a discussion of the firm with adjustment costs.

[33] Cash flows are defined as after tax profits plus depreciation charges for tax purposes.

[34] In Jorgenson's model, the price of labour does not affect the desired capital stock.

[35] Although Coen derives his "C" in a different manner the "C" is equivalent to some versions of Jorgenson's.

[36] Hall and Jorgenson (1969) suggest that these questions belong to a general equilibrium model. They are mainly concerned with partial equilibrium analysis.

[37] In some instances the accelerator model is referred to as a fixed factor proportions model, compared to the neoclassical model of investment in which factor proportions are variable.

[38] If $\mu = 1$, equation (3.27) yields the same results as the simple accelerator. Chenery (1952) finds that there is a close correlation between the rate of growth of an industry and the value of μ. The rapidly growing industries have high values of μ (e.g. 0.9 for public utilities is his sample).

[39] If K_t is measured in terms of capacity i.e., normal operating capacity, (but not necessarily maximum capacity obtainable) then equation (3.29a) relates percentage changes in capacity to a measure of capacity utilization. Chenery fits an equation of the form of (3.29a) to a number of industries for which capacity has a meaningful definition.

[40] To obtain the Koyck transformation equation (3.30) is lagged for one period.

$$K_{t-1} = \alpha \left\{ \beta \left[O_{t-1} + (1-\beta) O_{t-2} + (1-\beta)^2 O_{t-3} + \ldots \right] \right\} \quad (3.30a)$$

Multiply (3.30a) by $(1 - \beta)$

$$(1-\beta)(K_{t-1}) = \alpha\beta \left[(1-\beta) O_{t-1} + (1-\beta)^2 O_{t-2} + (1-\beta)^3 O_{t-3} + \ldots \right] \quad (3.30b)$$

Subtracting (3.30) - (3.30b)

$$K_t - (1-\beta) K_{t-1} = \alpha\beta\, O_t$$

or

$$K_t = \alpha\beta\, O_t + (1-\beta) K_{t-1}$$

and

$$I_t^n = \alpha\beta\, O_t + (1-\beta) K_{t-1} - K_{t-1} \quad (3.31)$$

Since

$$I_t^n = K_t - K_{t-1} \text{ from (3.25a).}$$

Hence

$$I_t^n = \alpha\beta\, O_t - \beta K_{t-1} \quad (3.31a)$$

[41]The assumption is the same as the proportionality hypothesis discussed above.

[42]See Evans (1969), pp. 84-86. Earlier Eckaus (1953) also pointed out the similarity between various forms of the accelerator principle.

[43]The statement above closely follows Eisner (1960); Eisner (1978), pp. 4-5 sets out a formal statement of the theoretical rationale for his use of the flexible accelerator. In this statement he adds another constraint to the maximisation process--that is the costs of obtaining useful information and adjustment costs. There are no inconsistencies between the two approaches; the factors which prevent instantaneous adjustment--e.g. costs of planning, supply constraints --fall into the general category of adjustment costs. See Eisner and Strotz (1963).

[44]Eisner (1958), "The Permanent Income Hypothesis: Comment," American Economic Review, vol. 48 (December), pp.

972-990 noted the mathematical similarity between the flexible accelerator and Friedman's permanent income hypothesis. Eisner (1967) discusses the theoretical similarities of the two approaches. A priori, one cannot say how long is "permanent;" firms may need for a year to 18 months before they decide changes in demand are not temporary.

45 Eisner (1960), p. 6.

46 Equation (3.31) is the flexible accelerator written in the form suggested by Koyck. For estimation purposes, equation (3.31) is preferred because there are not many coefficients to be estimated. For if we substitute for k_{t-1} into (3.31) there will be a number of coefficients of the form $(1-\beta)^3$, $(1-\beta)^4$ and so on. The estimation of these coefficients introduces many problems.

47 Eisner (1967), p. 364. Esiner recognises that the use of proxy variables for expected future values could lead to errors or mispecifications. He has done extensive work using sales expectations and realizations data from the annual McGraw Hill capital expenditure surveys in the United States. In some instances he incorporates the data into his investment equations. See Eisner (1978), Chps. 2 and 7 for example.

48 Unlike Eisner, Meyer and Kuh (1957) find a significant role for profits in the investment decision. But as Kuh (1963) notes, if manufacturing firms use markup prices, profits and sales have a linear relation. Hence one would not be able to distinguish easily between profits and sales formulations of the accelerator.

49 Eisner recognises the importance of financial variables but he insists that movements of investment demand are dominated by changes in final demand. See Eisner (1978), p. 13: "I accept in principle the role of relative prices and factor costs in determining desired capital stock and hence in influencing the rate of investment. At the same time, I view this role as decidedly less significant empirically in business investment than that of expected demand, sales and output."

[50] Lintner (1967) suggests that even in a world of perfect certainty, one needs to look beyond the accelerator type model. "To rely on unaugmented accelerator-type models as an empirically adequate representation of real investment behaviour would be to act upon a presumption that changes in the financial markets...are uniformly ignored by all business decision-makers." Lintner (1967), pp. 219-220.

[51] See Gratton (1979) for recent trends in Canada.

[52] Meyer and Kuh assume that firms know their demand curve and distinguish large shifts in demand: "where the marginal efficiency of capital could become so high that the firm will go to outside sources in order to finance the highly profitable investment opportunities." p. 203. In contrast Eisner considers "permanent" changes in demand. Some time must elapse before firms recognise that the increases in demand for their output are not temporary. There are no detailed discussions about what period of time constitutes the "short run" or the long run; but one may take the short run to be a period of at least three months to a year, and the long run three to four years.

[53] Lintner (1956) hypothesizes that firms follow a stable dividend policy. Firms use "target" payout ratios of dividends to current earnings, which would be paid annually if earnings remained relatively constant. An adjustment factor allows for changes in dividends towards a new target ratio in the face of higher current earnings. Once the dividend decision is taken, other decisions such as the financing and investment decisions follow. Lintner's model is closely connected to the Dhrymes-Kurz model discussed below.

[54] See Duesenberry (1958) especially Chapter Five.

[55] Distinctions between financial and other variables become hazy at times--especially when one considers that finance is needed ultimately to transform investment plans into actual physical capital.

[56] Some of the other models not considered are: R. Resek, "Investment by Manufacturing Firms: A Quarterly Time Series Analysis of Industry Data," Review of Economics and Statistics, vol. 48, no. 3, August 1966, pp. 322-333; M. Evans, "A Study of Industry Investment Decisions," Review of Economics and Statistics, vol. 49, no. 2, May 1967, pp. 151-164; W.H.L. Anderson, "Business Fixed Investment: A Marriage of Fact and Fantasy," in R. Ferber (ed.), Determinants of Investment Behaviour, Columbia University Press, New York, 1967.

[57] Meyer and Glabuer (1964), p. 250. See also the quotation from Eisner and Strotz (1963) reproduced on p. 93.

[58] Lintner (1959) discusses the financing of the modern corporation.

[59]Harkins and Walsh (1968) present evidence for firms in the United States manufacturing sector. Sullivan (1974) contains a description of different methods of finance used by Canadian firms. Sullivan's article is descriptive rather than statistical in nature. Data from Corporation Financial Statistics (Statistics Canada, Cat.: 61-207) provide an indication of changing trends. For example, between 1965 and 1975, the ratio of equity to capital employed in the manufacturing sector has fallen steadily from 72% to 65%; the ratio of net long term debt to capital employed has grown from 13% to 17%. See also Gratton (1979) and "Recent Trends in Term Financing in Canada," Economic Review, vol. IX, no. 3, May-June 1979, The Provincial Bank of Canada. For another interesting approach see Meir Tamari, Some International Comparisons of Industrial Financing: A Study of Company Accounts in the U.K., U.S.A., Japan and Israel, Technicopy Ltd., England, 1977.

[60]Leasing as a method of financing investment has grown quite a great deal. The 1972 Canadian Federal Budget recognized the growing trend towards leasing capital equipment. The budget allowed assets which were leased to be eligible for capital cost allowances. In 1976, because of abuses of the system, the favourable treatment was modified. New regulations limit capital cost allowances on the leasing of moveable property to income earned from leasing. See M. Miller and C. Upton, "Leasing, Buying and the Cost of Capital Services," Journal of Finance, vol. 31, no. 3, June 1976, pp. 761-786, for a theoretical discussion of the lease-buy decision.

[61]See footnote (53) above. The concept of a target payout ratio with an adjustment factor for higher earnings is expressed algebraically:

$$\Delta D_t = a + c\,(rP_t - D_{t-1}) + u_t$$

where

ΔD_t = dividends of the current year minus dividends of the previous year

P_t = current after tax profits in period t

c = speed of adjustment coefficient

r = target payout ratio

a = constant term*

u_t = random error

*The constant "a" is not consistent with Lintner's view of a stable dividend payout ratio. For if $D_{t-1} = rP_t$ then

$\Delta D_t = a$ if $a \neq 0$.* Lintner notes that the constant "a" will be zero for some firms; and in general if $a > 0$ it reflects the greater reluctance of firms to reduce than to raise dividends. When the dividend model is fitted to empirical data, traditional tests of significance will indicate whether the "a" term is large relative to its standard error.

[62] Dhrymes and Kurz view dividend behaviour slightly differently from Lintner. They view investment and dividend outlays as competitive. In the short run at least, Lintner sees "cash dividend payments...a top priority claim on funds." Lintner (1967), p. 229. For another contrasting view see Modigliani and Miller (1958). Their position is discussed in the next section.

[63] Kuh (1971) takes a similar position but he prefers to estimate the three equations as single ones, not as part of a system.

[64] A careful perusal of the Annual Reports of most corporations provides considerable evidence to support this point.

[65] For purposes of brevity, the following discussion does not include any proofs. Detailed proofs can be found in the original articles: Modigliani and Miller (1958; 1963). See also King (1977) and Nickell (1978), esp. Chps. 8 and 9.

[66] The special assumptions are: perfect capital markets; no taxes; no transactions costs; individuals and firms are free to borrow and lend at the same rate; no bankruptcy; static expectations.

[67] For an exposition of the "traditional" view see Durand (1952). See also Weston (1961) and Lintner (1962) for a discussion of some of the issues.

[68] See the readings in Archer and D'Ambrosio (1967) for an introduction to the original Modigliani-Miller articles and other participants in the debate. Also Solomon (1959).

[69] See Stigilitz (1972); Baron (1974, 1976); Smith (1970; 1972); Hagen (1976). These studies set out the special conditions under which the Modigliani-Miller theorem is valid.

[70] See also Davenport (1971) and Glyn (1973).

[71] See especially pp. 184-185 and pp. 212-214.

[72] See Nickell (1978), p. 167 where he insists that capital markets are inherently imperfect. He believes that the concept of perfection of capital markets in an uncertain world leads to absurdity.

[73] See Stigilitz (1969) in particular.

[74] For example firms must face the legal consequences of bankruptcy hence they cannot issue debt ad infinitum.

[75] See King (1977), pp. 152-161.

[76] Vickers (1968) as well as Vickers (1970). Vickers builds on the early work of Lange (1936) on the place of money capital in the theory of production. Traditionally micro-production theory is concerned with output and ignores factor prices, questions of capital investment and financing. In Vickers' approach firms maximize a profit function subject to a "money capital availability constraint." The maximization process determines optimum values of production, capital investment and finance. (Note that money is a constraint and not an input in the production function and consists of either debt or equity capital.)

[77] The procedure is consistent with the Modigliani-Miller approach which Jorgenson adopts. See Jorgenson and Siebert (1968b), p. 1124.

[78] See Jorgenson and Stephenson (1967). The cost of capital is defined as the ratio of corporate profits after tax and net monetary interest to the value of all outstanding securities. The outstanding securities consist of debt and equity capital.

[79] In Lintner (1967) the cost of capital variable is measured by the difference between retained earnings and long term debt as a ratio of the total value of the firm. The numerator reflects the fact that firms may use retentions to retain debt. Anderson (1964) and Dhrymus and Kurz (1967) have measures of short term liquidity as a determinant of investment.

[80] The United States: H. Liebling, U.S. Corporate Profitability and Capital Formation: Are Rates of Return Sufficient? Pergamon Press, 1980 and the references cited therein. The United Kingdom: "The Cost of Capital, Finance and Investment," Quarterly Bulletin of the Bank of England, vol. 16, no. 2, June 1976, pp. 193-205. Canada: Department of Finance, Rates of Return and Investment Profitability, Ottawa, April 1980.

[81] See for example Quarterly Bulletin of the Bank of England, op. cit., pp. 203-205.

[82] Tobin (1961, 1969); Brainard and Tobin (1968). See also Helliwell et al (1973) for a related approach.

[83] For a recent empirical application of the q-theory approach, see Tobin and Brainard (1977). Grunfeld (1960) uses a market value approach, but in his model the market value of the firm is a proxy for expected future profits.

CHAPTER FOUR

THE CHOICE OF AN INVESTMENT MODEL AND CANADIAN STUDIES OF INVESTMENT

I. INTRODUCTION

In the previous chapter we presented a concise review of the main theories of investment behaviour. These theories have formed the basis for empirical studies of investment and tax incentive policy.[1] The neoclassical theory of investment has been applied most frequently in empirical studies; in contrast the flexible accelerator and liquidity theories have limited appeal for most researchers.

For the most part the empirical studies of investment behaviour fall into two categories. At the one extreme are the studies which may be characterized as "conclusion-oriented."[2] In this method of approach, researchers have a specific policy conclusion in view and their quantitative research is directed towards obtaining support for the objective.[3] At the other extreme are the highly sophisticated models which are designed primarily to introduce new econometric techniques.[4] Given these two extremes there is a need for different types of quantitative studies.

Recent criticism[5] has focussed directly and indirectly on the gaps to be found in quantitative research on tax policy. It is possible to isolate one persistent theme in the criticisms of current research. There are repeated suggestions for more disaggregated studies on investment and tax policy. The call for more sector studies is especially valid because tax policy changes are directed increasingly towards very narrowly defined sectors.[6]

There are some advantages which arise from studies of narrowly defined industry groups. The knowledge gained from these studies is more than can be gained from those which deal with broad manufacturing aggregates. The studies can concentrate on a complete analysis of the group of firms and the way in which incentives affect the group of firms. Finally, while the results of sector studies may not be easily applied to total manufacturing, they may serve as a reliable guide to future tax policy.

Our aim in this thesis is to fill part of the gap between the two types of studies mentioned above. We elect, therefore, to analyse two subsectors of Canadian manufacturing and to determine some of the effects of tax incentive policy on the sectors. The sectors chosen are iron and steel and pulp and paper. In our choice of a model of investment, we have not been guided solely by theoretical considerations; we have allowed past experience of the industry as well as institutional features in the Canadian economy to determine the choice.

The rest of the chapter is devoted to a review of two Canadian studies of investment behaviour and a more formal statement on the choice of the investment model. The chapter closes with a description of one of the manufacturing industries analysed in Chapter Five.

II. CANADIAN STUDIES

Canadian econometric studies on investment behaviour and tax incentives follow the general trend and use one variant or another of the neoclassical model of investment. This section looks briefly at two of these studies[7]--McFetridge and May (1976) and Harman (1977).

McFetridge and May (1976) make adjustments[8] to the basic neoclassical model of investment and apply the model to Canadian data. They discard the assumption of a particular industrial structure (perfect competition); and they assume that firms minimize costs subject to an output constraint. When firms minimize costs the marginal conditions explicitly include a component for labour services.[9] Despite the adjustments the model retains the fundamental elements of the neoclassical model and the results obtained reflect this fact. For the 1951-1955 period, the researchers find that tax incentives and policies took a longer time to work than the authorities anticipated--"our model indicated that no effect will be felt for the fiscal year of the measure and that the modal impact occurs in the third year."[10] This result is characteristic of each incentive policy which McFetridge and May ~~examine~~ for the postwar period.

Harman (1977) rejects the neoclassical approach of Hall and Jorgenson as an unsatisfactory framework for the evaluation of Canadian incentive policies. One reason for the rejection is the long run nature of the neoclassical investment model, while tax incentive policy in Canada is essentially of a short run nature. Harman prefers to work with the Coen model.[11] The Harman study examines cash flow and timing effects of Canadian policies. There is also a discussion of the cost of tax incentive policy, a subject not treated in the McFetridge-May paper.

For each major tax incentive, Harman discusses the program with reference to: changes in implicit rental prices, revenue changes and timing effects. Three timing effects are distinguished--a general timing effect, a time constraint effect and a termination date timing effect.[12] The distinctions are interesting in theory, but in practice are more difficult to capture separately. Evidence presented in Chapter Two (in the discussion of the policymakers' model. See pp. 28 to 30 above) suggests that firms do not immediately react to tax policy changes. Firms must wait until official Regulations and Interpretation Bulletins are published to ascertain their eligibility for tax concessions. The period between the announcement of a tax policy change and publication of the Regulations is one of uncertainty. Therefore it is not surprising that McFetridge and May find induced investment occurs with a three year lag. And Harman is not quite correct when he criticizes the findings and consider them a direct result of the use of distributed lag models.[13]

If tax incentives are to alter significantly the time path of investment, the incentives must not be subject to uncertainty. Prior to 1974, there were no guarantees that an incentive would not be suspended before its original expiry date.[14] What is more important is the state of firms' expectations about future demand. Firms will be more induced to install new capacity if future expectations are buoyant rather than to take advantage of small tax savings.[15]

Harman's results on the cash flow effect are not unexpected, because of the small tax savings. Harman finds that investment expenditures were about 1% higher as a result of the increased cash flows of firms after the 1972 tax changes. Some of the reasons cited for the limited success of tax incentives are: the difference between the tax definition of an eligible asset and the traditional definition which form the basis of data collection; eligible assets are a small proportion of total assets; firms may not have enough taxable income.

Harman is very successful when he matches the costs of tax incentives with the increased investment arising from the incentives.[16] For example the 1972 tax changes are estimated to have generated $313.4m. in new investment. The policy cost the Federal Government an estimated $568.5m. in revenues foregone. These figures cast serious doubt on the efficiency of tax incentives and underline the need for tax expenditure budgets. The first official estimates of Canadian tax expenditures were published in December 1979.[17] The estimates have stimulated much discussion[18] and are considered in more detail in Chapter Six.

The Harman study is an interesting alternative to the Hall-Jorgenson approach to measuring tax incentive policy. The study highlights the importance of the cash flow effect in determining the speed of adjustment. In contrast to previous studies, Harman is one of the first to apply a type of benefit-cost analysis to tax incentive policy.[19]

III. THE CHOICE OF AN INVESTMENT MODEL

A properly specified investment model is a necessary prerequisite[20] for an evaluation of tax incentives. In the previous chapter, we reviewed the neoclassical and non neoclassical models of investment. The neoclassical model of investment was criticised because of the problems related to the inner workings of the model. Briefly the problems were: the choice of a Cobb-Douglas production function and the convenient results which follow the choice; the treatment of replacement investment; the assumption that output is exogenous to the model. The theoretical problems are concerned with the internal consistency of the neoclassical model. One can also criticise the neoclassical model outside its own framework. The model relies on assumptions of perfect foresight,[21] perfect competition and perfect capital markets. The assumptions are unrealistic when applied to Canadian and other economies.[22] On theoretical and on empirical grounds, the neoclassical model is rejected as inappropriate for explaining investment behaviour in Canada.

In general two features distinguish the neoclassical and non neoclassical models of investment. The non neoclassical models--the accelerator and liquidity models--identify different variables as determinants of investment; and the link with tax policy is not as clearly defined as in the neoclassical model. Eisner's version of the flexible accelerator suggests that the appropriate tax incentive policy would be to stimulate the demand for output produced by the capital using industries. In one version of the liquidity models--Meyer and Glauber recommend tax policies to change over the business cycle; tax incentives that would increase consumer demand in the early stages of cyclical upturns and a reduction in corporate taxes early in the downturns in order to increase cash flows.

The non neoclassical models of investment examined here are complementary and not competing theories of investment. The flexible accelerator examines investment in terms of real factors, for Eisner believes that sales variables are a good proxy for expected output. The liquidity models stress the role of financial factors which affect the investment decision. The Dhrymes-Kurz model provides an appropriate framework for investigating investment behaviour in an economy.

The Dhrymes-Kurz model provides the basis for our examination of the effects of tax incentives on investment in Canada. The three main reasons for choosing the model are the following: first, the model highlights the interdependent nature of investment, dividend payments and financing decisions. The mutual determination of the three decisions is an attempt to integrate the theory of investment with the theory of business finance. This approach is more realistic than the approach of the neoclassical model of investment. In the neoclassical model of investment, the role of finance is compressed into the implicit rental cost of capital variable.

A second reason for the choice of the Dhrymes-Kurz model is the attention paid to different sources of finance. Within recent times, firms have had a wide spectrum of financial choices available to them and they utilise the different choices. The present position is in direct contrast to that in the immediate postwar decade. For example Dhrymes and Kurz's econometric study found evidence of the reluctance of firms to borrow externally. Despite its popularity and sophistication the Jorgenson neoclassical model cannot handle the different financial arrangements found in the real world.[23]

Finally the Dhrymes-Kurz model and other non neoclassical models are essentially more flexible in approach than the neoclassical model of investment. The flexibility is due in part to differences[24] between the methods of theorizing. The non neoclassical models of investment have a closer connection to behaviour in the real world. For these theorists:

> the theory of investment is a living and developing thing, and we have learned as a methodological principle to welcome the feedback of empirical studies on the theory to be promoted.
>
> --Eisner and Strotz (1963), p. 61

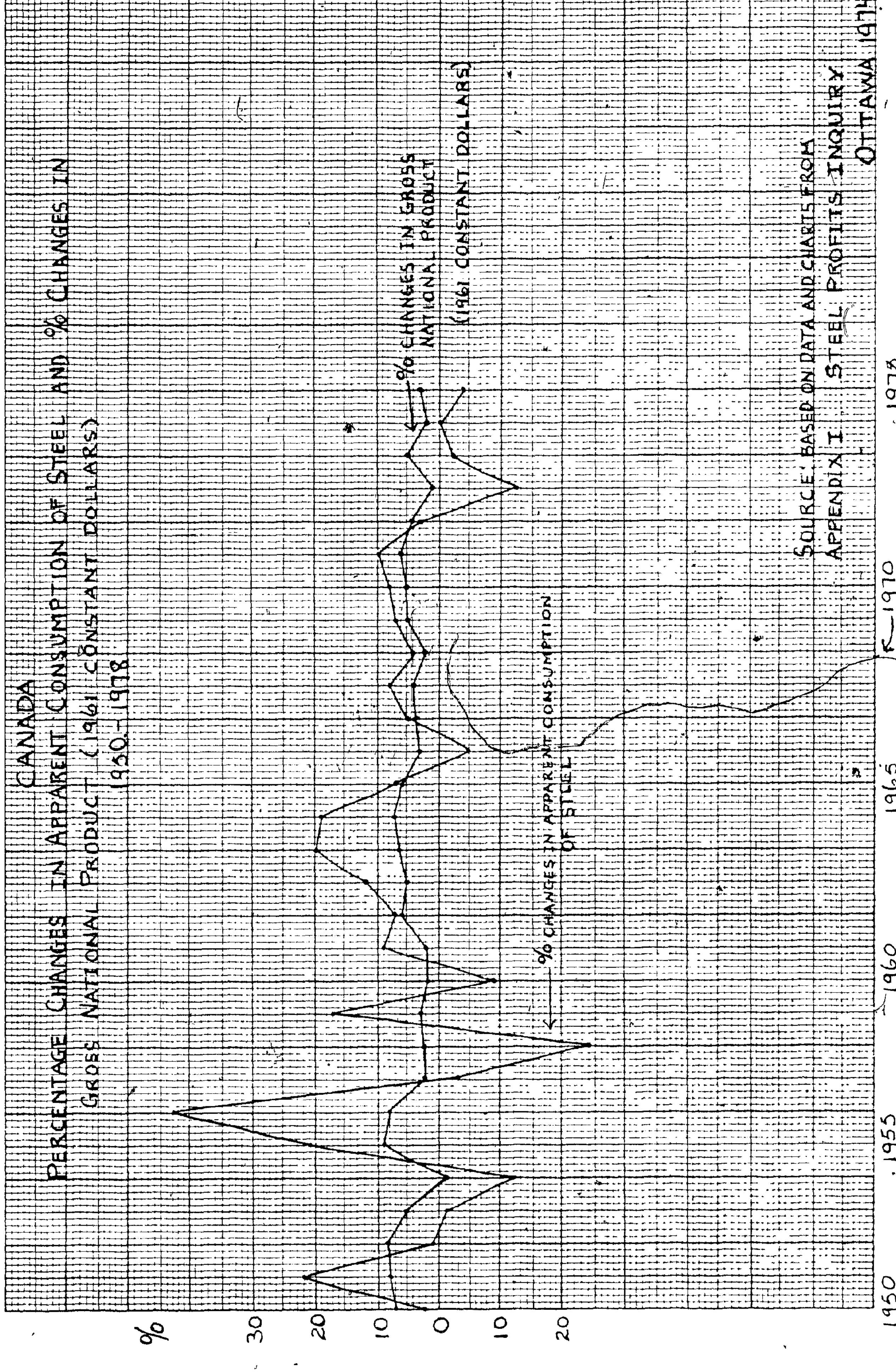
The models portray how firms behave instead of how they ought to behave. In direct contrast, Jorgenson's model reflects abstract theorizing without references to institutional realities. The abstractions from reality cause severe difficulties when there is a movement from theoretical model building to empirical tests.[25] The difficulties are well illustrated when one examines the experience of the Canadian steel industry.

The steel industry is an important capital goods industry which exerts great influence on other sectors of the economy. For example price changes in the steel industry have repercussions on other industrial sectors. The steel industry is cyclical in character with wide swings in demand for its output from the steel using industries.[26] The behaviour of the Canadian steel maker is characterized as follows:

> constantly facing the dilemma of whether or not to increase capacity, and if so when, in order to expand his market coverage to take in part of the domestic steel market serviced by imports.
> --Steel Profits Inquiry (Ottawa: Information Canada, October 1974), pp. 140-141.

The above description suggests the following pattern of behaviour: the industry increased capacity to accommodate the growing demand for steel in the Canadian economy. Imports are assigned two basic roles: to provide for peaks in demand over the cycle and to provide steel goods whose domestic production is not economically feasible. In Canada, capacity utilization ratios are generally high and evidence of the high ratios is presented in Chart II below. Over the postwar period, the steel industry also adapted very quickly to technological changes[27] in the production of steel. Much of the investment which occurred was the replacement of old machines with new and better ones. Clearly investment

CHART I

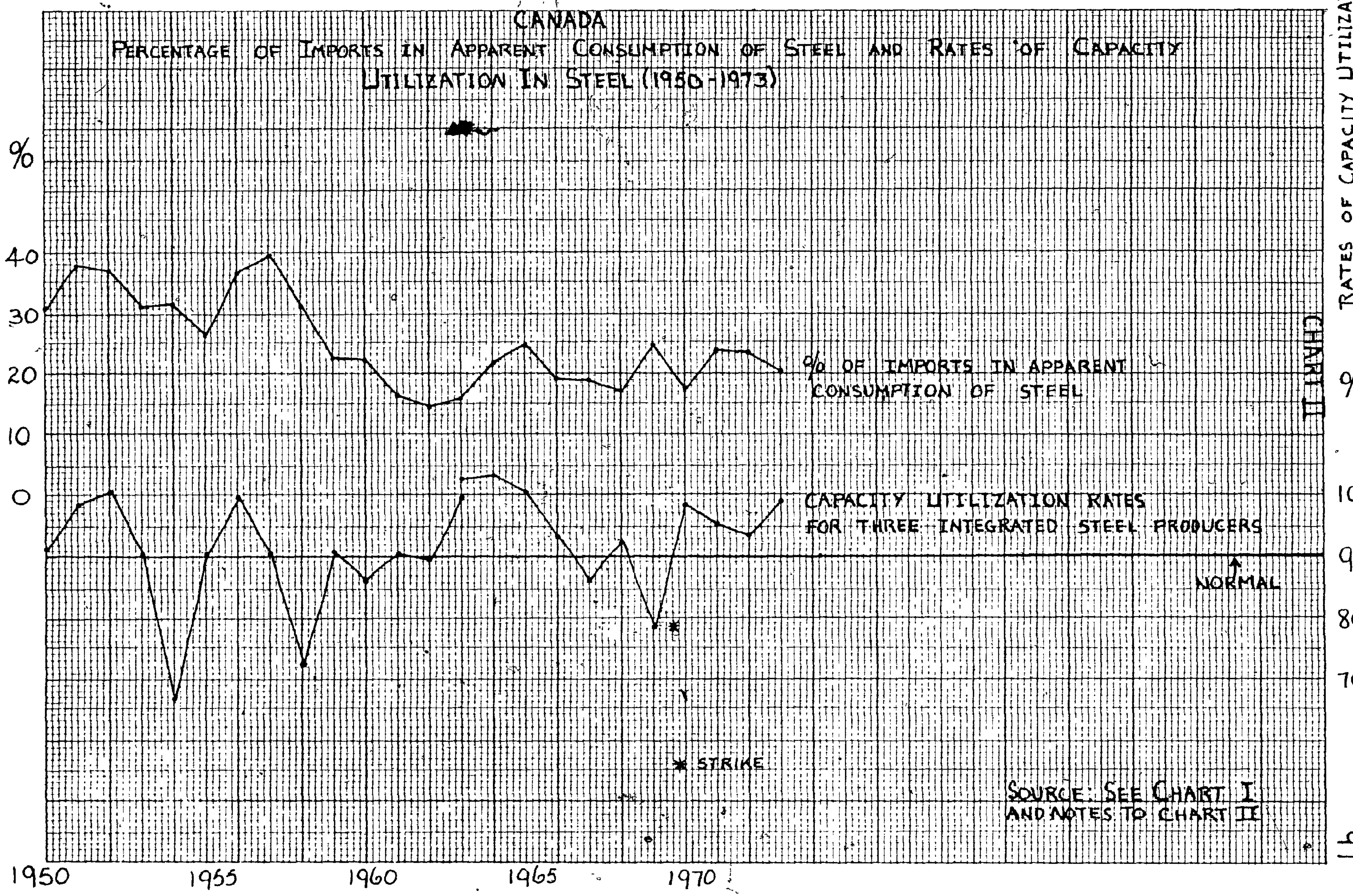

CANADA
PERCENTAGE CHANGES IN APPARENT CONSUMPTION OF STEEL AND % CHANGES IN
GROSS NATIONAL PRODUCT (1961 CONSTANT DOLLARS)
1950 - 1978
% CHANGES IN GROSS NATIONAL PRODUCT
(1961 CONSTANT DOLLARS)
% CHANGES IN APPARENT CONSUMPTION OF STEEL
SOURCE: BASED ON DATA AND CHARTS FROM
APPENDIX I STEEL PROFITS INQUIRY
OTTAWA 1974
%
30
20
10
0
10
20
1950
1955
1960
1965
1970
1978

Notes to Chart I

One method of capturing the cyclical fluctuations in demand for steel is to plot percentage changes in apparent consumption of steel and percentage changes in Gross National Product. The chart is taken from Appendix F of the Steel Profits Inquiry. The problem of aggregating different categories of steel output is solved by converting output of steel into equivalent units of raw steel.

The chart demonstrates the wide swings in demand for steel between 1950 and 1968. Since then the wide fluctuations have stabilised. Some of the reasons for the stability are: the overall growth in the Canadian economy; the decline in importance of steel relative to other capital goods; increased use of substitutes for steel in many areas of the economy.

The data for the period 1974-1978 are based on a different measure of apparent consumption [See: The Steel Market in 1978 and The Outlook for 1979, OECD, Paris, 1979]. Apparent consumption is measured in tons of ingot equivalents. Changes in Gross National Product are derived from data in Economic Review, Department of Finance, Ottawa, 1980.


CANADA
PERCENTAGE OF IMPORTS IN APPARENT CONSUMPTION OF STEEL AND RATES OF CAPACITY UTILIZATION IN STEEL (1950-1973)
%
40
30
20
10
0
% OF IMPORTS IN APPARENT CONSUMPTION OF STEEL
CAPACITY UTILIZATION RATES FOR THREE INTEGRATED STEEL PRODUCERS
NORMAL
RATES OF CAPACITY UTILIZATION
CHART II
%
100
90
80
70
✱ STRIKE
SOURCE: SEE CHART I AND NOTES TO CHART II
1950
1955
1960
1965
1970

Notes to Chart II

The chart shows the decline in the share of imports in apparent consumption of steel from a peak of about 40% in the 1950's to 20% in the early 1970's. The cyclical peaks in the curve correspond to peaks in the consumption of steel during the period: 1951, 1956, 1959, 1965.

The data on capacity utilization consists of two adjoining series[a] of capacity utilization ratios. If "normal" usage is taken to be 85% to 90%, the chart clearly demonstrates that for many periods between 1950-1973, firms have been operating above the normal ratio.

---

[a]The data on capacity utilization derives from: de Melto (1970), Table 5-4 for 1950-1963; and Table 5. Official data from Statistics Canada on capacity does not extend as far back as the 1950's.

responded to changes in demand conditions as well as changes in technology.

The experience of the industry suggests a non neo-classical model of investment as an appropriate model to apply to the Canadian steel industry. In particular, the flexible accelerator provides a good description of investment within the industry. The evidence[28] on lead times within the industry suggests a lag of three to four years for the investment function. The important technological improvements are difficult to separate in an accelerator type model. Walters (1963) suggests that when technical progress and output changes are highly correlated, the estimates of the accelerator are biased downwards. The estimates presented in the next chapter seem to be biased downwards.

Recent surveys[29] and articles on the econometrics of investment have expressed dissatisfaction with single equation models of investment. For instance Lund (1976) suggests a movement away from a single equation framework to one in which there are sequential stages; the sequential stages would pinpoint the issues of simultaneity, which are overlooked in a single investment equation. Nickell (1978)[30] and Schramm (1972) also make similar comments. The simultaneous equation model provides a useful starting point for this type of analysis.

One limitation of the analysis in the next chapter is that there are no ways of directly measuring the effects of tax incentive policy. An alternative approach is to consider the elasticity of investment with respect to a number of variables. The elasticities serve as an useful guide to policymakers. Shoup (1972) is correct in pointing to the difficulty of extracting quantitative answers on this subject.[31] He believes that the aims of such studies are too high; instead he suggests more micro research[32] is needed to reveal associations which may prove useful for policy guidance. The models of investment which are fitted in this thesis to the data for firms in two industries are a small contribution to the research.

IV. SUMMARY

This chapter examined two Canadian studies of investment. One of the studies is typical of the aggregative approach which some commentators have criticised. The first study reviewed found that tax incentives affect investment but only after a long period of time has elapsed. The second study is interesting because of its benefit-cost approach. Harman found that the costs of tax incentives outweighed the benefits of the increased investment.

In the chapter reasons were advanced for the choice of an investment model suitable for two Canadian manufacturing industries. The choice is justified on theoretical and on empirical grounds. The neoclassical model is considered inappropriate and a simultaneous approach is preferred. The simultaneous approach incorporates an accelerator type equation with two additional equations which capture the dividend and financing behaviour of firms. In the concluding section of the chapter a description is provided of one of the two manufacturing industries. The description illustrates some empirical and institutional factors which must be taken into account when choosing a model of investment behaviour.

FOOTNOTES

[1]Bridge (1971) and Jorgenson (1971) review studies on the United States manufacturing sector; Lund (1976) reviews British studies; May (1979) summarises recent Canadian research.

[2]See Helliwell (1978), p. 163. Helliwell suggests that this type of research is primarily concerned with obtaining statistically significant regression coefficients with the correct signs.

[3]The Report submitted by The Tax Measures Review Committee in 1975 is an example of this type of research. The Federal Government set up the Committee to report on the effects of the 1972 tax changes; the results the Committee produced indicated that the policy changes met with complete success. The Committee also published estimates of increased investment due to the 1972 tax changes which were higher than all other published estimates. See Table 1 of May (1979) for a comparison of the estimates.

[4]In actuality there are many studies which fall within the two extremes; Meyer and Kuh, op. cit.; Kuh, op. cit.; Eisner (1978) are excellent studies of investment behaviour which fall between the two extremes.

[5]See Bird (1980); Helliwell (1978) and Shoup (1972).

[6]In Canada, the National Energy Program introduced in the 1980 Federal Budget is a most recent example; other examples are the tax incentives which are directed towards manufacturing and processing firms where "manufacturing and processing" has a specific meaning. See Knechtel and Penny (1973) for a discussion of what constitutes "manufacturing and processing."

[7]Other studies are Braithwaithe (1974); Gaudet, May and McFetridge (1976); Harman and Johnson (1978). See also May (1979) for a comparison of the results of these studies with that of the Tax Measures Review Committee (1975). Recently Johnson and Scarth (1979) show that that in addition to their ineffectiveness, the benefits of tax incentives accrue to foreigners and to high income Canadians. They insist that the relevant tax rate "u" (in implicit rental price formulas; the particular formula they utilise is of the form found in equation 3.16c above) must be the foreign tax rate for firms incorporated in other countries. Hence all calculations which use the Hall-Jorgenson approach overestimate the benefits of tax incentives. Note that these arguments about the distribution of the benefits of tax policies are not new. The arguments can be found in Kierans (1960; 1972).

[8]McFetridge and May hope to avoid some of the criticisms of the basic neoclassical model of investment by making the adjustments. Some of the advantages of the cost minimization approach are: there is no need to make assumptions about the market structure; the elasticity of the capital stock with respect to output is unity only in the case of production function with constant returns to scale; relative factor prices (ratio of the cost of capital to the cost of labour) and not relative prices (the ratio of the price of output to the rental price of capital) determine investment expenditures. See Brechling (1975), Chp. One for a discussion of the advantages of the cost minimization approach.

[9]See equation (3.11) above and note that there is no component for labour services. Coen (1968) also uses the cost minimization technique. Helliwell (1976) shows that under special conditions the assumption of profit maximization by the firm leads to the same conclusions as the cost minimization assumption.

[10]McFetridge and May (1976), p. 320.

[11]See above pp. 51 <u>et seq</u>. Harman finds Coen's approach an "attractive" one because: no assumptions are needed about the production function; firms minimize costs and hence output can be included in the investment equations; relative factor prices and output are separate determinants of the capital stock.

[12]The <u>general timing</u> effect is identified as follows: firms which intend to add to their capital stock in the future may do so immediately to take account of incentive policy. The effect is measured by considering relative factor prices. The relative factor price is one determinant of the capital stock and investment expenditure. The strength of the timing effect can be gauged by comparisons of preincentive and post-incentive relative factor prices. The <u>termination date timing</u> effect: firms respond to a policy earlier than they would because they want to acquire assets before the expiry date of the policy. This effect is measured by comparing discounted values of capital cost allowances, with and without the incentive policy. The <u>time constraint</u> effect: only those categories of investment which can be completed within this period of time will be influenced by the incentive policy.

[13]See Harman and Johnson (1978), p. 702. Here there is some recognition that investment may be induced well beyond the termination date of a particular tax incentive.

[14]All tax incentives in existence before 1974 are now a permanent feature of the tax system. Bird (1980) cautions against undue stress on this feature of the system, since "no Parliament can bind future Parliaments," p. 20.

[15]Theoretically tax savings generated from liberal depreciation allowances are viewed as an advantage to the firm. In practice the tax savings for the firm are relatively small percentages of an investment project. The result arises because not every dollar of an investment qualifies for faster write offs.

[16]The calculations of revenues losses are only first round estimates. To the extent that income and expenditures on investment increase, then tax revenues can be increased in the second round. However as long as investment is growing the government can never recoup all of the revenue losses.

[17]Department of Finance, Government of Canada: Tax Expenditure Account, Ottawa, 1979.

[18]See the articles and panel discussion in Canadian Taxation, Fall 1979, and a Review of the Tax Expenditure Account in Canadian Taxation, Spring 1980.

[19]See also Johnson and Scarth (1979).

[20]Many critics (see Fromm: 1971, p. 1) argue that two variable analysis is inadequate for quantifying the relationship which exists between tax incentives and investment. Researchers must go further than merely relating changes in depreciation allowances to changes in the ratio of investment to Gross National Product.

[21]Actually the perfect foresight assumption is relaxed to account for lags between actual and expected values. See Jorgenson and Siebert (1968b), p. 1124.

[22]Schramm (1972) found the neoclassical model of investment unsuitable for explaining the behaviour of French private investment. See also Loranger (1976) and Harman (1977) for similar suggestions for the Canadian economy.

[23]The neoclassical model of investment assumes the existence of perfect capital markets. The assumption is not true for the Canadian economy. The belief that some firms do not have easy access to capital markets is one reason for the existence of tax incentives. See the policymakers' model outlined above on pp. 28 *et seq*.

[24]The differences go much further than the arguments of Break (1974) and Helliwell (1976). Break (1974) suggests that the essential difference between the neoclassical theory of investment and the opposing theories is that relative factor prices matter in the neoclassical framework; the opposing theories "while not denying the influence of relative prices, assign greater importance to such factors as recent changes in output or sales, future profit expectations, and the liquidity position of firms." Break (1974), p. 205. Helliwell's (1976) survey of the issues leaves a similar impression.

[25]See Gould and Waud (1973) who believe that almost all empirical investment models suffer from this type of problem. The problem arises from a mixture of optimality conditions for comparative statics and dynamics.

[26]In Canada, demand for steel using products has shifted from railways to use in consumer goods. The future demand for steel will come primarily from energy related projects, e.g., pipelines. See Chart I, p. 95 and the accompanying notes for evidence of the cyclical nature of demand for steel products.

[27]De Melto (1970) has an excellent discussion of technological changes in the Canadian steel industry. De Melto's data show that in 1954 the basic oxygen process (the modern efficient method of producing steel) accounted for 7% of total Canadian capacity. By 1965 this proportion increased to 32% of total capacity. A recent study for the Royal Commission on Corporate Concentration (Study No. 19: Corporate Dualism and the Canadian Steel Industry: A Background Report) finds that for 1976, 54% of total capacity was of the oxygen furnace type, 25% the open hearth furnace and 21% the electric furnace.

[28]"The lead time for increasing capacity for making steel is four years in the case of a major vertically integrated producer operating from iron ore and somewhat less for the limited capacity electric furnace industry operating from scrap." Steel Profits Enquiry, op. cit., pp. 5-6. For a similar statement see also Laing (1973).

[29]See Lund (1976) and Nickell (1978) in particular.

[30]See pp. 269 and the corresponding footnote 18.

[31]Shoup (1972), p. 28: "...it is difficult to extract quantitative answer on which all will agree (or almost agree) as to the effects on certain types of investment decisions of tax changes made over a period of time."

[32]See also Bird (1980), pp. 59-60.

CHAPTER FIVE

EMPIRICAL ESTIMATES OF THE INVESTMENT MODELS

This chapter presents empirical estimates of investment functions which are based on the flexible accelerator and a simultaneous equation model of investment. The chapter also includes a model of dividend behaviour based on the Lintner hypothesis. The data are for firms in the Canadian iron and steel and pulp and paper industries for the 1955-1975 period. The values obtained for the parameters that can be affected by tax incentives will give some indication of the possible quantitative effects of these tax incentives on investment.

Section I contains a description of the samples; in Section II the results of the single equation model of investment and the dividend model are presented. Section III deals with the regression estimates for the simultaneous equation model. The chapter closes with an examination of various elasticity coefficients.

I. DESCRIPTION OF THE TWO SAMPLES

The sample consists of eight firms primarily engaged in the iron and steel and pulp and paper industries. The firms are selected for two main reasons: the Canadian iron and steel sector is an important capital goods producer and has the added advantage of being almost wholly Canadian owned;[1]

the pulp and paper firms are also important export industries with roughly 60% Canadian ownership. Both industries are highly capital intensive and earn large amounts of capital cost allowances. Tables 1 to 4 contain information on the contribution of the two sectors to manufacturing activity. The tables present data on investment expenditures, capital cost allowances, sales and book profits in the two sectors. Together the two sectors account for an average of 30% of manufacturing investment, 25 to 30%[2] of earned capital cost allowances and 14% of sales. The two sectors contribute substantially to manufacturing activity in Canada.

The three firms chosen from the steel industry are the largest integrated producers of iron and steel and account for 75% of output within the industry. Unlike the pulp and paper industry, the steel industry is highly concentrated and oligopolistic in nature. Although the non-integrated producers account for the rest of domestic steel output, the group consists of a heterogeneous collection of firms.[3] The three integrated producers form the core group of firms from the steel industry.

The other five firms are those engaged in the pulp and paper industries. The pulp and paper industry provides an interesting contrast to the steel industry. The industry is less concentrated, has substantial foreign ownership and is very dependent on export earnings. Firms in the pulp and paper industry are very sensitive to exchange rate fluctuations.[4] Chart II below is an historical series of the value of the United States dollar in terms of the Canadian dollar. Some firms specialize in newsprint, others in lumber, paperboard and paper products. Contrary to the experience in the steel industry, the pulp and paper firms did not experience great technological changes during the postwar period. Capital equipment is extremely old[5] and needs substantial amounts of repair and maintenance. In addition firms have been concerned with the installation of pollution control equipment; in many instances firms have preferred to increase the capacity of existing equipment rather than to build new mills.[6]

Although overall the sample we ended up with consists of only eight firms, the choice of the firm as the unit of analysis is not an unusual one.[7] Theoretical and statistical reasons justify the use of firm data and not higher levels of aggregation. Theories of investment behaviour are formulated at the level of the firm, and in these theories the firm managers are the decision makers. To obtain industrial aggregates, one sums up over the individual firms. Most researchers work with two digit and three digit industrial classifications. Yet at some levels of aggregation, distortions arise and theoretical constructions lose their validity. For example Statistics Canada has made numerous classification changes[8] within the manufacturing industry. Continuous time series data are almost impossible to obtain. One method of obtaining reliable data for a particular industry is to aggregate over the individual firms.[9]

Data problems also exist at the level of the individual firm. Firm mergers, differences in financial years, different accounting units (United States dollars),[10] multi-product firms, conglomerates--all cause numerous problems when one examines individual firm data. The original sample of nineteen firms had to be reduced to eight for a number of reasons.[11] Two steel firms were omitted because during the sample period Provincial Governments became majority shareholders.[12] Other firms were omitted because no continuous data were available for the sample period 1955-1975; firms which ceased to exist or became parties to mergers were not included; one firm was eliminated because the accounts were presented in United States dollars. Finally some firms, subsidiaries of United States corporations did not issue separate financial information prior to the Foreign Investment Review Act.[13]

The main data source consisted of the Annual Reports of each firm, supplemented by data from Financial Post publications. From each Annual Report, information was extracted from the following: Income Statements, Balance Sheets and Sources and Use of Funds tables. Definitions of the basic variables used now follow. As far as possible, measures were taken to ensure that the definitions were comparable across firms. The following is the list of firms in the sample.

A. The Steel Firms

Algoma Steel Corporation

Dominion Foundries and Steel Limited

The Steel Company of Canada Limited

B. The Pulp and Paper Firms

Abitibi Price Inc.

Br. Columbia Forest Products Limited

Consolidated Bathurst Inc.

Gt. Lakes Paper

McMillan Bloedel Ltd.

Variables

S - net sales

I - gross capital expenditures (includes construction as well as machinery and equipment expenditures)

P - net profits after taxes

D - capital cost allowances

F - gross fixed assets

D^V - common dividends paid

L - net long term debt

R - interest payments on long term debt outstanding

V - value of the firm given by the market value of shareholders' equity

EF - net current long term borrowing obtained by taking the first difference of the book value of long term debt outstanding

In some instances net borrowing was obtained directly from information in the Annual Reports. The above variables were used to generate additional variables such as:

$$S_t^* = \frac{S_t - S_{t-1}}{S_{\text{base year}}}$$ i.e. partial acceleration variables

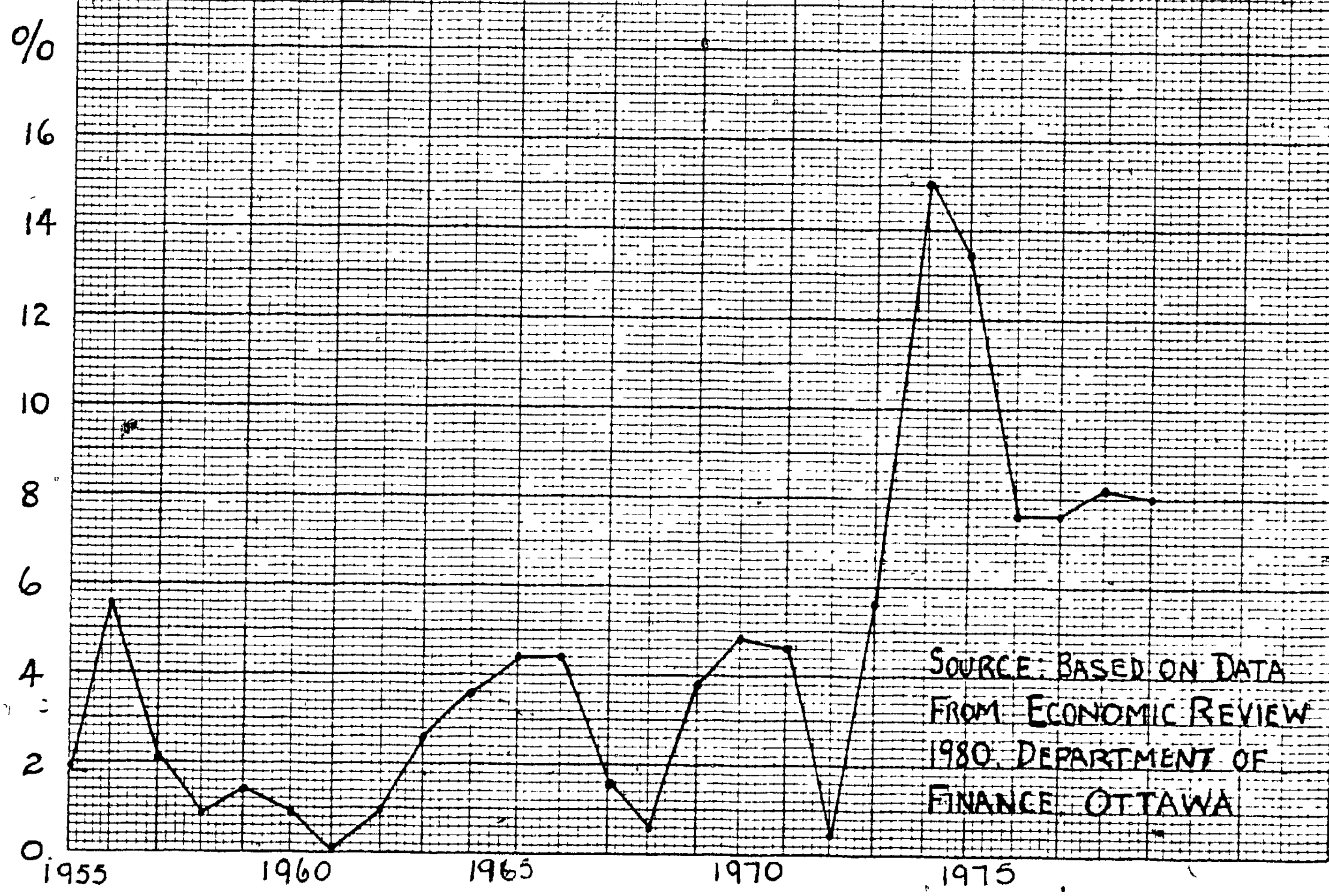
and so on.

CHART I

PERCENTAGE CHANGES IN THE IMPLICIT PRICE INDEX FOR BUSINESS FIXED INVESTMENT

(1971 = 100)

1955-1979



The United States Dollar
in terms of the Canadian Dollar
(monthly averages)

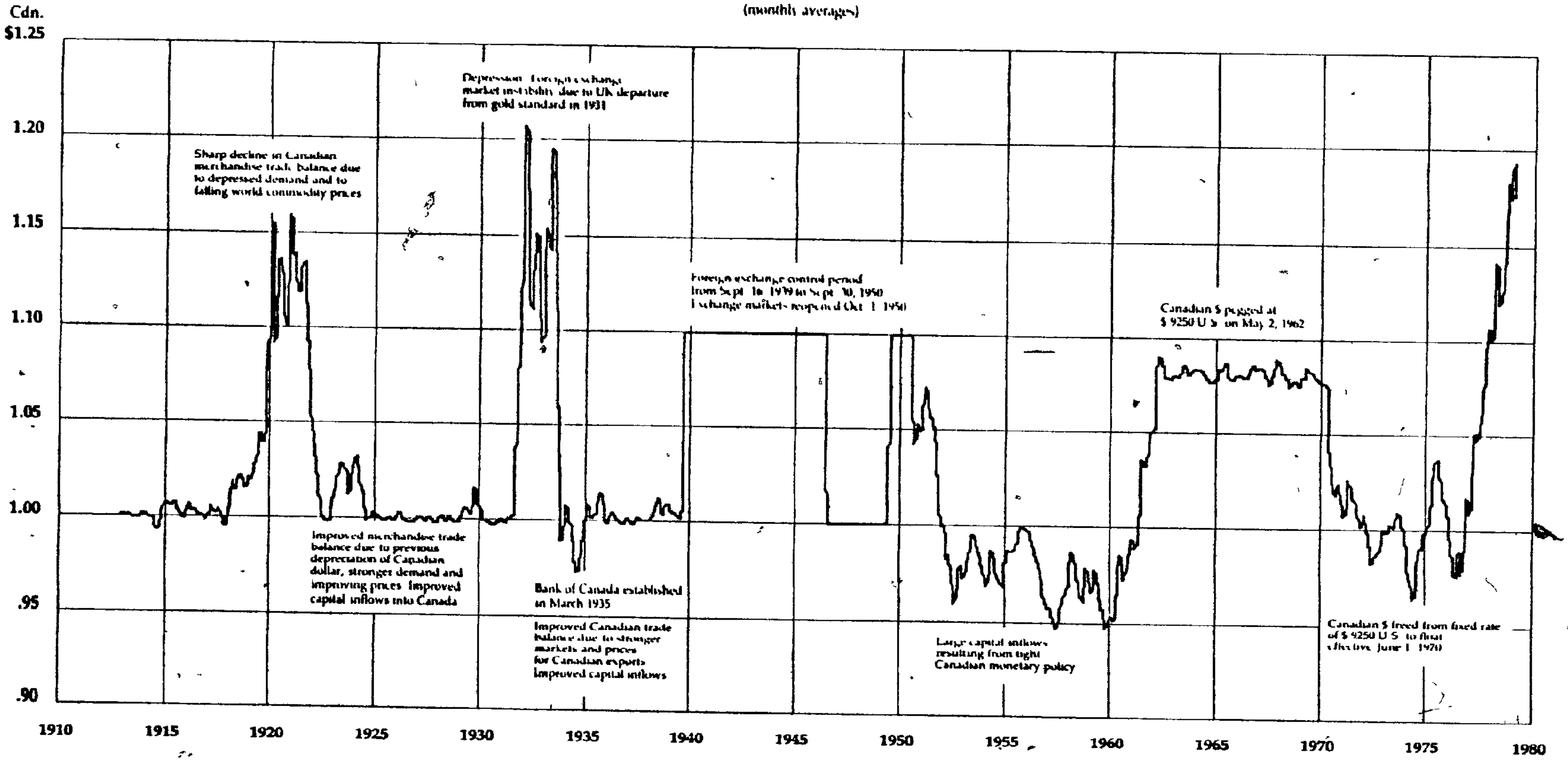


CHART II

Note to Chart II

This chart formed part of the Annual Report of MacMillan Bloedel Limited for 1978. The inclusion of the chart in the company's Annual Report underlines the importance of the (foreign) exchange rate to the industry.

CANADA

TABLE 1: TOTAL INVESTMENT IN PRIMARY METALS AND PULP AND PAPER INDUSTRIES (IN CURRENT AND CONSTANT 1971 DOLLARS) (1955 - 1978)
$m

Year	Primary Metals		Pulp and Paper Industries	
	Current	Constant	Current	Constant
1955	95	145	223	343
1956	163	236	354	522
1957	180	256	365	523
1958	126	177	220	315
1959	166	230	230	326
1960	359	493	269	376
1961	281	387	272	379
1962	387	522	292	402
1963	364	478	326	437
1964	485	615	454	588
1965	498	605	565	697
1966	661	709	719	844
1967	568	651	656	753
1968	544	619	480	546
1969	583	639	592	646
1970	778	813	758	795
1971	773	773	782	782
1972	790	759	708	681
1973	863	784	713	632
1974	1257	993	968	742
1975	1444	1006	955	630
1976	1337	806	1187	716
1977	1468	821	1289	720
1978	1467	756	1264	651

Source: Public and Private Investment in Canada
Statistics Canada, Cat. 61 - 205

Note (i) Data from 1955 - 1959 represent investment in the iron and steel industries. In 1960 the

TABLE 1:
(continued)

categories "iron and steel" and "non ferrous metals" were replaced by "primary metals", "metal fabricating" and "machinery."

(ii) For comparison, the 1960 capital expenditure estimates are produced below for both classifications.

1960 Capital Expenditures
$m

Iron and Steel	196.5
Non Ferrous Metals	69.7
	266.2

AND

Primary Metals	194.2
Metal Fabricating	46.7
Machinery	23.0
	263.9

Other metals now included in the primary metals group are aluminium, copper, silver and lead.

(iii) Statistics Canada provides the following sub-groups for primary metals:

Primary Metals

Iron and Steel Mills
Iron Foundries
Smelting and Refining

TABLE 1:
(continued)

The subgroupings are not available for data on investment spending.

(iv) The changes in the Standard Industrial classification in 1960 created one source of discontinuity in the data. The discontinuity is compounded further for the following reasons: data on sales, profits and capital cost allowances were originally published by the Department of National Revenue; since 1965 Statistics Canada has been publishing the information; however Statistics Canada and the Department of National Revenue do not use the same sample of firms. The data in Tables 2 to 4 are based on firms which earned taxable profits.

(v) The investment expenditures of the 3 integrated steel firms in the sample comprise approximately 1/3 of the investment of the group "primary metals". The data for the 3 firms are reproduced in the Appendix Tables.

CANADA

TABLE 2: SALES OF OUTPUT IN TOTAL MANUFACTURING, PRIMARY METALS AND PULP AND PAPER INDUSTRIES

(1955 - 1977)

$m

Year	Total Manufacturing	Primary Metals	Pulp and Paper Industries
1955	18,392	1172	1747
1956	20,646	1437	1826
1957	19,563	1552	1759
1958	18,979	1322	1711
1959	20,725	1483	1768
1960	21,465	1866	1983
1961	21,342	1596	2066
1962	24,073	1728	2120
1963	26,968	2039	2085
1964	29,821	1901	2187
1965	36,433	3146	3214
1966	40,484	3390	3312
1967	41,716	3312	3644
1968	44,278	3603	3844
1969	48,622	3028	4318
1970	52,536	3455	4682
1971	57,462	3469	4816
1972	63,964	3591	5348
1973	75,748	4331	6347
1974	95,819	5660	8448
1975	103,857	5941	7876
1976	116,048	6394	9135
1977	128,102	7473	10377

See notes for Table 1

Source: 1955 - 1964 Taxation Statistics, Department of National Revenue.

1965 - 1977 Corporation Financial Statistics, Statistics Canada, Cat: 61 - 207

CANADA

TABLE 3: CAPITAL COST ALLOWANCES FOR TOTAL MANUFACTURING PRIMARY METALS AND PULP AND PAPER INDUSTRIES (1955 - 1977)

$m

Year	Total Manufacturing	Primary Metals	Pulp and Paper Industries
1955	608	95	85
1956	682	105	99
1957	608	111	100
1958	642	116	100
1959	666	121	94
1960	746	126	106
1961	762	121	110
1962	823	139	106
1963	964	158	129
1964	1145	149	165
1965	1656	334	294
1966	1867	355	328
1967	1788	351	297
1968	1569	259	251
1969	1671	159	278
1970	1286	156	142
1971	2090	259	243
1972	2484	302	303
1973	3165	350	454
1974	4043	416	636
1975	4073	500	632
1976	4037	429	557
1977	4261	432	617

See notes for Table 1.

Source: 1955 - 1964 Taxation Statistics, Department of National Revenue.

1965 - 1977 Corporation Taxation Statistics, Statistics Canada, Cat: 61 - 208

CANADA

TABLE 4: BOOK PROFITS AFTER TAXES IN TOTAL MANUFACTURING PRIMARY METALS AND PULP AND PAPER INDUSTRIES

(1955 - 1977)

$m

Year	Total Manufacturing	Primary Metals	Pulp and Paper Industries
1955	1536	69	278
1956	1655	106	280
1957	1548	96	220
1958	1439	76	205
1959	1696	129	223
1960	1587	125	241
1961	1591	129	249
1962	1843	122	279
1963	2030	143	251
1964	2081	127	253
1965	1793	401	248
1966	1919	341	269
1967	1620	297	182
1968	1854	345	165
1969 1/	1957	191	221
1970	1685	153	112
1971	2177	224	29
1972	2602	198	65
1973	4160	306	574
1974	5284	461	852
1975	4619	336	594
1976	4656	255	377
1977	4663	425	351

1/ In 1969 Statistics Canada reclassified a number of firms from the primary metals to the mining sector.

Source: 1955 - 1964 Taxation Statistics, Department of National Revenue

1965 - 1977 Corporation Taxation Statistics, Statistics Canada, Cat: 61 - 208

The choice of the base year to deflate sales changes and gross capital expenditures implied a year unaffected by major tax changes or business cycle effects. The year 1959 was chosen as appropriate for both samples.

To obtain the regression estimates, undeflated and price deflated data were used. The price deflated data corrects for changes in the absolute price level. The GNP Implicit Price Deflator for fixed business investment was applied as the common price deflator for the variables. The total index (not the subgroups of machinery and equipment) was employed because neither of the two subgroups was appropriate. Chart I above shows the percentage changes in the index between 1955 and 1979.

II(a) THE FLEXIBLE ACCELERATOR--THE STEEL FIRMS

The investment equation of the simultaneous equation model discussed in Section III of Chapter Three is essentially an accelerator equation augmented by dividend and external finance variables.[14] For exploratory purposes, it is interesting to fit a flexible accelerator equation to the sample data. The results of the equation would throw light on the following: the existence, size and the appropriateness of the accelerator coefficient to the body of data. Equation (5.1) below is the basic accelerator equation:

$$\frac{I_t}{F_b} = \beta_0 + \beta_1 \frac{S_t - S_{t-1}}{S_b} + \beta_2 \frac{S_{t-1} - S_{t-2}}{S_b}$$

$$\beta_3 \frac{S_{t-2} - S_{t-3}}{S_b} + \beta_4 \frac{S_{t-3} - S_{t-4}}{S_b}$$

$$+ \beta_5 \frac{S_{t-4} - S_{t-5}}{S_b} + \beta_6 D_t + e_t \qquad (5.1)$$

where I_t = gross capital expenditures in period t[15]

D_t = capital cost allowances in period t

F_b = gross fixed assets for the base year 1959

S_t = sales in period t

S_b = sales in the base year 1959

e_t = error term

The equation is similar to Eisner (1960) and if the flexible accelerator model is true, certain results are expected: all the sales change coefficients (or partial accelerator coefficients) are expected to be positive; for firms which are close to capacity or whose sales are rising the accelerator coefficients are expected to be higher; as the lagged terms increase however, the sizes of the partial accelerators are expected to decrease, but their sum should approach unity.[16]

Table 5 gives the results[17] for the first sample for the period 1955-1975. The results for the iron and steel firms are presented for undeflated and price deflated data. An assessment of the results is divided into statistical properties and economic characteristics of the equation.

One measure generally used as a measure of goodness of fit is $\bar{R}^2$ (R^2 corrected for degrees of freedom) the coefficient of determination. In Table 5 the $\bar{R}^2$'s show that more than half the variation in capital expenditures is explained by

TABLE 5: FLEXIBLE ACCELERATOR MODEL: TIME SERIES DATA 1955 - 1975 FOR AGGREGATE SAMPLE OF STEEL FIRMS

Variables		Undeflated Data		Deflated Data	
Investment Expenditures with		Coefficients and standard errors	Beta Coefficients	Coefficients and standard errors	Beta Coefficients
$\frac{S_t - S_{t-1}}{S_b}$	β_1	0.06910 (0.08598)	0.09422	0.07553 (0.08192)	0.14071
$\frac{S_{t-1} - S_{t-2}}{S_b}$	β_2	0.33524* (0.08828)	0.46249	0.27333* (0.08394)	0.48989
$\frac{S_{t-2} - S_{t-3}}{S_b}$	β_3	0.19004** (0.10831)	0.19713	0.16534*** (0.09879)	0.25211
$\frac{S_{t-3} - S_{t-4}}{S_b}$	β_4	0.11248 (0.11718)	0.09933	0.12118 (0.10674)	0.17531
$\frac{S_{t-4} - S_{t-5}}{S_b}$	β_5	-0.03324 (0.11697)	-0.02839	-0.07123 (0.10953)	-0.09862
D_t	β_6	0.00172* (0.00078)	0.34193	0.00127* (0.00063)	0.34181
Intercept	β_0	0.02490 (0.06260)	—	0.028583 (0.04871)	—
$\overline{R}^2$		0.82794		0.58089	
F		17.0401		5.62	
DW		1.945		1.975	
Sum of Sales Change Coefficients		0.673		0.564	

NOTES TO TABLE 5

1. The standard errors are in brackets below the regression coefficients.

2. The Beta Coefficients are the standardized regression coefficients. They are useful for comparing the relative effects of the independent variables on the dependent variables.

3. The appropriate t values for one tail tests of significance are:-

	10%	5%	1%
t (14 degrees of freedom)	1.345	1.761	2.62

* .... SIGNIFICANT at 1% level
** .... SIGNIFICANT at 5% level
*** .... SIGNIFICANT at 10% level

4. $F(6, 14)_{0.01} = 4.45$

$F(6, 14)_{0.05} = 2.84$

$F(6, 14)_{0.10} = 2.24$

the model. But while the R^2's measures are quite reasonable,[18] they are supplemented by the t ratios. The t-ratio test applied here is not sophisticated. With Kuh's[19] arguments in mind, the rule of thumb requires that each regression coefficient be at least twice its standard error for the coefficient to be statistically significant. These significant coefficients are detailed in Table 5. β_1, β_4 and β_5 are not statistically significant, but there are no overwhelming reasons to exclude the three variables from the model.

Another method of measuring the goodness of fit of the model is the direct examination of the residuals. When the criteria set out by Draper and Smith (1966) are taken into account, the graphs of the standarized residuals exhibit no unusual patterns.[20] The Durbin-Watson statistics indicate no evidence of serial correlation among the error terms.

The statistical properties discussed above suggest that the model performs fairly well in explaining investment expenditure. The economic properties also support and provide sufficient evidence of the flexible accelerator. First consider the signs and sizes of the accelerator coefficients of Table 5. With one exception the coefficients are positive and sum to just over one half. Over the sample period, the firms in the steel sector worked at close to capacity and experienced large increases in demand for their output. This behaviour suggests a very high value for the accelerator and the estimates support _a priori_ expectations to some extent. The value of the accelerator is 0.673 for the undeflated data and 0.56 for the price deflated data. There are two reasons why the accelerator is not closer to unity. First the increases in output were closely connected to technological changes in the industry. Walters (1963) has argued that when there has been technical progress, there will be a 30% to 60% downward bias in the estimates of the accelerator coefficient. Secondly the pure accelerator is concerned with net induced investment. In practice it is difficult to distinguish between net induced investment and replacement investment. The experience of the steel industry is a good example here because the investment which occurred is a mixture of induced and replacement investment. Thus estimates of the accelerator are expected to be lower than unity.

Overall[21] the regression results indicate the existence of an accelerator relationship in the iron and steel industries. The coefficients show that the peak annual response of investment to an increase in sales occurs in the second year following the changes in sales. The response of investment to changes in sales declines beyond this period.

The sums of the accelerator coefficients are also an approximate measure of the elasticity[22] of the capital stock with respect to output (sales). Since the coefficients sum to approximately 0.6, the elasticity coefficient implies that over a five year period, a 1% change in output (sales) will increase the capital stock by less than 1%.[23] It is also possible to evaluate short run impact elasticities.[24] The short run elasticities of investment with respect to output (sales) show that over a two year period, a 1% change in sales will produce a 1½% to 2% change in investment. These short run elasticities suggest the following type of tax incentive policies: a stimulation of demand for finished steel products will lead to increases in investment expenditures.

There are no large differences between the estimates based on price deflated data and non price deflated data.[25] One possible reason is that dramatic increases in the price of capital goods occurred in the last three years of the sample period. However the estimates based on deflated data are used to generate forecasts outside the sample period. The forecasting procedure is one test of the suitability of the model. The forecasts in Table 6 below are for the 1976-1978 period. The forecasts from the model are quite good compared to those of the "naive model." Here the "naive model" is the "no change model" which has $I_{t+1} = I_t$. Theil's Inequality Coefficient[26] indicates that the forecasts are accurate about 90% of the time.

Some researchers (Meyer and Kuh: 1957 for example) suggest that profits rather than sales, or profits and sales should be the appropriate accelerator variables. However there is a fixed relationship between sales and profits which causes multicollinearity in the data. Alternative formulations of equation (5.1) with lagged profits proved to be less successful than equation (5.1).

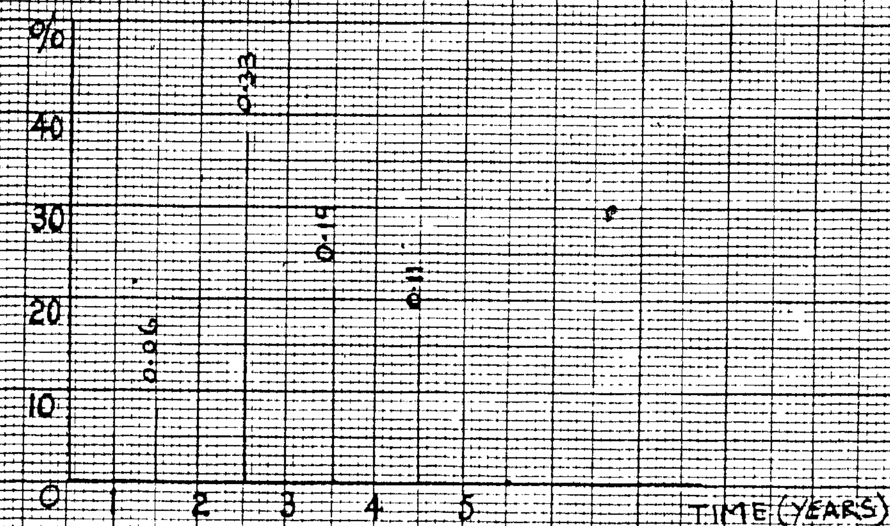
In estimating the flexible accelerator, the procedure followed was to fit the lags directly in the equation, rather

TABLE 6

FORECASTS OF THE FLEXIBLE ACCELERATOR MODEL AND THE NAIVE MODEL FOR THE SAMPLE OF STEEL FIRMS
(IN 1971 CONSTANT DOLLARS)
(1976 - 1978)
$m

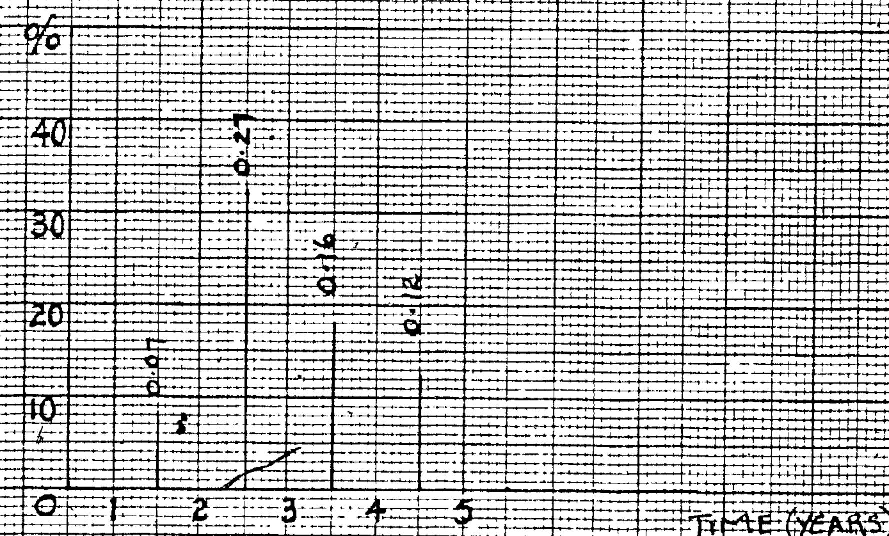
Year	Actual Investment	Forecasts of Investment based on: Accelerator Model	"Naive" Model
1976	217.8	255.5	317.0
1977	200.4	237.6	217.8
1978	176.3	215.9	200.4
MEAN ABSOLUTE ERROR (of the forecasts)		38.2	46.9
MEAN SQUARED ERROR		1457.8	3574.7
ROOT MEAN SQUARED ERROR		38.2	59.8

CHART III



RESPONSE OF INVESTMENT TO ANNUAL SALES CHANGES IN THE STEEL INDUSTRY (UNDEFLATED DATA)

CHART IV



RESPONSE OF INVESTMENT TO ANNUAL SALES CHANGES IN THE STEEL INDUSTRY (DEFLATED DATA) than follow a particular distributed lag scheme e.g., the Almon lag.[27] The method used here avoids the a priori imposition of weights on the lags; the only assumption made is that the lag coefficients are expected to first rise and then fall. The diagrams above describe the lag distributions obtained from the data. The peak response occurs in the second year and declines gradually afterwards. Investment adjusts completely to sales changes after four years.

II(b). THE FLEXIBLE ACCELERATOR--THE PULP AND PAPER FIRMS

Table 7 shows the estimates of equation (5.1) for the sample of pulp and paper firms. Unlike the first sample of steel firms, here the estimates display remarkable diversity. Results are presented for individual firms and for undeflated data.

Some statistical properties of the results are as follows: the coefficients of determination range from a low 22% to 78%; the low $\bar{R}^2$'s are reinforced by F values which are not statistically significant. The residuals plotted against the dependent variable show no unusual patterns, nor is there any strong evidence of serial correlation.[28]

Only two firms appear to conform to the accelerator theory. The two are firms A and E; the accelerator coefficients are 0.53 and 1.18 respectively.[29] The results for the other firms are rather peculiar although there are some possible reasons for the peculiarity.

One reason is the connection of the firms' sales data and the type of capital expenditure undertaken. For firms with a substantial[30] component of lumber sales in overall sales, the

TABLE 7: FLEXIBLE ACCELERATOR MODEL: TIME SERIES DATA 1955-1975 FOR THE SAMPLE OF PULP AND PAPER FIRMS: UNDEFLATED DATA 1/

Variables Investment Expenditures with		FIRM A Abitibi-Price	FIRM B BC Forest	FIRM C Consol. Bathurst	FIRM D Mc.Millan Bloedel	FIRM E Great Lakes Paper
$\frac{S_t - S_{t-1}}{S_b}$	β_1	0.05591 (0.05073)	-0.02875 (0.10640)	-0.04968 (0.12499)	0.25455 (0.15435)	0.29719 (0.27690)
$\frac{S_{t-1} - S_{t-2}}{S_b}$	β_2	0.17603* (0.07727)	-0.12321 (0.14141)	0.14596 (0.09775)	0.02451 (0.17381)	0.73414* (0.32022)
$\frac{S_{t-2} - S_{t-3}}{S_b}$	β_3	0.11128* (0.09398)	-0.14054 (0.12870)	-0.15203 (0.18095)	0.40038** (0.21647)	0.61620 (0.43645)
$\frac{S_{t-3} - S_{t-4}}{S_b}$	β_4	0.13832 (0.12225)	—	-0.19135 (0.19426)	0.07857 (0.23039)	-0.26440 (0.48713)
$\frac{S_{t-4} - S_{t-5}}{S_b}$	β_5	0.05353 (0.11177)	-0.24554 (0.26889)	-0.11290 (0.16658)	0.48544 (0.53223)	-0.19934 (0.41203)
D_t	β_6	-0.00487 (0.00506)	0.05627* (0.02137)	0.02267 (0.01523)	-0.00717 (0.00622)	-0.01328 (0.04558)
Intercept	β_o	0.08152 (0.02589)	-0.06654 (0.22740)	0.04271 (0.09401)	0.25934 (0.11455)	0.08679 (0.20998)
$\bar{R}^2$		0.78153	0.23658	0.77909	0.2273	0.49553
F		12.924*	2.05	12.756*	1.784	4.2743*
DW		1.67	2.09	1.09	0.832	1.1319
Sum of Sales Change Coefficients		0.53508	-0.53804	-0.36010	1.124245	1.18379

FOOTNOTES TO TABLE 7

1/

Not all the firms in the sample had observations for the 1955 - 1975 period.

					OBSERVATIONS
FIRM	A	(Abitibi - Price)	1955 - 1975	(21)	
FIRM	B	(BC Forest)	1958 - 1975	(18)	"
FIRM	C	(Consol-Bathurst)	1955 - 1975	(21)	"
FIRM	D	(Mc. Millan Bloedel)	1959 - 1975	(17)	"
FIRM	E	(Gt. Lakes Paper)	1955 - 1975	(21)	"

* SIGNIFICANT at the 5% level

** SIGNIFICANT at the 10% level

$F\ (6,14)$	=	2.24	10%	$F\ (1,\ 14)$	= 3.10
$F\ (6,14)$	=	2.84	5%	$F\ (1,\ 14)$	= 4.60
$F\ (6,14)$	=	4.45	1%	$F\ (1,\ 14)$	= 8.86

The standard errors are in brackets below the Coefficients.

correlations between investment and sales changes are fairly low.[31] For these firms the nature of their capital expenditures is very different from firms with large newsprint operations. In addition, the newsprint industry does not fluctuate as much as lumber and logging operations. For one firm crude estimates were made for sales which excluded lumber and other products. The regression, in which the crude estimates were used, was not better than the one in Table 7.[32]

Much of the capital expenditure over the sample period took the form of repairing[33] newsprint mills and introducing pollution control equipment. Very few newsprint mills were built entirely new and hence there was no induced investment equalling that of the steel industry. The flexible accelerator provides a good explanation of net induced investment. The link with repair expenditure is not so clear however.

Other reasons for the unsatisfactory results are: (a) some firms experienced fluctuations in sales income because of changes in the exchange rate.[34] Eisner (1960) shows that the accelerator is smaller for firms whose sales are not increasing rapidly; (b) the existence of excess capacity[35] in some years of the sample period; (c) small sample periods which allow few degrees of freedom.

One solution to the problem of diverse results for the individual firms is to apply the model to one of the leading firms. There are economic as well as statistical reasons why Firm A is an appropriate choice. Firm A is the largest newsprint producer[36] and exporter in the Canadian economy.

In direct contrast Firm E accounts for approximately 4% of the newsprint market. Although Firm D is the largest in terms of asset size there are two reasons against a choice of D. First, lumber sales are a substantial component of total sales; secondly there are seventeen observations and seven coefficients to be estimated, which raises questions about the number of degrees of freedom. Statistically the results for Firm A are in accordance with an accelerator model and provide useful answers on the response of investment to demand changes.

Table 8 below contains results of the flexible accelerator based on the price deflated data of Firm A. The results permit comparisons of the size of the accelerator for the two samples. As to be expected the accelerator coefficients for the steel firms are higher than that for the paper firm A. The results conform to the experience of the two industries. Chart V displays the response of investment to sales changes. Here the peak response also occurs in the second year and declines afterwards. The lag sequence follows a simple geometric[37] decline similar to the one obtained for the steel industry.

No forecasts beyond the sample period are made for the pulp and paper group of firms. The sensitivity of the industry to external influences--exchange rate fluctuations and changes in demand--distorts the data on profits and sales. At present the low value of the Canadian dollar places the industry in a strong competitive position and results in improved earnings. The increased earnings have been ploughed

TABLE 8: FLEXIBLE ACCELERATOR MODEL: TIME SERIES DATA: 1955 - 1975

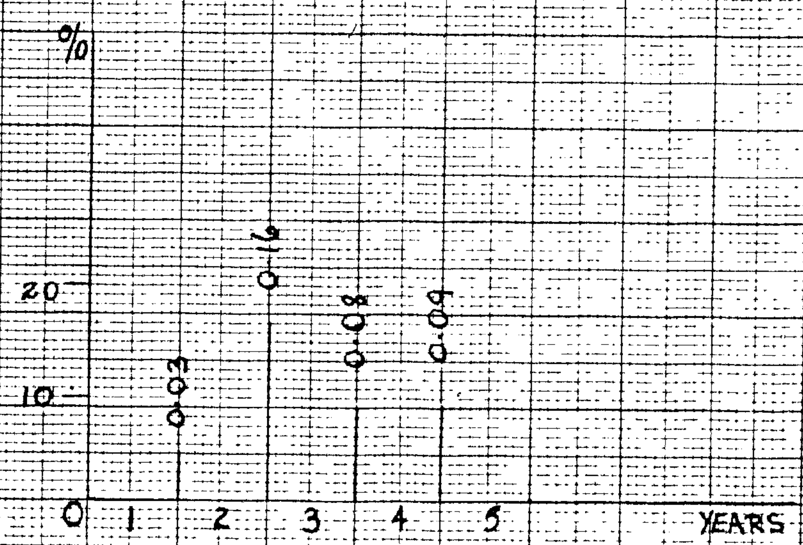
FIRM A

Variables		Deflated Data	
Investment Expenditures with		Coefficients and standard errors	Beta Coefficients
$\frac{S_t - S_{t-1}}{S_b}$	β_1	0.03722 (0.05189)	0·28404
$\frac{S_{t-1} - S_{t-2}}{S_b}$	β_2	0.16528* (0.07780)	0·83852
$\frac{S_{t-2} - S_{t-3}}{S_b}$	β_3	0.08404 (0.09389)	0·28198
$\frac{S_{t-3} - S_{t-4}}{S_b}$	β_4	0.09186 (0.11245)	0·22942
$\frac{S_{t-4} - S_{t-5}}{S_b}$	β_5	0.00804 (0.10109)	0·01994
D_t	β_6	-0.00471 (0.00411)	-0·67409
Intercept	β_o	0.09945 (0.02295)	—
$\bar{R}^2$		0.37673	
F		3.041*	
DW		1.661	
Sum of the sales change Coefficients		0.38644	

See notes to table 7

CHART V

RESPONSE OF INVESTMENT TO ANNUAL SALES CHANGES
FOR FIRM A
DEFLATED DATA



back into investment designed to reduce production costs. As noted above this kind of investment spending is not well explained in an accelerator model.

II(c). A NOTE ON EXPECTATIONS IN THE ACCELERATOR MODEL

The simple accelerator implies that the elasticity of expectations is unity. The elasticity of expectations is defined as percentage changes in expected output divided by percentage changes in actual output. Given this definition, then equation (3.26) is written as

$$I_t^n = \alpha \eta (O_t - O_{t-1}) \tag{3.26a}$$

where η = elasticity of expectations.

Generally η is assumed to be close to unity and stable and thus "α" can be written for "$\alpha\eta$." If $\eta = 0$, then $I_t^n = 0$; if $\eta < 0$, disinvestment occurs because past increases in output are not expected to continue in the future. In practice cases of $\eta < 0$ occur rarely and only cases of $0 < \eta < 1$ are considered.

The elasticity coefficient also carries over into the flexible accelerator and η is absorbed into the value of the flexible accelerator. Thus if the flexible accelerator is less than unity, then it is possible that the elasticity of expectations is also less than unity. In fact Eisner cites this as one reason why empirical values of the accelerator are less than expected from the theoretical analysis (See footnote 23). Eisner's findings of "regressive" expectations in his sales data reinforces this position. With regressive expectations there is a tendency to predict a return toward a situation of the previous period, rather than extrapolate the recent trend. That is for example when sales have increased in this period, they are expected to fall in the next period; when sales have declined they are expected to rise in the next period.

The existence of "regressive" expectations suggests that in general $\eta < 1$ and that the flexible accelerator will be below unity.

II(d). THE LINTNER MODEL

The Lintner model provides the theoretical base for the dividend equation in the simultaneous equation model. Lintner suggests that firms have a target payout ratio "r" which they apply to current earnings. Firms try to maintain the target ratio and adjust dividends upwards very slowly by a fraction "c." Thus

$$D^V_t - D^V_{t-1} = a + c(rP_t - D^V_{t-1}) + e_t \qquad (5.2)$$

where D^V_t = dividends paid out in period t

c = "speed of adjustment" coefficient

P_t = after tax profits in period t

r = target payout ratio

e_t = error term

a = constant term[38]

Equation[39] (5.2) and another variant[40] of equation (5.2) were fitted for the two samples. The regression results for the steel firms are reproduced in Table 9 below. As a group,

TABLE 9

ESTIMATES OF THE COEFFICIENTS OF THE LINTNER MODEL AND THE CASH FLOW VARIATION FOR THE SAMPLE OF STEEL FIRMS (1955 - 1975)

	Profits Model 1/	Cash Flow Model 2/
r	0.5980*	0.3216*
c	0.2211*	0.3152*
Constant term	-1.0119 (2.7273)	-1.2790 (2.917)
$\overline{R^2}$	0.6177	0.5626
F	17.157*	13.866*
DW 3/	2.086	1.782

* SIGNIFICANT at the 5% level

Standard ERRORS are in brackets below the constant term.

1/ See Equation 5.2 above.

2/ In Equation 5.2 the profits term is replaced by the cash flow variable defined in Footnote 40

3/ The Durbin Watson statistic is not strictly applicable when there is a lagged dependent variable on the right hand side of the equation. The bias is not a serious one, but Durbin (1970) suggests instead the use of an "h" STATISTIC. The statistic is approximately normally distributed and applicable for large samples.

the steel firms have a target payout ratio of approximately 60% of current earnings, a ratio which the firms change very slowly. The reaction coefficient "c" which is fairly low at 0.22 is an indication of firms' reluctance to change dividend behaviour.

In the Lintner model, the presence of a constant term raises some complications. One could estimate the equation in the homogeneous form or the nonhomogeneous form and test the statistical significance of the constant term. The second approach was adopted here; the tests show that the constant terms are not significantly different from zero.

Supporters[41] of the cash flow model argue that the relevant variable for dividend decisions is a firm's cash flow. Changes in tax laws, depreciation provisions and tax credits have allowed firms to increase their internal cash flows. Firms then look at these cash flows in deciding on their dividend payments. The argument is valid if liberal depreciation allowances remain in force for a fairly long time. However the Canadian experience has been one of periodic interruptions and uncertainty about the allowances. Once the liberal depreciation allowances are in force uninterrupted for a period of five years or so, the cash flow approach appears to be the appropriate model.[42] For the sample period and the firms in the steel industry, the Lintner model provided better forecasts of dividends than the cash flow model.

The Lintner model works well if firms follow the path outlined on p. 137 above. The model breaks down if dividends remain constant for a long period of time or if dividends are suspended. Between 1969 and 1971 pulp and paper firms lowered and in some instances suspended dividend payments. These policy changes were partly a result of lowered earnings because of the rising value of the Canadian dollar. In one sense there is a structural break in the data and alternative regressions were estimated for a shorter sample period, 1955-1970. The alternative regressions are not for the complete set of five firms nor for the cash flow model.[43] For the shorter sample period two firms have nine and eleven observations respectively. These same two firms have a smaller group of observations for the longer sample period, but their results are presented in Table 10 below.

The reaction coefficients in parts (a) and (b) of the table are all low with one exception. A high reaction coefficient is to be expected from a firm with frequent changes in dividend payments over the sample period. Kuh (1971)[44] points out that the "luxury" of stable dividends may be limited to firms who expect limited fluctuations in their revenues. In general the payout ratios are higher for the newsprint firms than for the lumber producers. The target payout ratios are lower under the cash flow hypothesis than under the Lintner hypothesis.

There are no estimates for Firm E in the table. For this firm, dividends remained constant for a fairly long period of time. Thus over the sample period $D_t^V = D_{t-1}^V$ for many years. In such a situation the dividend model breaks down. Firm C also had dividend payments which were relatively

TABLE 10

ESTIMATES OF THE COEFFICIENTS OF THE LINTNER MODEL AND THE CASH FLOW VARIATION FOR THE SAMPLE OF PULP AND PAPER FIRMS (1955 - 1975)[1]

(a) The Lintner Model

Firms	cr	c^P	r^P	$\bar{R}^2$	DW	F
A	0.19495*	0.24987	0.7802	0.68112	1.55	22.35*
B	0.08673	0.22479	0.3858	0.01048	1.75	1.99
C	0.24623*	0.27086*	0.9090	0.77556	1.64	35.55*
D	0.25029	0.76252*	0.3280	0.75140	3.29	25.19*
E[2]						

(b) The Cash Flow Model

	cr	c^{CF}	r^{CF}	$\bar{R}^2$	DW	F
A	0.06312*	0.34557*	0.1826	0.23689	1.35	4.1043*
B	0.05853	0.31181	0.1909	0.13231	1.69	2.29
C	0.13683*	0.18633*	0.7343	0.43706	1.57	8.76*
D	0.17394*	1.02273*	0.1700	0.69768	2.21	19.46*

TABLE 10
(continued)

(c) The Lintner Model (1955 - 1970)

Firms	cr	c^p	r^p	$\bar{R}^2$	DW	F
A	0.24980*	0.39054	0.6396	0.62934	2.035	13.73*
C	0.42777*	0.64766*	0.6605	0.58222	1.34	11.4520*

(d) The Lintner Model (1955 - 1975)
For the Sample of Pulp and Paper
Firms (All 5)

Firms	cr	c^p	r^p	$\bar{R}^2$	DW	F
All Paper	0.18132*	0.45846*	0.3954	0.64673	2.01	19.307*

*Significant at the 5% level

1/ See Table 7 and the notes to table 7 for the firms and the number of observations for each firm.

2/ This firm had 1 change in dividend policy over the sample period. The Lintner model breaks down for this case i.e. $D_t^V = D_{t-1}^V$ for almost all t.

See also footnote 3 of Table 9.

constant for about five years. A decision was made to include Firm C's results with the others in the table.

The regression estimates for the shorter sample are listed in part (c) of the table. The payout ratios are relatively lower and the reaction coefficients higher than those of the 1955-1975 period. The results are close to the actual average payout ratios which occurred over the sample period.[45]

Finally part (d) of Table 10 reveals the estimates for the group of pulp and paper firms. Care must be exercised in the interpretation of the results because of the problems mentioned above. Inter industry comparisons show that the payout ratio is lower and the reaction coefficient higher than that of the steel firms. The result is in part a consequence of the suspension of dividend payments over the 1969-1971 period.

The estimates presented in Table 10 are generally consistent with those obtained by Chateau (1976). Several features distinguish the two approaches: Chateau uses a cash flow model and has as the dependent variable dividends per share; he argues that the variable dividends per share captures the problem of new equity issues, firm takeovers and mergers;[46] his estimating technique is augmented least squares (see Feldstein, 1970) and the sample extends from 1947-1970 for 40 Canadian firms. Chateau obtains payout ratios (out of cash flows) for the ferrous and nonferrous group of 0.22 and 0.32 for the pulp and paper group. Within the pulp and paper group newsprint firms have higher payout ratios; this characteristic is also common to the estimates in Table 10 above. There are also differences in the actual sizes of the coefficients obtained by Chateau[47] and those reported in this thesis. The differences reflect the assumptions of the two models and a different sample period.

As already noted, the cash flow hypothesis is acceptable when accelerated capital cost allowances enjoy an uninterrupted life. The Canadian experience of the allowance does not reflect this feature. The major proportion of the accelerated allowances to the pulp and paper firms are conditional allowances. They must be spent on anti-pollution equipment and there is clear evidence that the firms made this type of investment. Thus a cash flow model is not strictly valid for this group of firms.

In this section estimates are outlined for the basic Lintner model of dividend behaviour. The results confirm Lintner's hypothesis that firms adjust dividends in line with a target payout ratio. The cash flow variant of the model is not as appropriate as the profits model for the firms in the two samples. In the next section the investment and dividend equations are combined to form part of the simultaneous equation model.

III. THE SIMULTANEOUS EQUATION MODEL

A. The Sample of Steel Firms

The results outlined in Section II prepared the groundwork for the simultaneous equation model. The three equations of the model are:

$$I_t = f_1(S^*, D^V_t, EF_t, D_t) \qquad (5.3)$$

$$D^V_t = f_2(P_t, I_t, EF_t, D^V_{t-1}) \qquad (5.4)$$

$$EF_t = f_3(D^V_t, I_t, D_t, P_{t-1}, C, L^V) \qquad (5.5)$$

where the variables[48] not defined on p. 110 are:

C = cost of external borrowing, measured by interest payments as a ratio of long term debt

L^V = measure of leverage--the ratio of long term debt to the value of the firm

$S^* = \frac{S_t - S_{t-3}}{S_{t-3}}$ = an accelerator measure

The above model differs in a number of ways from the Dhrymes-Kurz (1967) version. The most important difference is in the dividend equation. Dhrymes and Kurz do not support the Lintner formulation and omit the lagged dividend variable. Another difference is the inclusion of the depreciation variable in the investment equation. The depreciation variables can be explained either as a measure of available funds or as an imperfect measure of the age of the capital stock. Thus it can be expected to have some explanatory power for investment.

In the investment equation, the accelerator variable is expected to have a positive impact on investment. Dividends and investment compete for funds and hence the coefficient of the dividend variable is expected to be negative. On the other hand external financing will have a positive effect on investment expenditures. In the model, external financing consists only of long term borrowing. The borrowing permits a firm to carry out investment projects unimpeded by lack of sufficient internal funds.

For the dividend equation, the main changes between equation (5.2) and equation (5.4) are the inclusion of the two jointly dependent variables. Investment and dividends will be negatively related to each other. The ability to borrow allows the firm to maintain a stable policy for dividend payments.

In the external finance equation, external borrowing is expected to be positively related to investment, but negatively to depreciation, profits and the cost of finance. Although the cost of borrowing is measured simply by the ratio of interest costs to long term debt, the variable should prove to be negative and significant. The leverage measure which incorporates an element of risk should be negatively related to the amount of external finance.

There are two other differences to be noted between the Dhrymes-Kurz (1967) version and the model presented below. First Dhrymes-Kurz deflated some of their variables by sales and some by a capital stock variable; this procedure was criticized by Latané (1967) and Resek (1967) in their comments on the paper. Their criticisms are generally valid and the same procedure is not followed here. Next, Fama (1974) noted that the Dhrymes-Kurz model is more consistent with time-series models applied to individual firms than the cross-section approach followed by the two researchers. In our case we choose to utilize the time series approach for individual firm data.

Statistically[49] the model raises questions about the method of estimation. Possible methods of estimation are ordinary least squares (OLS), two stage least squares (2SLS), or any other method of estimating simultaneous equations.[50] Following Johnston (1972), OLS is biased in a system of simultaneous equations. The other methods of estimation also yield biased estimates, but the estimates are consistent. Arguments in support of 2SLS and other methods of estimation stress the properties of consistency and asymptotic efficiency. These properties are large sample properties and give no information about the small sample properties of various estimators. Monte Carlo studies yield no conclusive evidence, because the studies find little differences among the estimators. (See the discussion in Johnston: 1972, pp. 408-420 for example.) Given the inconclusive evidence on the small sample properties, the method of estimation chosen here is ordinary least squares.

There are a number[51] of arguments to support the use of OLS for this batch of regressions: the OLS and 2SLS coefficients will not be significantly different from each other; OLS is biased but in some situations is more robust against specification errors than other methods. The strongest argument in favour of OLS is that in small samples one cannot reject the estimator because of a large sample property.

The procedure followed below is to examine both the OLS and 2SLS results. The differences between the two results are noted but the OLS estimates are employed for forecasts and other statistical analysis. An assessment of the regression results considers how well the model explains investment behaviour. The significance of the external finance variable in the investment equation is also very important.

Tables 11(a) to 11(c) give the results for the sample of steel firms. The investment equation has a fairly good fit as measured by $\bar{R}^2$; the overall F statistic is also highly significant and confirms the heterogeneity of the regression coefficients. Except for the intercept term and the depreciation variable, the regression coefficients are significant at the 10% level. Finally plots of the standardized residuals do not display any irregularities.

The investment equation has a number of interesting properties. The first is the relative[52] strength of the external finance variable, which is very significant. The results support *a priori* expectations and confirm that firms financed their investment spending by external borrowing. The inadequacy of retained earnings and the need for outside financing are representative of conditions very different from that of an earlier period.[53]

As mentioned above, the depreciation variable has dual characteristics. However the variable is better interpreted as a short term financial variable because policymakers tinker with the determinants of depreciation expenses. The depreciation variable has a negative coefficient which is not statistically significant. This result for the depreciation variable is discussed later in the chapter.

The dividend variable is significant but has a wrong sign.

TABLE 11(a)

THE INVESTMENT EQUATION FOR THE SAMPLE OF STEEL FIRMS UNDEFLATED DATA: 1955 - 1975

	OLS coefficients and t - ratios	Beta coefficients	2SLS coefficients and t - ratios	Beta coefficients
Intercept	-0.97238 (-0.02992	0	-1.76881	0
S^*	79.41401 (2.24020	0.17694	82.33719	0.18345
D^V (Dividends)	3.31264 (1.74572)	0.64264	4.13484	0.80047
EF	0.52003 (3.36916)	0.41733	0.49036	0.38913
D (Depreciation)	-0.34465 (-0.31060)	-0.10078	-0.82575	-0.24146
$\bar{R}^2$	0.8994			
F	45.729			
DW	2.60			

(a) The errors are assumed to be normally distributed

(b) The F statistic measures the overall fit of the equations

(c) The Durbin Watson (DW) statistic tests for the presence of serial correlation among the error terms

TABLE 11(b)

THE DIVIDEND EQUATION FOR THE SAMPLE OF STEEL FIRMS UNDEFLATED DATA 1955 - 1975

	OLS coefficients and t - ratios	Beta coefficients	2SLS coefficients and t - ratios	Beta coefficients
Intercept	-0.12442 (-0.04772)	0	-1.45941	0
D^V_{t-1}	0.72509 (11.0022)	0.66779	0.66204	0.60972
P	0.11832 (4.7139)	0.27791	0.09081	0.21329
I	0.01179 (0.67103)	0.06079	0.06137	0.30472
EF	0.00943 (0.60371)	0.03904	-0.02622	-0.10725
$\overline{R}^2$	0.9828			
F	286.685			
DW	2.38			

See notes to Table 11(a)

TABLE 11(c)

THE EXTERNAL FINANCE EQUATION FOR THE SAMPLE OF STEEL FIRMS UNDEFLATED DATA: 1955 - 1975

	OLS coefficients and t - ratios	Beta coefficients	2SLS coefficients and t - ratios	Beta coefficients
Intercept	-121.41020 (-7.9092)	0	-121.05731	0
L^V	747.82610 (9.3888)	0.70411	698.37175	0.65755
C	-780.21610 (-1.5495)	-0.14197	-459.17716	-0.08355
I	0.17158 (1.6614)	0.21382	0.33382	0.40068
D^V	4.61103 (3.5395)	1.11466	4.72314	1.13939
P_{t-1}	-0.35993 (-0.9796)	-0.20430	-0.62242	-0.35328
D	-1.97010 (-3.060)	-0.71787	-2.19133	-0.79847
$\bar{R}^2$	0.9651			
F	93.338			
DW	1.95			

See notes to table 11(a)

In one sense this contradicts the assumptions of the simultaneous equation model. One possible explanation of the positive coefficient is that there are feedbacks between investment and dividends. Over time as investment increases, dividends will also increase because of an improved earnings position.

Table 11(b) details the results of the dividend equation. The measures of goodness of fit confirm that the equation is well explained and there are no patterns of correlation among the error terms. However the coefficients of the two jointly dependent variables are small and not statistically significant. The results imply that for this particular sample of firms the dividend decision is independent[54] of the other two decisions. The role of the intercept term is similar to that discussed above on p. 139. In the model the payout ratio is smaller than that obtained in equation (5.2) above and closer to the actual average payout ratio.[55]

The external finance equation also has a good fit with three significant coefficients, although one has the wrong sign. The other coefficients maintain their expected signs but are not statistically significant. One interesting aspect of the results is that the leverage variable has the wrong expected sign. The leverage variable measures the extent to which firms finance their activities through debt and also contains an element of the risk inherent in borrowing. A negative coefficient would support Kalecki's "principle of increasing risk." The results show that for the sample of steel firms, neither limitations on capital nor the increasing cost of capital created barriers for the firms. The rate of interest measured by the cost variable is appropriately negative, but appears to be not a dominant variable in the equation. Similar arguments can be made for the profit and to a lesser extent the depreciation variables. Both variables are negatively related to the amount of external borrowing. As retained earnings decline, the amount of external funds increases. When investment increases and dividends are unchanged, the new sources of funds meet the gap left by internal funds. The results for equation (5.5) generally support the hypothesis of the simultaneous equation model.

Earlier, a strong case was made for the use of OLS in a simultaneous equation model. The argument is reinforced by comparisons between the OLS and 2SLS estimates. The tables reveal that there are no major differences between the two estimates.[56] There are no dramatic changes in sign or size from one method of estimation to the next. There seems to be very little to gain from any of the other methods of estimation (LIML or FIML).

One question to be answered is how well the equations forecast investment spending beyond the sample period. Estimates based on the price deflated data were used to obtain the forecasts. The additional estimates required for this test are found in Tables 12(a) to 12(c). The results show no marked differences from those of the undeflated data.

How well the equations forecast beyond the sample period will depend on a number of factors: the model's structure; the

TABLE 12(a)

THE INVESTMENT EQUATION FOR THE SAMPLE OF STEEL FIRMS DEFLATED DATA: 1955 - 1975

	OLS coefficients and t - ratios	Beta coefficients	2SLS coefficients and t - ratios	Beta coefficients
Intercept	0.08139 (0.20321)	0	0.09322	0
S^*	66.29910 (1.89535)	0.26379	69.94271	0.27828
D^V (Dividends)	3.74669 (1.85481)	0.75487	4.84945	0.97146
EF	0.52563 (2.90034)	0.44433	0.49886	0.40067
D (Depreciation)	-0.67085 (0.5079)	-0.19032	-1.35742	0.38510
$\bar{R}^2$	0.6813			
F	11.692			
DW	2.67			

See notes to Table 11(a)

TABLE 12(b)

THE DIVIDEND EQUATION FOR THE SAMPLE OF STEEL FIRMS DEFLATED DATA: 1955 - 1975

	OLS coefficients and t - ratios	Beta coefficients	2SLS coefficients and t - ratios	Beta coefficients
Intercept	-0.00289 (-0.09850)	0	-0.02920	0
D_{t-1}	0.75902 (10.78459)	0.75126	0.68958	0.68252
P	0.10618 (3.46540)	0.23312	0.08274	0.08166
I	0.01410 (0.86769)	0.07003	0.06961	0.30348
EF	0.00259 (0.16106)	0.01091	-0.03558	-0.14185
$\overline{R}^2$	0.9578			
F	114.715			
DW	2.27			

See notes to Table 11(a)

TABLE 12(c)

THE EXTERNAL FINANCE EQUATION FOR THE SAMPLE OF STEEL FIRMS
DEFLATED DATA: 1955 - 1975

	OLS coefficients and t -ratios	Beta coefficients	2SLS coefficients and t - ratios	Beta coefficients
Intercept	-2.42605 (-10.61775)	0	-2.45561	0
L^V	814.21850 (6.22728)	0.69591	748.53932	0.63977
C	-1039.577 (-1.83969)	-0.19529	-620.80572	-0.11661
I	0.22844 (1.73613)	0.27025	0.48663	0.50559
D^V	3.73782 (2.22339)	0.89088	3.29943	0.78190
P_{-1}	-0.07730 (-0.16122)	-0.03957	-0.41289	-0.21135
D	-0.54805 (-0.66864)	0.18394	-0.55010	-0.18462
$\bar{R}^2$	0.8548			
F	20.636			
DW	1.74			

See notes to Table 11(a)

TABLE 13

FORECASTS OF THE INVESTMENT EQUATION OF THE SIMULTANEOUS EQUATION MODEL FOR THE SAMPLE OF STEEL FIRMS
(in 1971 Constant dollars)
$m

Year	Actual Investment	Forecasts based on OLS Estimates
1976	217.8	266.0
1977	200.4	217.7
1978	176.3	184.7
MEAN ABSOLUTE ERROR (of the forecasts)		24.6
MEAN SQUARED ERROR		897.6
ROOT MEAN SQUARED ERROR		29.9

fact that large changes in the prices of capital goods occurred towards the end of the sample period and beyond. (See Chart II above.) After 1975, investment in the steel sector was sluggish and recovered only in 1979. Despite these factors, the OLS model forecasts reasonably well compared to the naive model. Forecasting too far outside the sample period is not generally recommended for this model. For the sample of steel firms, a number of interesting features stand out. There is the general downturn in investment spending mentioned previously. Over the same period, firms continued to obtain additional outside financing, partly from more borrowing and partly by a return to preferred shares.[57]

External borrowing attained its peak during the sample period while equity financing declined. Since the mid 1970's there has been a shift away from bond financing towards equity and other hybrid methods.[58] To use this model for further work, the finance equation must be adjusted accordingly.

B. The Pulp and Paper Firms

Before discussing the results for the pulp and paper group, the peculiarities in the data must be stressed. First, the data consists of information for five firms, but only three of the firms have observations for the full sample period. Next, the sensitivity of the industry to external changes distorts the data and certainly affected dividend policy over the 1969-1971 period. In the previous section we used the data of the largest newsprint firm to obtain results for the flexible accelerator model. It is inappropriate to follow the same procedure here; for example the external finance variable has missing observations because a single firm will not venture into the capital markets every year. What is important is to obtain regression results which reflect the behaviour of the pulp and paper group. Despite the difficulties the results are in keeping with what we expected.

The OLS estimates of the simultaneous equation model in Tables 14(a) to 14(c) are well explained in terms of $\bar{R}^2$'s and F values. The Durbin-Watson statistic suggests there is no evidence of positive first order autocorrelated error terms. Plots of the residuals display no unusual patterns.

In the investment equation, the accelerator and external finance variables provide good explanations of investment activity. The result parallels that of the steel firms. The same is not true of the coefficient for the depreciation variable which is positive and highly significant here but was negative and not significant for the steel firms. The dual nature of the depreciation variable and its relative importance to both industries are discussed later.

The regression estimates for the dividend equation are similar in almost all respects to those for the sample of steel firms. The two jointly dependent variables are negative, small and insignificant. The poor showing of the two variables provides additional support for representing the firms' behaviour as recursive rather than simultaneous. Wold[59] has argued consistently that economic relationships are recursive in nature. In recursive systems, each dependent

TABLE 14(a)

THE INVESTMENT EQUATION FOR THE SAMPLE OF PULP AND PAPER FIRMS
UNDEFLATED DATA: 1955 - 1975

	OLS coefficients and t - ratios	Beta coefficients	2SLS coefficients and t - ratios	Beta coefficients
Intercept	-70.87459 (-2.31400)	0	-81.93355	0
S^*	67.70698 (2.83196)	0.21782	70.92250	0.22816
D^V (Dividends)	2.21806 (4.04598)	0.33554	2.54416	0.36563
EF	0.34300 (2.56885)	0.25192	0.29523	0.18891
D (Depreciation)	1.21167 (5.66559)	0.52632	1.21223	0.52656
$\overline{R}^2$	0.89335			
F	42.88090			
DW	2.05			

See notes to Table 11(a)

TABLE 14(b)

THE DIVIDEND EQUATION FOR THE SAMPLE OF PULP AND PAPER FIRMS
UNDEFLATED DATA: 1955 - 1975

	OLS coefficients and t - ratios	Beta coefficients	2SLS coefficients and t - ratios	Beta coefficients
Intercept	0.97827 (0.14039)	0	8.03725	0
D^v_{t-1}	0.69411 (4.8065)	0.74013	0.49784	0.53085
P	0.20139 (3.60913)	0.64039	0.32116	1.02122
I	-0.00894 (-0.22046)	-0.05914	-0.14294	-0.91960
EF	-0.04189 (-0.95858)	-0.20340	0.15846	0.67028
$\bar{R}^2$	0.75878			
F	16.728			
DW	2.30			

See notes to Table 11(a)

TABLE 14(c)

THE EXTERNAL FINANCE EQUATION FOR THE SAMPLE OF PULP AND PAPER FIRMS UNDEFLATED DATA: 1955 - 1975

	OLS coefficients and t - ratios	Beta coefficients	2SLS coefficients and t - ratios	Beta coefficients
Intercept	53.73834 (1.44337)	0	38.54148	0
L^V	96.22505 (1.40071)	0.31577	235.91423	0.77415
C	-1942.829 (2.50798)	-0.43666	-1364.65	-0.30671
I	0.155909 (0.58355)	0.21228	-0.38275	-0.50717
D^V	-1.58136 (-1.67481)	0.32572	0.55455	0.10850
P_{t-1}	1.39010 (3.28176)	0.93254	1.73007	1.16060
D	—	—	-0.38462	-0.22748
$\bar{R}^2$	0.70784			
F	10.691			
DW	2.35			

See notes to Table 11(a)

variable enters the system one by one; instead of simultaneous determinations there are causal chains. Lintner (1967) takes a similar position when he suggests that the dividend decision is determined first, then the debt-equity and investment decisions follow.

The estimate of the target payout ratio calculated from the dividend equation is higher than that obtained in Section II. The 65% ratio obtained (from the OLS regression) is close to the individual firm ratios tabulated in part (c) of Table 10.

To analyse the external finance equation, it is interesting to look at the four sets of regression coefficients (OLS and 2SLS for the deflated and undeflated data). The cost, leverage and, to a lesser extent, the investment variables all have their expected signs. Again there is no strong indication that the "principle of increasing risk" affects the paper and pulp firms. One possible reason is that firms in the steel and paper industries have not approached the upper limits of borrowing capacity. For the sample period and the eight firms in the overall sample the average leverage ratios are 21% (steel) and 43% (pulp and paper). See Appendix Tables A3 and A4. These ratios are generally below the averages for the manufacturing sector.[60] With one exception the coefficients of the depreciation variable are negative in the external finance equation. The exception may well be explained in terms of the algorithm used to compute OLS.[61]

The positive relation between lagged profits and external finance does not support the view that external finance is

TABLE 15(a)

THE INVESTMENT EQUATION FOR THE SAMPLE OF PULP AND PAPER FIRMS DEFLATED DATA: 1955 - 1975

	OLS coefficients and t - ratios	Beta coefficients	2SLS coefficients and t - ratios	Beta coefficients
Intercept	-0.68443 (-1.27752)	0	-0.44753	0
S^*	52.52063 (1.90026)	0.27279	39.36808	0.20447
D^V (Dividends)	1.55994 (2.50998)	0.32286	1.29203	0.24993
E^F	0.50830 (3.02654)	0.41840	0.75481	0.50215
D (Depreciation)	1.35734 (3.77849)	0.56069	1.11179	0.45926
$\overline{R}^2$	0.71656			
F	13.640			
DW	2.05			

See notes to Table 11(a)

TABLE 15(b)

THE DIVIDEND EQUATION FOR THE SAMPLE OF PULP AND PAPER FIRMS DEFLATED DATA: 1955 - 1975

	OLS coefficients and t - ratios	Beta coefficients	2SLS coefficients and t - ratios	Beta coefficients
Intercept	-0.01015 (-0.13845)	0	0.08866	0
D^{v}_{t-1}	0.74083 (6.35539)	0.75277	0.58757	0.59740
P	0.21153 (3.81575)	0.50379	0.36805	0.87653
I	-0.01218 (-0.31464)	-0.05888	-0.21574	0.97945
EF	-0.03485 (-0.82764)	-0.13862	0.24652	0.79239
$\bar{R}^2$	0.7754			
F	18.2628			
DW	2.26			

See notes to Table 11(a)

TABLE 15(c)

THE EXTERNAL FINANCE EQUATION FOR THE SAMPLE OF PULP AND PAPER FIRMS DEFLATED DATA: 1955 - 1975

	OLS coefficients and t - ratios	Beta coefficients	2SLS coefficients and t - ratios	Beta coefficients
Intercept	0.07648 (0.17566)	0	-0.17997	0
L^V	109.2853 (1.06113)	0.34320	140.76526	0.44205
C	-1021.343 (0.82583)	-0.18678	-1056.58	-0.19322
I	0.24496 (0.87063)	0.29761	0.14778	0.16870
D^V	-0.72222 (-0.84142)	-0.18160	0.02266	0.00532
P_{t-1}	1.05737 (1.82455)	0.56531	0.99743	0.53326
D	-0.43454 (-0.61318)	-0.21808	-0.42917	0.21537
$\bar{R}^2$	0.49910			
F	4.321			
DW	2.42			

See notes to Table 11(a)

sought when retained earnings are insufficient. However one study[62] on the forests products industry pointed out the following: industry officials insist that accelerated write offs and other measures are relied on to improve retained earnings and enhance their ability to raise capital. Lending institutions presumably ensure themselves that firms' generate sufficient cash flows to meet their obligations. Note that the sign on the lagged profits variable is opposite to that obtained for the steel firms.

In general the OLS and 2SLS estimates are not significantly different from each other. Table A8 of the Appendix illustrates the differences between the two estimates. Except for two cases there are no dramatic changes in sign or size for the deflated and the undeflated data.

Interindustry comparisons reveal some interesting features. Dividend payout ratios are higher for firms in the pulp and paper industries than for the steel firms. Note that Chateau's (1976) cash flow model produced similar findings. Firms experienced no serious barriers in their access to external finance. Over the sample period, firms used a judicious mix of retained earnings, stock financing and external borrowing. Borrowing dominates total sources of finance, especially for the steel firms, (see Chart I of Chapter Six below) but capital cost allowances do not have the same importance for the two sectors. The differences show up in the regression coefficients of the depreciation variables.

The depreciation variable has a dual role in models of investment. One possibility is that depreciation serves as a measure of the age of the capital stock. However policy-makers frequently change depreciation rates and the variable is no longer an adequate proxy for the age of the capital stock. The second possibility recognises that policymakers alter depreciation rates for tax purposes. In this case depreciation captures the relationship between investment and increases in these cash flows. This explanation fits the regression results which are summarised in Table 16. A positive significant coefficient implies that increases in cash flows from accelerated depreciation have a positive effect on investment expenditures.

In the flexible accelerator model, the depreciation variables are positive and highly significant for the two samples. Here the depreciation variable acts as a proxy measure of finance available to the firm. In the simultaneous equation model, the coefficients of the depreciation variable change sign and significance for the steel firms. These changes reflect the fact that faster write offs are more important to the pulp and paper firms than to the steel firms. Capital cost allowances which are conditional on special categories of investment serve a useful purpose in the forest products industry. The 1972 tax changes also generated additional funds for the firms in the industry. The amounts earned by the pulp and paper firms are almost double those of the primary metals industry.[63] The negative coefficients for the steel firms confirm Laing's (1973) contention that faster

TABLE 16

REGRESSION COEFFICIENTS OF THE DEPRECIATION VARIABLE IN:-

(a) The Flexible Accelerator Model

	Undeflated	Deflated
All Steel	0.00172	0.00127
All Paper 1/	0.00237	0.00166

Note: All four coefficients have t - ratios greater than 2.

(b) The Investment Equation of the Simultaneous Equation Model

	Undeflated		Deflated	
	OLS	2SLS	OLS	2SLS
All Steel	-0.34465	-0.82575	-0.67085	-1.35742
All Paper	1.21167	1.21223	1.35734	1.11179

Note: Only the coefficients for the pulp and paper firms have t - ratios greater than 2.

1/ See Appendix Table A6

Source: Tables: 5, 11(a), 12(a), 14(a), 15(a) write offs are unlikely to have an impact on investment. The statement referred to the 1972 tax changes specifically, but is also applicable to earlier instances of rapid write offs.

In the next section the regression estimates are used to calculate elasticity coefficients. The elasticity coefficients provide an indirect test on the effects of tax incentives.

IV. FURTHER ANALYSIS OF THE REGRESSION ESTIMATES

There are four main conclusions to be drawn from the empirical analysis of the previous sections. First changes in sales (a proxy for demand) are a major determinant of investment spending in the steel and pulp and paper industries. Secondly investment does not respond immediately and automatically to changes in demand. Instead the response is spread out, for example over a period of four years in the steel industry. In the steel industry technological change has accompanied the response of the industry to changes in demand. This factor created a downward bias in the value of the accelerator coefficient. In the pulp and paper industry improvements to existing capacity have accompanied the changes in demand for the industry's output. Next, accelerated capital cost allowances improve a firm's internal cash flow, but these funds are inadequate for the financing of investment projects especially in the iron and steel sector. Inadequate internal funds must be supplemented by borrowing and stock financing. For the pulp and paper firms increased cash flows from depreciation allowances assist in their gaining access to external finance. Finally there is clear evidence of the link between decisions to pay dividends, invest and obtain external finance.

Comparisons between the empirical results here and those of other studies yield useful insights into the investment process. It is worth noting whether the results bear out the assumptions of the hypothetical policymakers' model outlined in Chapter Two. The policymakers' implicit model assumes: (a) existing profitable investment opportunities are not taken up because the corporate income tax reduces the cash flows of firms; (b) once a firm increases its cash flows new investment occurs immediately and automatically; (c) there is perfect symmetry between increases in investment and changing cash flows. The results we have obtained are not consistent with the assumptions of this policymakers' model. There is no evidence of instantaneous adjustment of investment to its determinants. The modal impact occurs between the second and third years after changes in demand. One conclusion which must be drawn here is that policymakers ought not to seek policy tools which would guarantee immediate short term gains. For the investment process, such tools probably do not exist. In addition a liberal depreciation policy cannot contribute substantial increases to total sources of funds to a firm (see Chart I below in Chapter Six). **For the steel firms** the additions are marginal.

The analytic results in Sections II and III demonstrate that there is no direct link between changes in tax policy and changes in investment. The main determinant of increased investment is demand (sales variable); capital cost allowances play a subordinate role. One measure of the indirect link is given by the elasticity of investment with respect to depreciation. Table 17 lists three different elasticities calculated from the simultaneous equation model. From the Table it follows that a 1% increase in borrowing leads to 1/5% increase in investment for the sample of steel firms and less than 1/5% for the pulp and paper firms. A 1% change in demand also generates similar results for the two samples.

The relative sizes of the elasticity of investment with respect to the S^* variable confirm the findings of the flexible accelerator model for the two sectors. The most important aspect of the elasticity of investment to depreciation is the algebraic sign. The depreciation variable in the regression equation measures the absolute amounts of depreciation available to the firm. To capture the effects of tax changes one must consider the increments to depreciation allowances. Thus investment increases by about ½% when there are faster write offs for the pulp and paper firms; but there appears to be no significant increase in investment for the sample of steel firms.

If policymakers want to increase investment in a particular sector, they will obtain reasonable results if demand for the sector's output is stimulated. The flexible accelerator implies that the increase in investment will be spread over a long period of time. Also, policymakers ought to tie

TABLE 17

ELASTICITY MEASURES DERIVED FROM THE SIMULTANEOUS EQUATION MODEL 1/

	Elasticity of Investment With Respect To		
	S^*	EF	D
All Steel	0.2	0.2	-
All Paper	0.1	0.1	0.5

1/ See Appendix Table A9 for the formulas used to calculate these elasticities

Source: Based on data from Tables 11(a) - 11(c) and 14(a) - 14(c) accelerated capital cost allowances to particular types of investment spending[64] e.g. pollution control equipment; in this way the allowances are more meaningful to the firm.

In one respect the empirical findings here are in agreement with those of the Tax Measures Review Committee (1975). The Committee found that 80% of the increased investment from the 1972 tax changes occurred between 1974 and 1975. The Committee's Report clearly acknowledge the existence of lags in the investment process. This position conforms closely to our discussion in Chapter Two, Section Four and the estimates presented above in the second section.

Harman (1977) uses Coen's adaptation of the neoclassical model to examine investment and tax incentives in Canada. He estimated that after the 1972 tax changes, increased cash flows led to a 1%[65] increase in investment in the manufacturing sector. Harman's figure is much more optimistic than our estimates obtained above. Harman believes that the use of distributed lag models yields estimates for the modal impact of tax policy well beyond the period after a policy is introduced. He suggests that models be developed to enable policy effects to be constrained in time. The suggestion overlooks the administrative lags which occur whenever a tax policy is introduced.

Consider the faster writeoffs for manufacturing and processing firms introduced on 8 May 1972 and to come to an end on 31 December 1974. At first glance it appears that firms have 32 months to plan and put into place particular pieces of machinery and equipment. Draft Regulations and final Regulations were published on 28 July 1972 and 30 August 1973 respectively. At least two features of the Regulations must be underlined. The Regulations define the meaning for tax purposes of "manufacturing and processing" and they also detail depreciable property eligible for the allowances. Thus over a year passes before firms know whether their particular activity constitutes "manufacturing or processing." Firms had about 15 months to install their new equipment before the original expiry date. For the steel firms "it takes eighteen months to plan and three years to construct and put into operations major productive facilities."[66] Clearly the incentives had little or no effect on this subsector of manufacturing.

V. SUMMARY

In this chapter two investment equations are estimated for samples of steel and pulp and paper firms. The flexible accelerator illustrates the importance of demand changes for increasing investment spending. The simultaneous equation model focusses on the interrelationship of three decisions. The model attempts to integrate the real and financial sectors in the investment decision. The model posits a simultaneous relationship between investment, dividend and financial decisions. The regression estimates suggest a modification of the hypothesis from a simultaneous relationship to a recursive one.

The simultaneous equation model emphasizes the importance of external finance in the investment decision. The results reflect the trend in statistics for the manufacturing sector. The statistics reveal that over the sample period cash requirements are not adequately supported by internal funds. Firms have had to reinforce gross retained earnings with bond finance, new equity issues and to a lesser extent preferred shares. Over the sample period borrowing replaced preferred issues as an important source of finance. The equations make clear the limited role capital cost allowances play in financing investment spending. The implications of the limited role are explored in the next chapter.

FOOTNOTES

[1]This characteristic is important within the context of tax incentives and investment spending. Many of the early tax incentives required applicants to have some degree of Canadian ownership. For example between 13-6-63 and 1-1-67 all firms which applied for faster write offs on certain classes of assets had to possess at least 15% Canadian ownership.

[2]Between 1955 and 1964 the two sectors accounted for 30% of earned capital cost allowances. In 1969 Statistics Canada reclassified a number of firms from the primary metals sector to the mining sector. (See notes to Table 1, p. 115) Since 1970 the two sectors now account for 25% of earned capital cost allowances. Other manufacturing subsectors which earn large amounts of capital cost allowances are the petroleum, chemicals and transport sectors.

[3]The heterogeneous collection can be divided into those with substantial Provincial Government investment and other firms. Among this collection, some firms have had considerable financial difficulties and one became bankrupt in 1977; two are subsidiaries of United States conglomerates, and separate financial information is difficult to obtain for a fairly long time series. For a recent study on corporate dualism in the steel industry see Study No. 19: Corporate Dualism and the Canadian Steel Industry, Royal Commission on Corporate Concentration, February 1977, Ottawa.

[4]Estimates of the effects of changing Exchange Rates are always found in the Annual Reports of pulp and paper firms. For example: "Thoughout much of the year, the Canadian dollar traded at or above par with the U.S. dollar. Since a very large proportion of the company's total production is sold in markets calling for payment in U.S. dollars, the effect on net revenues as compared to a situation in which the Canadian dollar is trading at a discount is obviously damaging.

"For each percentage point by which the Canadian dollar exceeds par, the net after tax effect on the company's profits is approximately $1.8 million." p. 11, MacMillan Bloedel Limited 1972 Annual Report.

[5]The last major expansion in the industry took place in the 1950's; since most of the equipment lasts for about 25 years, the equipment is generally very aged. Statistics Canada has the following estimates of average economic lives:

Estimated Average Economic Lives (Years)

	Buildings	Engineering	Machinery & Equipment
Paper & Allied Industries	50	55	22
Primary Metals	40	45	22

Fixed Capital Flows and Stocks, Statistics Canada, Cat.: 13-543 (Occasional).

[6]To build a modern pulp and paper mill today costs approximately $300 million (See The Canadian Forests Products Industry, Department of Industry, Trade and Commerce Sector Profiles), (1978).

[7]See for example Meyer and Kuh (1957), Kuh (1971). Other studies which use the firm as the unit of analysis are Grunfeld (1960); Jorgenson and Siebert (1968b); Eisner (1967).

[8]In 1960 Statistics Canada reclassified a number of industries to bring the classification in line with the Revised Standard Industrial Classification. Later during the same decade some manufacturing firms were reclassified as mining firms. Data reclassifications do not allow continuous time series observations on many variables.

[9]Aggregation of individual firm data introduces a number of problems e.g. aggregation bias. (See H. Theil, Linear Aggregation of Economic Relations, Amsterdam, 1954.) Griliches and Grunfeld (1960) show that, for predictive purposes, aggregation is not "necessarily bad." (See also Boot and de Wit (1960) for another perspective on aggregation.) What is important is to put firms into groups where structural coefficients of individual firms are not significantly different from each other. The grouping of the three integrated steel producers is one example of this approach.

[10]The conversion of data, especially financial statements from one currency unit to another is fraught with difficulties. One must decide whether to use the rate in effect at the end of the year or the historical rates which prevailed at the time that transactions occurred. In the United States, the Financial Accounting Standards Board (FASB) originally proposed the second alternative but has recently reversed its position to the first alternative. The Canadian Institute of Chartered Accountants took the same position and later suspended their rules. (Reference: The Financial Post, 13 July 1980, Accounting and Auditing Section.) See also the panel discussions: "Foreign Currency Transactions: Business and Accounting Aspects" and "Foreign Currency Transactions: Tax Aspects," pp. 338-358 and pp. 490-546 in Report on the Proceedings of the Thirtieth Tax Conference, Canadian Tax Foundation, Toronto, 1978.

[11]See Kuh (1971), pp. 60-62 for a discussion of the way he chose his sample of firms.

[12]The Province of Québec: Sidbec-Dosco; the Province of Nova Scotia: Sydney Steel.

[13]The Foreign Investment Review Agency came into being during the 1974-1975 period--at the end of the sample period.

[14]The discussion in footnote 22 of Chapter Three makes it clear that an accelerator relationship is basic to most investment equations. The investment equation in the simultaneous equation model is essentially an accelerator equation augmented by other jointly dependent variables. The length of the lag will differ from industry to industry; and will depend also on whether firms in the industry are growing or not. There are insights to be gained from fitting equation (5.1) to the data.

[15]The time period t is taken to be one year. Most researchers disaggregate their models over time and use quarterly data; some researchers actually compute ~~artificial~~ series to obtain quarterly models. [See for example Harman (1977).] If firms adjust very quickly, annual adjustments will seem almost instantaneous. However, decisionmakers in the steel industry provide enough evidence to show that the lead time for increasing capacity is at least four years. (See <u>Steel Profits Inquiry</u>, 1974.) An annual model is therefore not inappropriate for the steel industry. See also Kuh (1971), pp. 201-203 for a discussion of aggregation over time periods; and Wallis (1969), pp. 777-778 especially.

[16]A rigid statement of the accelerator principle implies a value of unity for the coefficient. In actual practice estimates may be less than one. Some of the factors which contribute to the downward bias are as follows: if changes in output and technological progress are correlated the accelerator is biased downwards (See Walters, 1963); the inclusion of a lagged investment term in equation (5.1); the use of <u>ex post</u> rather than <u>ex ante</u> data; most researchers use <u>ex post</u> data in their investment equations mainly because data on sales expectations for example are unavailable.

[17]The method of estimation used here is least squares.

[18]Dhrymes (1970) discusses R^2's and problems associated with the measure.

[19]See Kuh (1971), Chp. 8, pp. 205-207. Kuh argues convincingly against the standard textbook interpretation of t-statistics: the sample t statistic reflects the variability of the estimates and not whether a given coefficient was drawn from a population whose mean was zero.

[20]Draper and Smith (1966), Chp. 3. Draper and Smith outline criteria to determine whether errors are random or not. For these regressions, there are no discernible irregularities when the standardized residuals are plotted against the dependent variable. Similarly, when the standardized residuals are plotted against time, there is no evidence of serial correlation. One interesting characteristic emerges from these plots. Most of the standardized residuals lie well within ± 1 standard deviation of the mean values. Because there are 21 residuals, tests for normality will not be very conclusive.

[21]The results for the individual firm regressions follow the general pattern of the results for the aggregate steel firms. There are some small differences however; for one firm investment does not respond to sales changes beyond the third year; another firm shows a distributed lag similar to the inverted W of Evans (1969: see especially pp. 102-103). Charts III and IV depict the shape of the lag for the aggregate sample of steel firms. As a group the steel firms provide substantial support for the flexible accelerator with first rising and then declining coefficients. The appendix tables contain detailed results for one of the steel firms.

[22]Equation (5.1) can be written in the form:

$$I_t = a + \Sigma \mu_i \Delta O_{t-i} \qquad (5.1a)$$

where

$\Sigma \mu_i$ represents the sum of the coefficients of the sales change variables

and

ΔO_{t-i} the sales change variables are proxies for the output variable.

Equation (5.1) is derived from the relation:

$$K_t = \alpha \, O_{t-i} \qquad (5.1b)$$

where α the accelerator is replaced by $\Sigma \mu_i$

$$K_t = \Sigma \mu_i \, O_{t-i} \qquad (5.1c)$$

From (5.1c) one can derive a long run elasticity of the capital stock with respect to output (sales). If we measure elasticity at the sample-period mean values, the elasticity of the capital stock with respect to output is given by $\Sigma \mu_i$ (or the accelerator).

[23]Eisner (1960, 1978) argues that with a linear homogeneous production function and constant factor proportions, the elasticity of the capital stock with respect to output is unity. Eisner also outlines reasons why the elasticity coefficient may not be precisely unity. Some of the reasons are: a non linear homogeneous production function; if the elasticity of sales expectations were less than unity; the production function is changing because of increased innovation.

[24]The short run impact elasticities of investment with respect to sales are more difficult to estimate. The following calculations are based on Evans (1969), pp. 143-149. To calculate the elasticity for the first year for example, rewrite equation (5.1) as follows:

$$\frac{I_t}{F_{t-k}} = \beta_1 \frac{\Delta S_t}{S_{t-k}} + \text{other terms} \qquad (5.1a)$$

where $F_{t-k} = F_b$ and $S_{t-k} = S_b$ and $\Delta S_t = S_t - S_{t-1}$

$$I_t = \beta_1 \frac{\Delta S_t \cdot F_{t-k}}{S_{t-k}} \qquad (5.1b)$$

$$\frac{\partial I_t}{\partial S_t} = \beta_1 \left[\frac{S_{t-k} \cdot F_{t-k} - \Delta S_t \cdot F_{t-k}}{S_{t-k}^2} \right]$$

$$= \beta_1 \frac{F_{t-k}}{S_{t-k}} \quad \text{(assuming } \Delta S_t \text{ is small relative to } S_{t-k}^2\text{)}$$

Multiplying both sides by S_t/I_t

$$\frac{\partial I_t}{\partial S_t} \cdot \frac{S_t}{I_t} = \beta_1 \frac{F_{t-k}}{S_{t-k}} \cdot \frac{S_t}{I_t}$$

Taking mean values and omitting subscripts

$$\frac{\partial I}{\partial S} \cdot \frac{\bar{S}}{\bar{I}} = \beta_1 \frac{\bar{F}}{\bar{I}} \quad \text{(assuming } \bar{S}_t \cong \bar{S}_{t-k}\text{)}$$

For the steel firms $\frac{\bar{F}}{\bar{I}}$ is approximately equal to 10 for the sample period. Following Evans (1969), to obtain the elasticity of investment with respect to sales over a one year period, the β_i are written in terms of quarters such that:

Quarter	Weights[1]	
1	0.075	
2	0.075	Average for first year = 0.174
3	0.273	
4	0.273	
		Average for second year ≅ 0.2

[1]See Table 5. Hence for first year the elasticity is given by 0.174 x 10 = 1.74 and for the second = 2.00.

[25]In absolute terms the differences in the two estimates range from 0.001 to 0.06.

[26]Theil (1965). For perfect forecasts, the Inequality Coefficient

$$U = \frac{\sqrt{1/n \sum (P_i - A_i)^2}}{\sqrt{1/n \sum P_i^2} + \sqrt{1/n \sum A_i^2}}$$

where P_i = predictions

A_i = actual values

should be zero.

U can be broken into proportions of inequality due to bias, variance and covariance. If $U \neq 0$, then the next desirable property is that the proportion of inequality due to bias be zero. For the steel sample U = 0.1, but the proportion of inequality due to bias is zero.

[27]Despite the popularity of the Almon lag, critics maintain that the shapes obtained are a result of the constraints imposed on the endpoints. See Dhrymes (1971); Schmidt and Waud (1973), argue convincingly for the use of unconstrained lags which yield sensible results without the imposition of constraints.

[28]The Durbin-Watson Statistics are all in the inconclusive area.

[29]The accelerator coefficient of 1.18 is very high, but this firm experienced steady growth over the sample period. In fact a recent study (See Study No. 5 of the Royal Commission on Corporate Concentration by T. Salman) shows that the firm has outperformed the industry in its returns on invested capital and equity. However this firm has only a 4% share of the newsprint and pulp markets.

[30]The West Coast firms all have sales of lumber products which account for almost 50% of total sales e.g. between 1959 and 1968 sales of lumber and shingles averaged 44% of total sales for Br. Columbia Forest Products Limited.

[31]The table below consists of the simple correlation coefficients between investment and sales and investment and the sales change variables for each firm. The sales variable is denoted S and the sales change variables S^*_t to S^*_{t-2}.

Correlation Coefficients

Firms	S	S^*_t	S^*_{t-1}	S^*_{t-2}
A	0.81241	0.82615	0.90379	0.74813

Firms	S	S^*_t	S^*_{t-1}	S^*_{t-2}
B	0.54406	0.26344	0.29177	0.20420
C	0.84480	0.43979	0.84025	0.47214
D	0.59417	0.36559	0.55512	0.54300
E	0.62248	0.04646	0.72636	0.46854

[32] Few of the firms have a continual time series on sales by categories--pulp, newsprint, lumber, plywood. In some instances the amounts must be read off charts; in others averages are given for a five year period. The crude estimates were based on a combination of both types of information.

[33] In some years of the sample period Consolidated Bathurst spent equal amounts on capital and repair expenditures.

[34] Chart II above shows that in the middle of 1970 the Canadian dollar was allowed to float freely in foreign exchange markets. One consequence was a Canadian dollar above par in the early 1970's. The rising value of the dollar shows up in falling profits for the export industries because of fluctuations in the value of sales.

[35] The Canadian Pulp and Paper Association publishes operating ratios for the newsprint industry. Over the sample period the operating ratios generally lie between 80% and 90%. Two exceptionally good years for the industry were 1965-1966. Within recent times a Canadian dollar below par has helped the industry and operating ratios have climbed well over 90%.

[36] There are also some disadvantages to being the leader within the industry. Firm A has served as a leader for wage negotiations and has been more prone to strikes than other firms.

[37] The coefficients do not decline immediately because $\beta_3 < \beta_4$. The difference is only 0.01, so one can ignore it.

[38] See footnote 61 of Chapter Three.

[39] There are two ways in which equation (5.2) can be estimated: in the first difference form or with D_t as the dependent variable, the simple distributed lag form. Both forms yield identical estimates of "r" and "c," but $\bar{R}^2$ falls in the first difference form.

[40] Another variant of equation (5.2) is the cash flow model outlined by Brittain (1964). Here cash flows are defined as after tax profits plus depreciation allowances. In Brittain's model, dividends depend on cash flows and not after tax profits.

[41]Brittain (1964); Chateau (1976); Dhrymes and Kurz (1964).

[42]The position is in direct contrast to Chateau (1976) who finds enough evidence to support the cash flow model for the Canadian manufacturing sector. As noted below, Chateau's approach is based on (slightly) different assumptions--in particular he takes into account the rate of growth of the firm. [Chateau's analysis is closely related to Kuh (1971), pp. 26-44.]

[43]The results for the cash flow model for the shorter sample period were extremely poor and are not reported. The capital cost allowances for pollution control equipment dominate capital cost allowances for the pulp and paper firms (and hence are an important part of internal cash flows). The special allowances were never interrupted once they were introduced into the tax system. There is enough evidence that firms used the allowances for the purposes for which they were introduced. The impact of the increased cash flows has been to allow firms to at least maintain dividends.

[44]See p. 315. In his regression analysis Kuh found that firms with high reaction coefficients tended to have low payout ratios; but he did not consider the relationship to be an extremely powerful one.

[45]One method of evaluating the results is to plot a scatter diagram of theoretical (target payout ratios) and the actual average payout ratios

$$\left[\text{i.e. } \sum_{t=1}^{T} D_t^V \Big/ \sum_{t=1}^{T} P_t \right].$$

If the observations are tightly clustered around the 45° line, there is little difference between target and actual ratios. Four of the actual average ratios are listed below.

	Actual Average Payout Ratios	"Theoretical" Payout Ratios 1955-1975	"Theoretical" Payout Ratios 1955-1970
Firm A	46.8	78.0	63.9
Firm B	32.8	38.5	--
Firm C	54.8	90.9	60.0
Firm D	54.7	32.8	--

Kuh (1971) noted that when equation (5.2) is fitted without a constant term the two ratios are closer to each other. In general as a firm grows over time the "theoretical" (target payout ratio) is expected to be greater than the actual.

[46]One shortcoming of the dividend analysis in this section is that it ignores the question of growth and (the) merger of firms. Abitibi (Firm A) acquired Price in 1974, but this

occurred at the end of the sample period. Other firms in the sample acquired controlling interests in some enterprises. The acquisitions occurred primarily because of economies of scale for the firms. The increased merger activity in the Canadian economy occurs beyond the sample period.

[47]The following are the coefficients obtained by Chateau.

Firms	"Long Run" Payout Ratios	Speed of Adjustment Coefficient
A. Abitibi	0.320	0.287
B. BC Forest	0.225	0.426
C. Cons. Paper	0.412	0.668
D. Domtar	0.290	0.546
E. Great Lakes	0.365	0.621
F. Price Bros.	0.410	0.272
Pulp and Paper	0.327	0.770

Source: See Table 3 of Chateau (1976).

[48]C--in a period of rising interest rates, C may not be a good measure of the cost of borrowing. The ratio of interest costs to long term debt would measure the cost of old borrowing and not new borrowing. L^V--the leverage variable measures the extent to which firms use debt financing as opposed to internal sources of finance. Other measures of leverage are: the ratio of long term debt to total assets; the ratio of long term debt to capital employed; the second ratio is closest to the one defined above.

[49]Theoretically, the identification problem is prior to estimation and provides a direction for the choice of estimation methods. In practice the order condition for identification is always satisfied, but the rank condition is never satisfied. The order condition implies that all three equations are over identified and either two stage least squares or three stage least squares should be used. In the text a strong case is made for the use of ordinary least squares.

[50]Estimation methods for simultaneous equation models are characterized as single equation methods (or limited information methods) and system methods (or full information methods). Among the single equation methods are ordinary least squares (OLS), two-stage least squares (2SLS) and indirect least squares (ILS). In the single equation method each equation is estimated separately; for the system methods all the equations are estimated jointly.

[51]See for example Fox (1956); Theil and Kloek (1960); Maddala (1977), pp. 231-233; Kennedy (1979); Christ (1966), pp. 473-481. Other reasons to support OLS are: OLS is useful

as an exploratory or preliminary estimator; the predictions from OLS compare favourably with those of other estimators.

[52]The Beta Coefficients are useful for comparing the relative effects of the independent variables on the dependent variables.

[53]In the decade following World War II, firms relied heavily on retained earnings and share issues to some extent to finance investment projects. See Silberman (1956). In a recent study Shapiro (1980) found that United States controlled firms in the Canadian economy preferred retained earnings to debt. He found that the tendency grew over the period 1968-1972. He noted that the position of Canadian controlled firms was in direct contrast to the behaviour of the American subsidiaries.

[54]See footnote 62 of Chapter Three. For Lintner, once the dividend-retention decision is chosen the other decisions adjust. This then is one explanation of the poor showing of the two jointly dependent variables in the dividend equation. Note that in a Modigliani-Miller world (see pp. 67 *et seq.*) firms choose a debt-equity position first and the other two decisions adjust.

[55] $$D_t^V = \text{constant} + crP_t + (1-c)D_{t-1} + \text{other terms}$$

$$\widehat{cr} = 0.11832$$

$$\widehat{1-c} = 0.72509$$

$$\hat{c} = 0.27491$$

$$\hat{r} = \frac{0.11832}{0.27491} = 0.43039$$

Note that this payout ratio is close to the actual average payout ratio

$$\frac{\sum_{t=1}^{T} D_t}{\sum_{t=1}^{T} P_t} \quad \text{of } 0.4129.$$

[56]See Appendix Table A7 for further details of the differences.

[57]See footnote 59 of Chapter Three.

[58]See Sullivan (1974).

[59]For example Wold (1960) has an excellent discussion on causal chains and interdependent systems.

[60]Since 1972 Statistics Canada (61-207) has contained information on several financial ratios e.g. interest to total costs; ratio of profits to capital employed. The leverage measure used in the tabulations is the ratio of long term debt to equity. The ratios given below are for the 1972-1977 period; if it is remembered that borrowing increased over the sample years, then the sample averages are in line with official estimates.

Ratios of Long Term Debt to Equity

Year	Primary Metals	Paper and Allied	Total Manufacturing
1972	37.1	35.0	22.6
1973	32.1	35.6	20.5
1974	38.3	30.5	21.0
1975	43.8	28.1	21.6
1976	47.2	33.2	23.8
1977	38.3	36.2	24.6

Source: Corporation Financial Statistics, Statistics Canada, Cat.: 61-207.

[61]The algorithm used to compute OLS uses a stepwise procedure. Variables which have insufficient "tolerance limits" are not included in the equation. Another computer algorithm includes all the variables, but variables with "insufficient tolerance" show up with very small t-ratios.

[62]The Department of Industry Trade and Commerce Sector Profile entitled Canadian Forests Products Industry (1978).

[63]Appendix Table All contains details of faster write offs for the primary metals and pulp and paper firms. Note however that allowances attributed to primary metals are earned by the ferrous metals and non ferrous metals groups. The information is not available for the iron and steel mills group which corresponds roughly to the sample of steel firms.

[64]For an opposing viewpoint on tax incentives tied to a particular class of assets see Waverman (1970). Waverman believes that tax incentives are not an efficient method of controlling pollution.

[65]This estimate is based on the Results of a Department of Finance Survey reported in 1976 Supplementary Budget Papers, Department of Finance, Ottawa. The survey estimatec that 20% of deferred taxes were due to the existence of accelerated depreciation. On the basis of this figure Harman concluded that cash flows of firms were 1% higher because of the faster write offs.

[66]See Laing (1973), p. 141.

CHAPTER SIX

CONCLUSION

This chapter is divided into four sections. The first section examines further the limited role of capital cost allowances in the investment process. Special attention is paid to why the allowances are relatively unimportant and why in spite of this policymakers prefer to use these allowances.

Sections II and III consider the effects of the allowances on the private and public sectors. In the private sector the allowances compensate owners of assets for the rising replacement costs because of inflationary conditions. This unintended effect of accelerated capital cost allowances is important because Canada has not yet made any major provisions to allow business to adjust for inflation. The sole measure which has been adopted is the 3% inventory valuation adjustment. In the public sector there appears to be a growing realisation of the large revenue losses which a generous depreciation policy causes. The realisation materialises in the first official tax expenditure budget. Section III contains estimates of the costs of tax incentives in the manufacturing sector. The final section identifies areas for further study.

I. THE LIMITED ROLE OF CAPITAL COST ALLOWANCES

The analysis presented in the previous chapter suggests that accelerated write offs have limited scope in directly influencing capital spending. One reason for this statement is the strength of the demand variables in the regression equations. For some manufacturing sectors,[1] a 1% increase in capital cost allowances yields a ½% increase in investment expenditure. These Canadian results stand up well in comparisons with Evans' (1969) review and Kuh's (1971) study of a sample of United States manufacturing firms.[2] The Canadian results in this thesis underline the need for tax incentive policies which stimulate demand directly.

'rguments against incentives such as accelerated capital cost allowances usually stress the temporary nature of the incentives. Since 1974 all incentives in the Canadian tax system are extended for an indefinite period into the future. In the 1980 Federal Budget, the government reversed its stance on the generous tax incentives available to the resources sector.[3] The government's action is a clear indication that indefinite extensions of certain tax policies must never be taken for granted.

One example in Chapter Five describes in detail the administrative lags which accompany tax incentives. The lags prevent accelerated depreciation from speeding up the timing of investment spending. There are other institutional features in the tax system which restrict the overall effect of tax incentives. Consider a typical investment project. Not every dollar of total cost is invested in depreciable property. Appendix Table A10 lists some rates of capital cost allowances applicable to depreciable property. Most capital goods in manufacturing fall into the Class 8 category and now qualify for two year write offs. However certain manufacturing activities do not fulfill the requirements for the generous write offs.[4] Some proportions of the activity in the integrated steel firms and the pulp and paper industries are not included in the definition of "manufacturing and processing."

A clearer picture of the relationship between capital cost allowances and investment emerges from the data on Sources and Uses of Funds. In the mid 1950's most corporations began to include this type of data in their Annual Reports. Chart I below displays cumulative total sources of funds for the sample of three steel firms. The subcategories of gross retained earnings and capital cost allowances are also on the chart. There is a growing gap between gross retained earnings and the total; capital cost allowances (which include the faster write offs) are declining as a percentage of total sources of funds. The gap between retained earnings and total sources is filled by debt finance, preferred and common stock finance.[5]

The increase in the use of debt finance is a feature characteristic of a growing economy. A NBER Conference Report (1952)[6] stressed the following hypothesis based on an examination of prewar and the immediate postwar data in the United States: "...that asset financing during both the early and the very rapid stages of growth is carried on largely through stock and bond issues; that thereafter retained earnings are

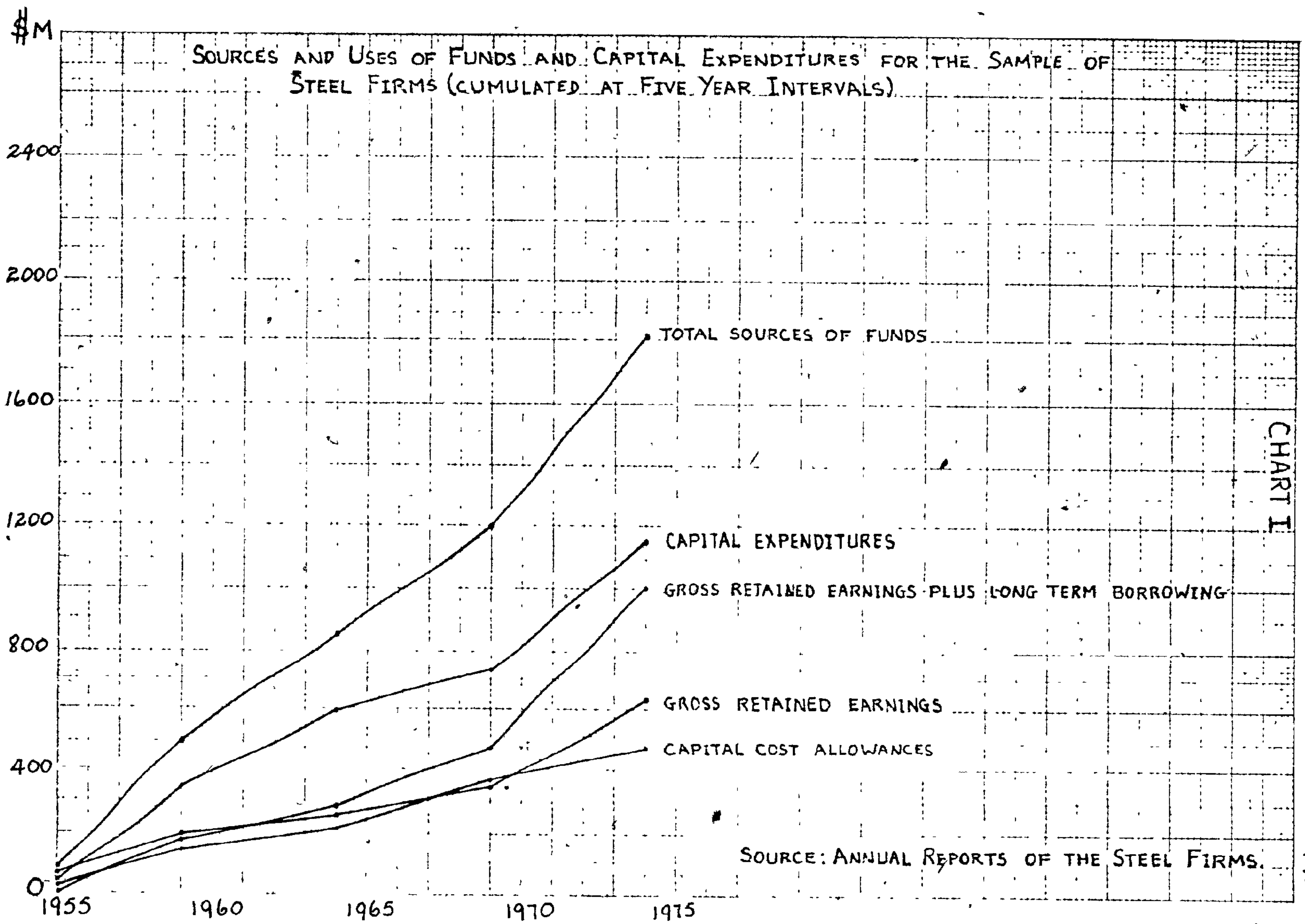

SOURCES AND USES OF FUNDS AND CAPITAL EXPENDITURES FOR THE SAMPLE OF STEEL FIRMS (CUMULATED AT FIVE YEAR INTERVALS)
$M
2400
2000
1600
1200
800
400
0
1955
1960
1965
1970
1975
TOTAL SOURCES OF FUNDS
CAPITAL EXPENDITURES
GROSS RETAINED EARNINGS PLUS LONG TERM BORROWING
GROSS RETAINED EARNINGS
CAPITAL COST ALLOWANCES
SOURCE: ANNUAL REPORTS OF THE STEEL FIRMS.

CHART I

likely to become very important and finally, that annual depreciation charges bulk large as a source of funds for gross additions to plant" (pp. 33-34). The first part of the statement is generally true of the steel firms for example; contrary to expectations (see Domar 1953a; 1953b for example) in a growing economy depreciation allowances do not constitute a dominant proportion of total finance. Instead, over time a changing mix of funds comprise the financial requirements of firms.

In Table 1, the percentage of total capital employed accounted for by equity in non financial corporations has fallen from 72% to 64%. Over the same period 1965-1976 the percentage accounted for by net long term debt has grown from 14% to 17%. Thus the observed reliance on additional external finance (as illustrated in the regression equations) is not peculiar to the steel industry. However since 1976 Canadian capital markets have experienced a relative decline in the use of bond financing. Data from the Bank of Canada show that in 1978 for the first time there was a fall in the value of new bonds issued. For all corporations (non financial as well as financial) the value of new bond issues was $4378 million as compared to $4787 million for the previous year 1977. The figures are indicative of changes in the trend of overall corporate financing.

While the Federal Government stresses the importance of accelerated write offs, there has been a growth in the use of other financial options open to firms. For example leasing,

TABLE 1

CANADA

FINANCIAL RATIOS IN THE CANADIAN MANUFACTURING SECTOR

Year	Capital Employed $m	Equity	Net Long Term Debt
		As a percentage of capital employed %	
1965	23,924	72	14
1966	27,303	70	15
1967	28,313	67	16
1968	30,018	66	17
1969	30,910	66	17
1970	34,966	66	17
1971	36,928	66	17
1972	39,646	65	16
1973	42,208	67	15
1974	48,984	66	15
1975	55,356	65	16
1976	60,436	64	17

Source: Based on data from Corporation Financial Statistics, Statistics Canada, Cat: 61 - 207 income debenture bonds, term preferred shares are all utilized by firms because they convey important tax benefits. Leasing falls into the category of "off-balance sheet financing" and so it is difficult to estimate the volume of leasing contracts held by firms in the manufacturing sector. Table 2 gives some information on the growth in leasing arrangements in Canada. Financial leasing grew rapidly in the late 1960's and received greater impetus with the 1972 Federal Budget Provisions.[7] Abuses to the system led to a curtailment of the favourable treatment in 1976.

The use of the income debenture bond is another financial option which possesses certain tax advantages for the firm. Although the bonds are essentially debt instruments, prior to 1978 the bonds were treated as equity for tax purposes. The financial institutions which issued the bonds treated this income as tax free dividends and not as fully taxable interest. The bonds were useful to firms, not in a taxable position, to finance investment activity. In 1978 the Federal Government removed the favourable tax treatment accorded to these bonds as well as to term preferred shares.[8] Two of the many arguments[9] used to support their actions were: the cost to the government was increasing at an estimated $500m; the benefits were in favour of large multinational and Canadian corporations who used the bonds to finance takeovers and mergers.

These examples are indicative of alternative financial arrangements with greater tax benefits than acclerated

TABLE 2

CANADA

LEASE AND RENTAL FINANCING BY SALES FINANCING COMPANIES. MACHINERY AND EQUIPMENT (EXCLUDING MOTOR VEHICLES)

$m

Year	Amount Financed	Balances Outstanding At End of Period
1969	70	126
1970	84	184
1971	91	224
1972	173	335
1973	195	460
1974	195	535
1975	315	710
1976	140	744
1977	180	779

Source: Sales Financing, Statistics Canada, Cat: 63 - 211 depreciation allowances. The expansion in use of the methods and subsequent clampdown on their use are a good reflection of the larger tax benefits. The growth[10] of institutional lenders has created increased sophistication in the financial markets. In the future this growth will ensure the creation of more financial instruments with greater complexity. A common denominator of the instruments will be the tax benefits attached to them.[11]

Despite the reduced role of capital cost allowances in the financing of investment projects, policymakers remain committed to this type of tax incentive. Their committal stems from the distinct political advantages to be gained. One advantage arises out of the nature of current budgetary procedures, where the cost of tax incentive programs are disguised from the average taxpayer. Once the program is introduced the annual estimates do not include the costs of the programs. The relative ease of administration is another factor favouring accelerated depreciation. As the average taxpayer is ignorant of depreciation policy and its effects the taxpayer is less prone to query the policy. Businessmen also prefer this method of subsidies because there is no apparent stigma attached. Woodside (1979) argues that this kind of subsidy favours the established businessmen whom the government wants to please.

Another advantage of tax incentives similar to accelerated depreciation allowances is that once introduced, periodic reviews of the programs are non existent. And even when the programs are reviewed, changes are very difficult to institute. A good example is provided by the decision to change[12] the capital cost allowance rates for aircraft. The Department of Finance concluded that:

> The present rate of 40 percent is clearly too high in view of the financial depreciation survey which indicates that a rate of 12 percent would generally be adequate. Internationally, the useful life of commercial aircraft is generally taken to be 14 years, which would warrant a diminishing balance rate of about 11 percent. At the same time, however, too abrupt a change in rate could be disruptive, and it must be kept in mind that this classification covers a wide variety of type, size and use of aircraft. Accordingly it is proposed that the rate be reduced to 25 percent.
>
> --p. 23, Budget Paper C, 1976 Federal Budget, Department of Finance.

Budget Paper C reveals the importance of international depreciation rates relative to Canadian rates. The reviewers compared domestic rates of capital cost allowances with those of other countries; if Canadian rates were competitive the rates were left unchanged; if Canadian rates were higher than those of other countries, they would have to be justified or else lower rates would be recommended. Despite the continued stress on accelerated allowances firms will continue to rely on outside financing. Internally generated funds cannot provide all the requirements for dividends and growth in capital assets. The large dollar size of investment projects and other financial securities with favourable tax options are reasons why firms will use outside sources of finance.

II. INFLATION AND CAPITAL COST ALLOWANCES

Although accelerated write offs have little effect on investment decisions, there is one unintended effect of a liberal depreciation policy. In a period of rapid inflation, faster write offs may well provide an offset to a capital cost allowance system based on historic costs. Chart I in Chapter Five traces percentage changes in the price of capital goods as measured by the GNP implicit price deflator. The growth of inflation during the 1970's has had both positive and negative aspects to its effects on the firm.

On the negative side, firms have to report illusionary profits which do not reflect the reality of their situation.[13] Inflation reduces the real value of capital cost allowances to the firm. The situation is worsened further because the allowances are not based on current replacement costs and do not provide for an adequate recovery of the cost of the capital good. Much has been written[14] on the need for changes in accounting procedures to reflect the impact of inflation. There are generally two schools of thought on the methods of adjustment. The usual methods suggested are current cost accounting (replacement cost accounting) and general price level accounting. In current cost accounting, the current cost is substituted for the historical cost of each item on the balance sheet. The current cost is computed by applying a specific index to each category of items. Alternatively general price level adjustments make use of an index of change in the general price level. Conceptually, the current cost accounting procedure is deemed superior to the general price level restatement. However general price level adjustments receive greater support because they are seen as more objective.

Some countries[15] have instituted different forms of price level adjustments for business income. In Canada the tax authorities allow business only a 3% inventory valuation adjustment.[16] The Canadian Institute of Chartered Accountants has drafted proposals for supplementary restatements of balance sheet items. As yet however no final rules have been laid down.[17]

On a more positive note, borrowing during inflationary conditions is often advantageous to a firm. Debtors gain because the rate of interest on current contracts does not compensate lenders for price increases. It is in a firm's interest to increase its debt ratio, but not beyond generally accepted levels. In fact this is one possible explanation why firms continued to accumulate debt in the post 1975 period despite sluggish investment.[18]

To judge the overall impact of inflation on business, the net financial impact must be considered. The net financial impact should take into account the effect of inflation on cash balances, depreciation allowances, inventories, short term and long term assets. This section is concerned primarily with inflation and depreciation allowances.

At present Canadian tax regulations do not allow for price level adjustments of capital cost allowances based on historic costs. If there is information available on the lifetime of capital assets and current replacement costs for example it is possible to compute by how much historic cost depreciation understates replacement costs. Recently Jenkins

(1977) examined the financial impact of inflation on business in Canada. Data in Tables 3 and 4 are reproduced from his study and utilize current cost accounting.[19] The first columns of ratios in Table 3 imply that capital cost allowances would have been 39% higher on average for the manufacturing sector. For the same period 1965-1974 the ratios for primary metals and paper and allied industries are not significantly different from the average for manufacturing.

However the use of accelerated write offs has allowed firms a partial offset to the effects of inflation. The first sets of ratios are not the appropriate ones to examine for the effects of inflation. The ratios are calculated with the rates of tax depreciation and not "true economic depreciation." In general tax depreciation rates are higher than those of economic depreciation. The proper comparisons should be between the following: capital cost allowances based on current replacement costs, at economic depreciation rates and historic cost depreciation with tax depreciation rates. The second ratio is one measure of the adequacy of existing capital cost allowances for replacement purposes. For all of manufacturing the tax system allowed firms 26% more than was actually needed. The picture is a little different for subsectors of manufacturing--the paper and allied group for example. In many years the ratio of "economic" replacement allowances to actual allowances claimed was greater than one. The ratio reflects the fact that many firms have old paper mills on their books valued well below their current replacement costs.

TABLE 3

RATIOS OF CAPITAL COST ALLOWANCES AT REPLACEMENT COST TO CAPITAL COST ALLOWANCES AT HISTORIC COSTS

(Constant 1974 prices)

YEAR	$\left[CCA_{RC}^{TD} / CCA_{HC}^{TD}\right]$ 1/	$\left[CCA_{RC}^{ED} / CCA_{HC}^{TD}\right]$ 2/
(a) Primary Metals		
1965	1.36	0.64
1966	1.37	0.70
1967	1.32	0.71
1968	1.28	0.94
1969	1.32	1.33
1970	1.33	1.15
1971	1.35	0.91
1972	1.39	0.84
1973	1.42	0.77
1974	1.54	0.90
Average	1.39	0.89
(b) Paper and Allied Industries		
1965	1.39	0.69
1966	1.38	0.68
1967	1.32	0.81
1968	1.27	0.99
1969	1.29	0.96
1970	1.32	1.11
1971	1.35	1.33
1972	1.35	1.10
1973	1.42	1.00
1974	1.54	1.06
Average	1.36	0.97

TABLE 3

(Continued)

YEAR	$\left[CCA^{TD}_{RC} / CCA^{TD}_{HC}\right]$	$\left[CCA^{ED}_{RC} / CCA^{TD}_{HC}\right]$
(c) Total Manufacturing		
1965	1.40	0.64
1966	1.40	0.67
1967	1.35	0.72
1968	1.30	0.83
1969	1.33	0.82
1970	1.35	0.82
1971	1.36	0.81
1972	1.37	0.73
1973	1.42	0.66
1974	1.59	0.72
Average	1.39	0.74

1/ The ratio of capital cost allowances based on current replacement cost to those based on historic costs, calculated at tax depreciation rates.

2/ The ratio of capital cost allowances based on current replacement costs, at economic depreciation rates, to capital costs allowances based on historic costs with tax depreciation rates.

Source: Table D1 Estimates of Depreciation Expense (Constant 1974 Prices) in JENKINS (1977)

TABLE 4

NET GAINS [1] FROM INFLATION ON NET LONG TERM DEBT

$m

Year	Total Manufacturing	Primary Metals	Paper and Allied Industries
1965	81.18	19.49	22.99
1966	129.55	26.86	38.82
1967	115.03	26.04	32.43
1968	61.69	13.98	17.58
1969	145.68	26.69	44.85
1970	152.60	29.06	45.26
1971	31.78	5.63	8.95
1972	160.40	26.82	41.42
1973	297.16	44.92	82.57
1974	561.63	107.38	136.14

1/ The net gain (or loss) is computed as the difference between the "decrease in net real liability due to actual inflation" and the "expected inflation premium on net short term assets and liabilities".

Source: Table D5: Impact of Income Transfer to Unexpected Inflation on Net Long - Term Debt (Constant 1974 Prices) in JENKINS (1977)

In general Jenkins' results are in agreement with earlier rough estimates by Helliwell (1972). He suggested that inflation would have to increase substantially before the general rates for Class 8 assets (see Appendix Table A10) became inadequate.[20] Clearly faster write offs are beneficial to a firm during inflationary conditions.

One other set of Jenkins' calculations are of interest here. Jenkins found that the primary metals and paper and allied industries were among the largest gainers from borrowing during an inflationary period. The two sectors enjoyed transfers of wealth from holders of financial debt over the 1965-1974 period. (See Table 4 above.) It may well be that the overall net effect of inflation is negative.[21] However for the two samples of firms discussed in the previous chapter, accelerated write offs and borrowing over inflationary periods yield positive benefits.

The unintended effect of accelerated capital cost allowances is to compensate owners of depreciable property for underdepreciation during periods of inflation. The unintended effects of accelerated capital cost allowances may well serve as an added justification for their continued use. At the same time, the faster write offs lead to a reduction in government revenues. The revenue losses are discussed next.

III. THE COSTS OF TAX INCENTIVES TO THE GOVERNMENT

One simple method of obtaining a perspective on the costs of faster write offs and other tax incentives is to examine data on "Reserves For Future Income Taxes." Statistics Canada estimated that in 1977 corporations provided $8380 million to meet tax liabilities; 21% of the amount was deferred[22] to reflect the timing differences between accounting for tax purposes and for book purposes. Table 5 below details the growth of the reserves since 1965.

The figures show the cumulative amounts of deferred taxes payable in the future on income. These deferred taxes will continue to grow as long as investment increases and tax incentives continue indefinitely. The largest percentage of the reserves originate in the manufacturing sector. Primary metals and paper and allied industries account for roughly 30% of the total in manufacturing. The size of the reserves are a clear reflection of the capital intensive nature of the two sectors.

Another method of identifying the costs of a particular tax incentive policy is the introduction of a tax expenditure budget. Tax incentives are part of a broad category of subsidies which are best described as tax expenditures. The terminology originates with Surrey who describes a system of tax expenditures as one

> ...under which government financial assistance programs are carried out through special tax provisions rather than through direct government expenditures. The system is grafted onto the Income Tax system and has no relation to that system.
>
> --S. Surrey in <u>The Economics of the Federal Subsidies Programs</u>, Joint Committee Print, Washington, 1972

There are many critics[23] who argue that the tax expenditure concept is a limited one with little analytic value. In many

TABLE 5

CANADA

RESERVES FOR FUTURE INCOME TAXES FOR SELECTED YEARS AND SELECTED INDUSTRIES

$m

Year	All Industries	Total Manufacturing	Primary Metals	Paper and Allied Industries
1965	1472.1	940.3	447.0	400.0
1970	3658.1	1788.3	457.3	414.2
1971	4172.3	1925.7	485.3	398.0
1972	4939.5	2124.4	494.8	374.3
1973	6298.9	2672.1	533.4	440.8
1974	8730.9	3691.5	637.0	580.8
1975	10281.6	4370.0	686.4	739.9
1976	11685.9	4821.0	665.1	882.3
1977	13631.8	5288.4	723.9	896.5

Source: Corporation Taxation Statistics, Statistics Canada. Cat: 61 - 208 instances, what constitutes a tax expenditure involves value judgements on the part of those compiling the data. In addition special programs have become entrenched in the Income Tax System and may be considered as "normal." Debate on the usefulness of the concept will continue in the future, but a tax expenditure budget will provide some useful functions.

First the tax expenditure budget gives an overview of total government expenditures, direct as well as indirect expenditures. In general indirect expenditures are not regarded as part of budgetary procedures; these expenditures require a deficit, cutback in other expenditures or possibly higher levels of taxes, since they involve shortfalls in government revenue. Next tax expenditure budgets may allow for proper justification of certain categories of expenditure. The budget method is also useful for periodic reviews of government programs. In Canada, over twenty years elapsed before any systematic review of capital cost allowances occurred. Finally tax expenditures allow the comparison of costs of achieving a certain goal of policy. While tax incentives are alternatives to direct spending, in many cases direct spending may be cheaper. By not considering the alternatives, policymakers may be choosing the most costly method available.

Perry (1976) and Smith (1979) examined a number of tax expenditures in the Canadian tax system. Smith's study examines a broader category[24] of tax expenditures than Perry's which considers only corporation tax expenditures. Smith estimated corporation tax revenues foregone because of tax deferrals amounted to $4814 million in 1975. The figure represents a 109% increase over Perry's estimates for 1972 ($2305 million); the financial significance of these estimates is important in the face of increasing concerns over the size of the Federal deficit.

The taxes are foregone as long as investment keeps growing. Taxes become payable only in the case of a major slump in investment; yet in such a situation it may not be considered appropriate for firms to repay the deferred taxes. The $4,814 million in corporate taxes foregone exceed the most optimistic estimates of investment expenditures generated by tax policies. [See the estimates from the Tax Measures Review Committee (1975).]

Policymakers recognise the growing importance of the revenue losses and the recognition is apparent in the publication of an official tax expenditure account.[25] The publication warns that the data must not be interpreted as passing judgement on any of the programs. This caveat contradicts an earlier official viewpoint[26] where it was acknowledged that faster write offs were not used to increase investment. The Report suggested that firms transferred the benefits of unused tax savings from incentive deductions to finance takeovers. Certainly if rapid write offs lead to a redistribution of benefits to large well established firms, then one could argue against their continued use as a policy tool.

The official estimates of tax expenditures contain no global totals. In many areas however it is apparent that revenue losses are larger than direct government expenditures. Efforts to curb the continued growth in government spending must involve clear control of these indirect expenditures. The publication of a tax expenditure budget is a first step towards recognition of the indirect expenditures. The data in the table below is extracted from the official estimates; the figures reveal the extent to which the government has relied on costly tax incentives to stimulate investment. Yet over the same period investment as a proportion of Gross National Product (GNP) has not changed significantly.

Many critics[27] contend that it is not enough to examine investment--GNP ratios to determine the success of tax incentives. In Canada the investment-GNP ratios have fluctuated between 21% and 23% (except for two periods of booms in investment 1955-1957 and the mid 1960's--See Table 2 of Chapter Two). While total investment has remained relatively unchanged as a proportion of GNP, there appears to be a slight improvement in the share of manufacturing investment in the total. See Chart II. An improvement in manufacturing investment relative to other sectors is one of the stated objectives of Canadian tax incentive policy.

The objective has been achieved at tremendous cost to government revenues. One may also consider the opportunity cost of investment not carried out in other sectors. Policy-makers may do well to reexamine the tax incentive approach and replace incentives by direct grants to particular industries.

TABLE 6

SELECTED TAX EXPENDITURES FROM THE GOVERNMENT OF CANADA TAX EXPENDITURE ACCOUNT

1976, 1979

$m

		1976	1979
1.	Total tax expenditure value of Investment Tax credit	100	625
2.	Total tax expenditure value of the excess of capital cost allowances over book depreciation.	910	1250
3.	Cumulative amounts of Federal corporate income taxes deferred per companies books.	8450	not available

Note: The tax expenditures are computed by applying a marginal tax rate to the appropriate items on the budget.

Source: Government of Canada Tax Expenditure Account, Department of Finance, Ottawa, 1979.

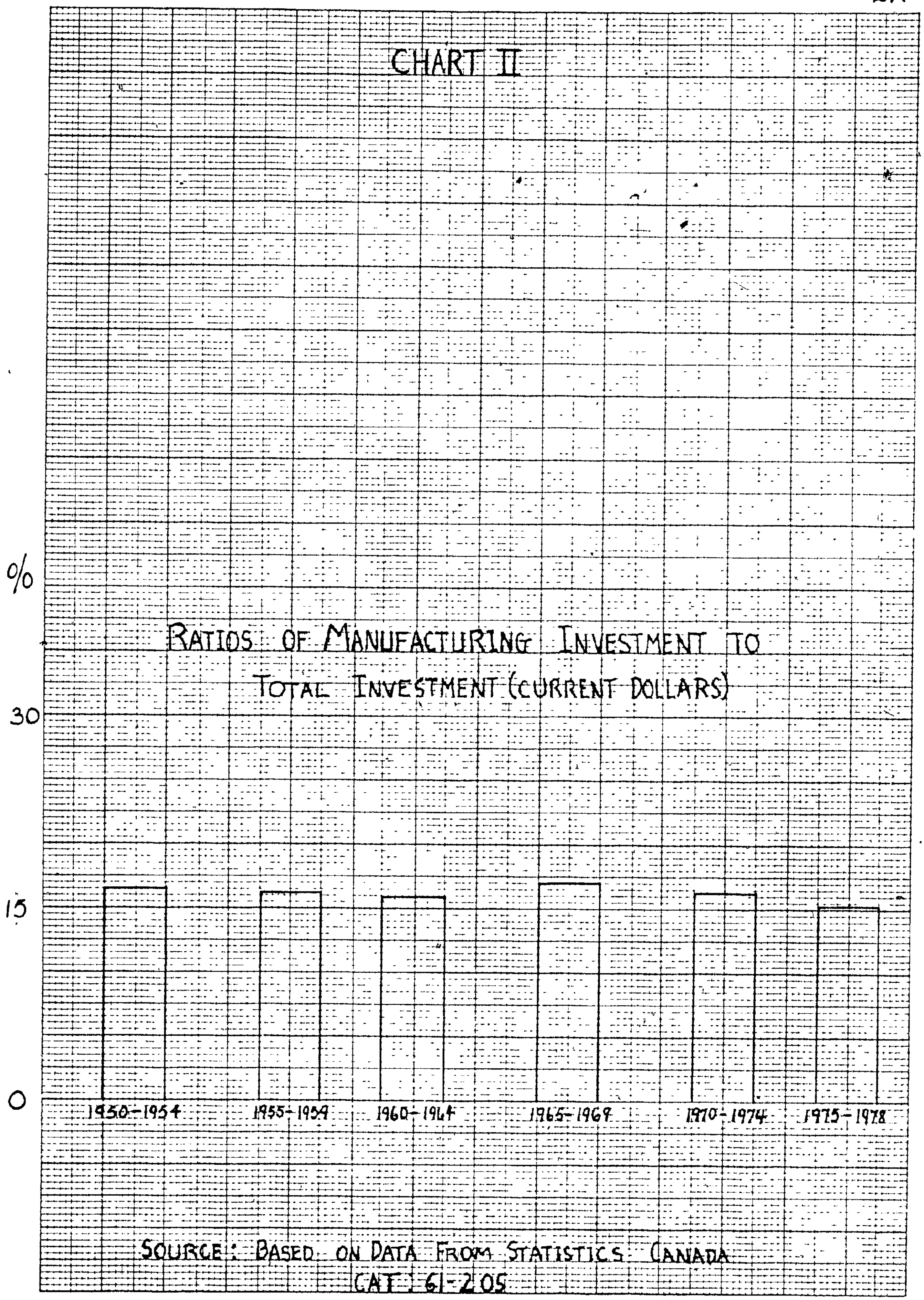


CHART II
%
RATIOS OF MANUFACTURING INVESTMENT TO
TOTAL INVESTMENT (CURRENT DOLLARS)
30
15
0
1950-1954
1955-1959
1960-1964
1965-1969
1970-1974
1975-1978
SOURCE: BASED ON DATA FROM STATISTICS CANADA
CAT. 61-205

In this way the costs of stimulating investment in manufacturing has its appropriate price tag.

IV. CONCLUDING STATEMENT

The thesis considered the nature of investment in two important sectors of the Canadian manufacturing industries. The investment equations illustrate that there is a limited role for tax incentives such as accelerated capital cost allowances in the investment process. For investment expenditures are determined primarily by demand factors and faster write offs contribute less to total finances than other methods. In addition certain financial instruments convey larger tax benefits to the firms than faster write offs. However in periods of inflation, accelerated depreciation helps a firm to offset inadequate allowances based on historical costs.

The costs of tax incentives, as evidenced by the growth in deferred taxes and estimates of revenues foregone, cast serious doubts on the efficiency of tax incentives. Our estimates from the sample of firms suggest that at best a 1% increase in cash flows from accelerated depreciation may yield about ½% increase in investment. If the aim of government policy is to stimulate investment spending, it would be cheaper to stimulate the demand for the output of certain industries.

The investment models utilized in the thesis underline the importance of demand changes as well as sources of external finance to the firm. Further studies with these models applied to other manufacturing firms can yield useful results.

Alternatively the simultaneous equation approach may be expanded to include: short term financing arrangements, trade credits. Similarly, leasing arrangements are common in many manufacturing subsectors, but they do not appear directly on balance sheets. The model can also be reformulated to capture elements of lease-buy decisions. Finally, investigations with an emphasis on the micro economic approach offer more guidance to policymakers than broad aggregative studies.

FOOTNOTES

[1]The elasticity coefficient is based on the sample of pulp and paper firms.

[2]Evans reviewed seven studies on investment and calculated elasticities for three variables i.e., the elasticity of investment relative to output, the interest rate and cash flow. Two of his conclusions are relevant here: a change of 1 percent in output yields an average change of $1\frac{1}{2}$ to 2 percent over a two year period; a change of 1 percent in cash flow will change investment from $\frac{1}{4}$ to $\frac{1}{2}$ percent (p. 138). Kuh (1971) reports similar results in his study on capital goods producers.

[3]For a concise summary on incentives available to the resource industry up to 1980, see the recent publication, R. Boadway and H. Kitchen, <u>Canadian Tax Policy</u>, Canadian Tax Foundation, Toronto, 1980, Chp. 3.

[4]R. Knechtel and R.W. Penny (1973) provide a good description of the type of property and the activities eligible for the 1972 faster write offs in the manufacturing sector. Some activities excluded are "logging," and the "processing of ore from a mineral resource to the prime metal stage."

[5]Another component of the total is a category defined as "not requiring an outlay of funds" i.e., income tax allocations relating to future years. The implications of the growth of "Reserves for Future Income Taxes" will be discussed in the next section.

[6]<u>Conference on Research in Business Finance</u>, National Bureau of Economic Research, New York, 1952.

[7]See footnote 60 of Chapter Three. In considering the lease-buy decision the tax position is very important. If a firm is fully taxable and can take advantage of faster write offs, then it is better to own rather than lease a capital good. A firm with no taxable income cannot utilize depreciation allowances; for this firm it is advantageous to sell the "tax attributes to a lessor and enter into a leveraged lease of the asset back from him." McClelland (1978), p. 30. McClelland cites specific examples of the use of leveraged lease financing in the United States.

[8]The term preferred share is also a hybrid financial instrument. Essentially it is an equity instrument with tax characteristics of bond finance.

[9]See <u>Budget Paper C, 1976 Federal Budget</u>, Department of Finance, Ottawa, 1976.

[10]For example Sullivan (1974) reported that investment holding companies and highly liquid corporations used the income debenture bonds. He found it difficult to document the transactions of the bonds, yet by 1978 the Federal Government considered the volume of transactions excessive. The Government took steps to curtail the volume of transactions by changing the tax status of the bonds.

[11]Over the last couple of years there has been some financial innovation in debt and equity markets. In bond markets, bonds are issued with certain "twists:" bonds are indexed to the price of silver and oil for example; there are bonds which allow for participation in profits. Similarly when convertible preferred shares are offered, investors are given options to purchase common shares in the future. See The Financial Post, 3-1-81, p. 1 and p. 13 for a description of recent innovations in financial arrangements.

[12]The change constituted part of an overall review of the system of capital cost allowances. The review resulted in the reduction of rates for certain classes of assets. See Appendix Table A10.

[13]Many firms now publish two accounting statements. The second statement is adjusted to reflect changes in the price level. The inflation adjusted statement is not new. See for example R. Jones, "Effect of Inflation on Capital and Profits: The Record of Nine Steel Companies," Journal of Accountancy, 1949, pp. 9-27.

[14]Research on price level restatements, inflation and capital cost allowances represent a small portion of the voluminous writings on inflation. Aaron (1976) has a group of studies on inflation and the income tax. Shoven and Bulow (1975; 1976) and Davidson and Weir (1975) examine inflation accounting and business financial statements.

[15]See Lent (1976) for a concise summary of international changes.

[16]The 1978 Supplementary Budget Information, Department of Finance acknowledges that the investment tax credit and accelerated capital cost allowances assist in "substantially mitigating the impact of inflation on business taxation."

[17]See The Financial Post 500, Summer 1980, p. 61, for a brief summary of the proposals. Note that CICA has to consider how their proposals match those laid down by the United States Financial Accounting Standards Board. This is especially important for firms who must file statements with United States Authorities.

[18]Other explanations are: (1) firms borrowed to buy the assets of other companies; (2) firms were expecting tax changes

to be introduced with respect to leasing and income debenture bonds and borrowed to consolidate their position.

[19]Jenkins insists that the relative merits of current cost accounting and general price level accounting are not relevant here. The availability of Statistics Canada information on current replacement values determined his choice of method.

[20]Helliwell calculated that "the proposed 50% straight line capital cost allowance for machinery and equipment in manufacturing and processing would have a higher present value than the constant dollar economic depreciation unless the inflation rate were as high as 75%." p. 173.

[21]See Jenkins (1977), Chapter 7.

[22]Firms choose the deferral method to account for differences in the timing between accounting for tax purposes and for book purposes.

[23]See in particular B. Bittker, "Accounting for Federal 'Tax Subsidies' in the National Budget," National Tax Journal, vol. 22, June 1969, pp. 244-261. Bittker's article was in response to a speech made by S. Surrey in 1967 and an excerpt from the Annual Report of the Secretary of the Treasury for the fiscal year 1968.

[24]Smith (1979) presents a comprehensive review of tax preferences in the personal and corporate income tax systems. Earlier Kesselman (1977) examined non business deductions.

[25]Government of Canada: Tax Expenditure Account, Department of Finance, Ottawa, December 1979.

[26]See the reference cited in footnote 16 above.

[27]See Brannon (1972) and the "Discussion" in Fromm (1971) for example.

APPENDIX TABLES

TABLE A1

SELECTED DATA FOR THE SAMPLE OF 3 STEEL FIRMS
(1955 - 1978)
$m

	Sales	Capital Expenditures	Capital cost Allowances	After-Tax Profits
1955	426	37	23	37
1956	505	72	25	47
1957	508	86	32	43
1958	446	59	31	39
1959	600	78	35	64
1960	541	107	36	46
1961	589	74	40	61
1962	678	127	45	68
1963	752	83	48	83
1964	923	200	53	95
1965	1026	147	58	100
1966	1011	216	65	93
1967	978	173	71	86
1968	1024	78	81	126
1969	1044	118	77	82
1970	1252	193	81	113
1971	1383	219	85	107
1972	1530	179	101	115
1973	1834	205	106	160
1974	2289	361	113	223
1975	2482	455	118	159
1976	2849	337	130	157
1977	3051	334	136	153
1978	3760	318	145	252

Source: Annual Reports of the Steel Firms.

TABLE A2

SELECTED DATA FOR THE SAMPLE OF 5 PULP AND PAPER FIRMS

(1955 - 1978)

$m

	Sales	Capital Expenditures	Capital cost Allowances	After-Tax Profits
1955	286	36	14	35
1956	526	69	16	36
1957	529	74	18	29
1958	536	33	19	26
1959	556	39	41	54
1960	659	49	50	60
1961	660	49	44	62
1962	689	75	44	76
1963	733	106	51	80
1964	835	160	54	87
1965	912	160	52	86
1966	1078	216	66	90
1967	1159	246	76	75
1968	1313	135	91	72
1969	1473	185	102	81
1970	1471	139	101	27
1971	1538	143	103	38
1972	1853	144	104	67
1973	2464	206	118	165
1974	3029	357	131	216
1975	3084	342	157	68
1976	3673	324	173	85
1977	4110	282	191	168
1978	5360	352	207	328

Source: Annual Reports of the Pulp and Paper Firms.

TABLE A3

MEANS AND STANDARD DEVIATIONS OF THE REGRESSION VARIABLES:

THE SAMPLE OF STEEL FIRMS

$m 1/

Variables	Means	Standard Deviations
I	155.5714	102.4766
S^*_t	0.1737	0.2058
S^*_{t-1}	0.1561	0.2082
S^*_{t-2}	0.1229	0.1565
S^*_{t-3}	0.0969	0.1333
S^*_{t-4}	0.0890	0.1289
D	63.0476	29.9658
D^V	38.2857	19.8800
D^V_{t-1}	34.7143	18.3089
P	92.7143	46.6917
EF	45.9524	82.2378
P_{t-1}	86.0952	46.6775
C	0.0540	0.0150
L^V	0.2159	0.0774
S^*	0.3469	0.2283

Note: There are 21 observations for each variable.

1/ All variables are measured in millions of dollars except for C and L^V which are measured in percentage points.

TABLE A4

MEANS AND STANDARD DEVIATIONS OF THE REGRESSION VARIABLES: THE SAMPLE OF PULP AND PAPER FIRMS

$m 1/

Variables	Means	Standard Deviations
I	141.0952	93.7864
S^{*}_{t}	0.2405	0.3103
S^{*}_{t-1}	0.2370	0.3123
S^{*}_{t-2}	0.1882	0.2602
S^{*}_{t-3}	0.1357	0.1587
S^{*}_{t-4}	0.1129	0.1244
D	69.1429	40.7385
D^{v}	36.9048	14.1877
D^{v}_{t-1}	35.4762	15.1282
P	72.8571	45.1135
EF	50.3333	68.8806
P_{t-1}	70.9048	46.2081
C	0.0551	0.0155
L^{v}	0.4303	0.2260
S^{*}	0.4293	0.3017

Note: Some variables have less than 21 observations.

1/ All variables are measured in millions of dollars except for C and Lv which are measured in percentage points.

TABLE A5

FLEXIBLE ACCELERATOR MODEL: TIME SERIES DATA 1955 - 1975
THE STEEL COMPANY OF CANADA

Variables		Undeflated Data		Deflated Data	
Investment Expenditures with		Coefficients and standard errors	Beta Coefficients	Coefficients and standard errors	Beta Coefficients
$\frac{S_t - S_{t-1}}{S_b}$	β_1	0.16828 (0.10700)	0.22435	0.19796 (0.09920)	0.37287
$\frac{S_{t-1} - S_{t-2}}{S_b}$	β_2	0.37150* (0.10449)	0.50923	0.32250* (0.10024)	0.59850
$\frac{S_{t-2} - S_{t-3}}{S_b}$	β_3	0.40505* (0.12432)	0.48084	0.29779* (0.12149)	0.50526
$\frac{S_{t-3} - S_{t-4}}{S_b}$	β_4	0.19705 (0.14499)	0.20479	0.15057 (0.13549)	0.23859

TABLE A5
(continued)

FLEXIBLE ACCELERATOR MODEL: TIME SERIES DATA 1955 - 1975
THE STEEL COMPANY OF CANADA

Variables		Undeflated Data		Deflated Data	
Investment Expenditures with		Coefficients and standard errors	Beta Coefficients	Coefficients and standard errors	Beta Coefficients
$\frac{S_{t-4} - S_{t-5}}{S_b}$	β_5	0.07979 (0.12932)	-0.08268	-0.09284 (0.12444)	-0.14125
D_t	β_6	0.00159 (0.00296)	0.12009	0.00090 (0.00272)	0.07334
Intercept	β_0	0.05186 (0.07474)	—	0.06593 (0.05877)	—
$\bar{R}^2$		0.7672		0.4861	
F		11.986		4.153	
DW		1.81		1.76	

See notes to Table 5 of Chapter Five.

TABLE A6

FLEXIBLE ACCELERATOR MODEL: TIME SERIES DATA 1955 - 1975 FOR AGGREGATE SAMPLE OF PULP AND PAPER FIRMS

Variables		Undeflated Data		Deflated Data	
Investment Expenditures with		Coefficients and standard errors	Beta Coefficients	Coefficients and standard errors	Beta Coefficients
$\frac{S_t - S_{t-1}}{S_b}$	β_1	0.00614 (0.05672)	0.01570	0.02374 (0.06799)	0.06996
$\frac{S_{t-1} - S_{t-2}}{S_b}$	β_2	0.10606 (0.06558)	0.27869	0.08878 (0.07732)	0.23567
$\frac{S_{t-2} - S_{t-3}}{S_b}$	β_3	—	—	-0.01804 (0.08619)	-0.04037
$\frac{S_{t-3} - S_{t-4}}{S_b}$	β_4	-0.10948 (0.12373)	-0.14620	-0.12233 (0.12363)	-0.20892

TABLE A6 (continued)

FLEXIBLE ACCELERATOR MODEL: TIME SERIES DATA 1955 - 1975 FOR AGGREGATE SAMPLE OF PULP AND PAPER FIRMS

Variables		Undeflated Data		Deflated Data	
Investment Expenditures with		Coefficients and standard errors	Beta Coefficients	Coefficients and standard errors	Beta Coefficients
$\frac{S_{t-4} - S_{t-5}}{S_b}$	β_5	0.25683 (0.13095)	-0.26884	-0.22962 (0.13222)	-0.35846
D_t	β_6	0.00237* (0.00073)	0.81561	0.00166* (0.00060)	0.75203
Intercept	β_0	0.03154 (0.05467)	—	0.03152 (0.03130)	—
$\bar{R}^2$		0.7884		0.4883	
F		15.911		4.181	
DW		1.26		1.18	

See notes to Table 5 of Chapter Five

TABLE A7

DIFFERENCES BETWEEN OLS AND 2SLS ESTIMATES FOR THE SAMPLE OF STEEL FIRMS [1]

	Deflated	Undeflated
(a) Investment Equation		
Intercept	0.028	0.035
S^*	0.102	0.081
D^v	0.352	0.385
EF	0.134	0.182
D_o	0.487	0.408
(b) Dividend Equation		
Intercept	0.746	0.640
D^v_{t-1}	0.687	0.692
P	0.551	0.768
I	1.449	1.258
EF	1.061	0.549

TABLE A7

(continued)

	Deflated	Undeflated
(c) External Finance Equation		
Intercept	0.046	0.017
L^V	0.382	0.436
C	0.535	0.525
I	0.789	0.767
D^V	0.185	0.037
P_{t-1}	0.516	0.586
D	0.001	0.286

1/ The differences are measured as follows: absolute differences divided by the standard error of the two stage squares estimator

Source: Based on data from Tables 11(a) - 11(c) and Tables 12(a) - 12(c)

TABLE A8

DIFFERENCES BETWEEN OLS AND 2SLS ESTIMATES FOR THE SAMPLE OF PULP AND PAPER FIRMS 1/

	Deflated	Undeflated
(a) Investment Equation		
Intercept	0.376	0.402
S^*	0.125	0.404
D^v	0.478	0.326
EF	0.236	0.899
D	0.002	0.563
(b) Dividend Equation		
Intercept	0.738	0.546
D^v_{t-1}	0.715	0.574
P	0.852	0.836
I	0.979	0.965
EF	0.631	0.772

TABLE A8
(continued)

	Deflated	Undeflated
(c) External Finance Equation		
Intercept	0.143	0.097
L^V	0.844	0.275
C	0.325	0.025
I	0.417	0.218
D^V	0.565	0.665
P_{t-1}	0.524	0.086
D	0.292	0.007

1/ The differences are measured as follows: absolute differences divided by the standard error of the two stage least squares estimator

Source: Based on data from Tables 14(a) - 14(c) and Tables 15(a) - 15(c).

TABLE A9

FORMULAS FOR CALCULATING THE ELASTICITY COEFFICIENTS IN THE SIMULTANEOUS EQUATION MODEL

The elasticity of investment with respect to:-

D is defined: $\frac{dI}{dD} \bullet \frac{\overline{D}}{\overline{I}}$

S^* is defined: $\frac{dI}{dS^*} \bullet \frac{\overline{S^*}}{\overline{I}}$

EF is defined: $\frac{dI}{dEF} \bullet \frac{\overline{EF}}{\overline{I}}$

and the elasticities are calculated at their mean values.

And $\frac{dI}{dD}$ for example is $\frac{\partial I}{\partial D} + \frac{\partial I}{\partial EF} \bullet \frac{\partial EF}{\partial D}$

Note: The Variables are defined in section I of Chapter Five.

TABLE A10

CAPITAL COST ALLOWANCES FOR SELECTED CLASSES OF ASSETS

(a) SPECIAL CLASSES

CLASSES	DESCRIPTION	MAXIMUM RATE ALLOWED %
19 (13.6.63-1.1.67)	Faster write-off for new machinery in specially designated areas (firms must have some degree of Canadian ownership)	50
20,21 (13.6.63-1.1.67)	Five year write-off for new buildings and two year write-off for new machinery and equipment (no restriction on the ownership of firms)	Buildings-20 Machinery-50
24 (26.4.65-present)	Two year write-off for new assets acquired primarily to control air pollution	50
27 (13.3.70-present)	Two year write-off for new assets acquired primarily to control water pollution	50
29 (9.5.72-present)	Two year write-off for new machinery and equipment for manufacturing and processing firms	50

TABLE A10

(continued)

(b) OTHER CLASSES

CLASSES	DESCRIPTION	MAXIMUM RATE ALLOWED %
3	Buildings of solid construction not elsewhere specified	5
8	Machinery and equipment and all tangible assets not elsewhere specified	20

(c) OTHER ASSETS

Note: The maximum rates and classes of these assets were changed after the Review of the Capital Cost Allowance System (effective 26.5.76).

ASSET	PRESENT RATE %	FORMER RATE
aircraft	25	40
powered earth moving equipment	30	50
electrical generation equipment	20	25

Source: A.W. Gilmore, Income Tax Handbook, Richard De Boo Ltd., Toronto (1978 - 1979 edition).

TABLE A11

SPECIAL CAPITAL COST ALLOWANCES FOR THE PRIMARY METALS, PAPER AND ALLIED INDUSTRIES AND TOTAL MANUFACTURING

$m

	Class 19	Class 20	Class 21	Class 24	Class 27	Class 29
	(a)	Primary Metals				
1966	150.6	-	-	-	-	-
1967	92.4	0.4	-	-	-	-
1968	4.8	0.7	3.2	-	-	-
1969	6.4	1.3	3.9	-	-	-
1970	1.7	2.6	11.5	6.0	-	-
1971	0.4	4.7	20.6	16.0	3.8	-
1972	-	4.8	4.9	9.4	13.0	20.7
1973	-	1.3	0.3	9.8	9.4	82.9
1974	-	3.7	0.6	18.3	20.0	159.9
1975	-	0.2	1.3	13.3	19.5	164.8
1976	-	0.1	0.3	14.8	19.3	122.1
1977	-	-	-	4.5	8.8	95.6
	(b)	Paper and Allied Industries				
1966	113.8	10.3	9.9	-	-	-
1967	51.4	6.1	27.3	-	-	-
1968	6.6	11.9	9.3	-	-	-
1969	7.4	12.8	11.1	-	-	-
1970	0.9	11.5	10.6	-	-	-
1971	1.5	6.9	10.7	13.1	0.9	-
1972	-	10.0	4.6	18.9	1.6	13.3
1973	-	8.9	15.6	24.4	2.6	96.2

TABLE A11
(continued)

	Class 19	Class 20	Class 21	Class 24	Class 27	Class 29
1974	-	13.9	70.6	22.7	6.2	215.2
1975	-	11.0	24.2	30.8	10.1	238.3
1976	-	4.6	4.3	17.9	9.7	231.9
1977	-	-	-	13.3	7.5	214.5

(c) Total Manufacturing

	Class 19	Class 20	Class 21	Class 24	Class 27	Class 29
1966	577.9	15.3	12.7	10.8	-	-
1967	336.1	13.8	44.0	15.3	-	-
1968	71.5	24.2	52.8	14.7	-	-
1969[1/]	30.1	32.0	102.6	15.8	-	-
1970	12.6	36.5	102.7	32.1	-	-
1971	6.0	42.5	112.9	48.9	16.9	-
1972	-	49.0	85.5	67.1	39.9	204.9
1973	-	40.6	60.1	69.9	31.6	917.7
1974	-	41.9	105.1	70.9	52.1	1749.3
1975	-	23.2	41.4	69.4	53.5	1783.6
1976	-	8.9	19.8	46.0	42.3	1751.2
1977	-	-	-	28.3	33.3	1838.0

Note: See Table A10 above for the definition of these classes.

Source: <u>Corporation Taxation Statistics</u>, Statistics Canada, Cat. 61 - 208

BIBLIOGRAPHY

Aaron, H. (1976), Inflation and the Income Tax. Brookings Institution, Washington.

Anderson, W.H. (1964), Corporate Finance and Fixed Investment An Econometric Study, Harvard University Press, Boston.

Archer, S.H. and C. D'Ambrosio (1967), The Theory of Business Finance: A Book of Readings, Macmillan, New York.

Asimakopulos, A. and J. Burbidge (1974), "The Short Period Incidence of Taxation," Economic Journal, vol. 84 (June), pp. 267-288.

Baron, D. (1974), "Default Risk, Homemade Leverage and the Modigliani-Miller Theorem," American Economic Review, vol. 64 (March), pp. 176-182.

_______, (1976), "Default Risk and the Modigliani-Miller Theorem: A Synthesis," American Economic Review, vol. 66 (March), pp. 204-212.

Bird, R. (1963), "Depreciation Allowances and Countercyclical Policy in the United Kingdom, 1945-1960," Canadian Tax Journal, Appendices to nos. 3 and 4, vol. XI, pp. 253-273 and pp. 353-380.

_______, (1965), "A Tax Incentive For Sales: The Canadian Experience," National Tax Journal, vol. 18 (Sept.), pp. 277-285.

_______, (1980), Tax Incentives For Investment: The State of the Art, Canadian Tax Foundation, Toronto.

Black, J. (1959), "Investment Allowances, Initial Allowances and Cheap Loans as a Means of Encouraging Investment," Review of Economic Studies, vol. 27 (October), pp. 44-49.

Boot, J. and G. de Wit (1960), "Investment Demand: An Empirical Contribution to the Aggregation Problem," International Economic Review, vol. 1 (Jan.), pp. 3-30.

Brainard, W.C. and J. Tobin (1968), "Pitfalls in Financial Modelbuilding," American Economic Association Papers and Proceedings, vol. 58 (May), pp. 99-122.

Braithwaite, C. (1974), "The Effects of Recent Tax Policy Changes on Investment in Canadian Manufacturing," unpublished paper, Economic Council of Canada, Canada.

Brannon, G. (1972), "The Effects of Tax Incentives For Business Investment: A Survey of the Evidence," in

The Economics of Federal Subsidy Programs, Part 3--Tax Subsidies, Joint Economic Committee Print, Washington.

Break, G. (1974), "The Incidence and Economic Effects of Taxation," in _The Economics of Public Finance_, Brookings Institution, Washington, pp. 119-237.

Brechling, F. (1975), _Investment and Employment Decisions_, Manchester University Press, Manchester.

Bridge, J.L., (1971), _Applied Econometrics_, North Holland, Amsterdam.

Brittain, J.A. (1964), "The Tax Structure and Corporate Dividend Policy," _American Economic Association Papers and Proceedings_, vol. 54 (May), pp. 272-287.

Brown, E. Cary (1948), "Business Income Taxation and Incentives," in _Income, Employment and Public Policy, Essays in Honor of Alvin H. Hansen_, Norton & Co., New York, pp. 525-537.

_______, (1955), "The New Depreciation Policy Under the Income Tax: An Economic Analysis," _National Tax Journal_, vol. 8 (March), pp. 81-98.

_______, (1962), "Tax Incentives For Investment," _American Economic Association Papers and Proceedings_, vol. 52 (May), pp. 335-345.

Chase, S. (1962), "Tax Credits For Investment Spending," _National Tax Journal_, vol. 15 (March), pp. 32-52.

Château, J. (1976), "La politique de distribution de dividendes des sociétés: une étude microéconométrique," _Canadian Journal of Economics_, vol. IX, no. 2 (May), pp. 255-277.

Chenery, H. (1952), "Overcapacity and the Acceleration Principle," _Econometrica_, vol. 20 (Jan.), pp. 1-28.

Christ, C. (1966), _Econometric Models and Methods_, Wiley, New York.

Clark, J.M. (1917), "Business Acceleration and the Law of Demand: A Technical Factor in Economic Cycles," _Journal of Political Economy_, vol. 25 (March), pp. 217-235.

Coen, R.M. (1968), "Effects of Tax Policy on Investment in Manufacturing," _American Economic Review_, vol. 58 (May), pp. 200-211.

_______, (1969), "Tax Policy and Investment Behaviour: Comment," _American Economic Review_, vol. 59 (June), pp. 370-379.

_______, (1971), "The Effect of Cash Flow on the Speed of Adjustment," in G. Fromm (ed.), Tax Incentives and Investment Spending, Brookings Institution, Washington, pp. 131-196.

Cohen, M.A. (1974), "Current Issues Respecting the Canadian Capital Cost Allowance System," National Tax Association, 67th Annual Conference, pp. 61-67.

Corner, D. and A. Williams (1965), "The Sensitivity of Business to Initial and Investment Allowances," Economica, vol. 32 (Feb.), pp. 32-47.

Davenport, M. (1971), "Leverage and the Cost of Capital: Some Tests Using British Data," Economica, vol. 38 (May), pp. 136-162.

Davidson, S. and S. Drake (1961), "Capital Budgeting and the 'Best' Tax Depreciation Method," Journal of Business, vol. 34 (October), pp. 442-453.

_______ and R. Weil (1975), "Inflation Accounting: What Will General Price Level Adjusted Income Statements Show?" Financial Analysts Journal, Jan.-Feb., pp. 27-31 and 71-84.

De Melto, D. (1970), The Effect of Foreign Competition on the Canadian Primary Steel Industry, 1950-1966, unpublished Ph.D. dissertation, McGill University, Montréal.

Dhrymes, P. (1970), "On the Game of Maximising $\bar{R}^2$," Australian Economic Papers, vol. 9, no. 15, pp. 177-185.

_______, (1971), Distributed Lags: Problems of Estimation and Formulation, Holden-Day, San Francisco.

_______ and M. Kurz (1964), "On the Dividend Policy of Electric Utilities," Review of Economics and Statistics, vol. 46 (Feb.), pp. 76-81.

_______, (1967), "Investment, Dividend and External Finance Behaviour of Firms," in R. Ferber (ed.), Determinants of Investment Behaviour, Columbia University Press, New York, pp. 427-467.

Domar, E. (1953a), "Depreciation, Replacement and Growth," Economic Journal, vol. 62 (March), pp. 1-32.

_______ (1953b), "The Case For Accelerated Depreciation," Quarterly Journal of Economics, vol. 67 (Nov.), pp. 493-519.

_______ and R. Musgrave (1944), "Proportional Income Taxation and Risk Taking," Quarterly Journal of Economics, vol. 58 (May), pp. 388-423.

Draper, N. and H. Smith (1966), Applied Regression Analysis, Wiley and Sons, New York.

Duesenberry, J. (1958), Business Cycles and Economic Growth, McGraw-Hill, New York.

Durand, D. (1952), "Costs of Debt and Equity Funds For Business: Trends and Problems of Measurement," in Conference on Research in Business Finance, N.B.E.R., New York, pp. 215-247.

Durbin, J. (1970), "Testing for Serial Correlation in Least Squares Regression When Some of the Regressors Are Lagged Dependent Variables," Econometrica, vol. 38, pp. 410-421.

Eckaus, R. (1953), "The Acceleration Principle Reconsidered," Quarterly Journal of Economics, vol. 67 (May), pp. 209-230.

Edelstein, H. and P. Bernstein (1961), "The Case Against Accelerated Depreciation," Social Research, XXVIII (Winter), pp. 491-496.

Eisner, R. (1952a), "Accelerated Amortization, Growth and Net Profits," Quarterly Journal of Economics, vol. 66 (Nov.), pp. 533-544.

_______, (1952b), "Depreciation Allowances, Replacement Requirements and Growth," American Economic Review, vol. 42 (Dec.), pp. 820-831.

_______, (1955), "Accelerated Depreciation: Some Further Thoughts," Quarterly Journal of Economics, vol. 69 (May), pp. 285-296.

_______, (1957), "Interview and Other Survey Techniques," in Problems of Capital Formation, Studies in Income and Wealth, vol. 19, N.B.E.R., Princeton, pp. 513-584.

_______, (1960), "A Distributed Lag Investment Function," Econometrica, vol. 28 (Jan.), pp. 1-29.

_______, (1963), "Investment: Fact and Fancy," American Economic Review, vol. 53 (May), pp. 237-246.

_______, (1967), "A Permanent Income Theory for Investment Some Empirical Explorations," American Economic Review, vol. 57 (June), pp. 363-390.

_______, (1969), "Tax Policy and Investment Behaviour: Comment," American Economic Review, vol 59 (June), pp. 379-388.

_______, (1972), "Components of Capital Expenditures: Replacement and Modernization Versus Expansion," Review of Economics and Statistics, vol. 54 (August), pp. 297-305.

_______, (1977), "Capital Shortage: Myth and Reality," American Economic Review, vol. 67 (February), pp. 110-115.

_______, (1978), Factors in Business Investment, N.B.E.R., Ballinger Press, Mass.

_______ and M. Nadiri (1968), "Investment Behaviour and Neoclassical Theory," Review of Economics and Statistics, vol. 50 (August), pp. 369-382.

_______, (1970), "Neoclassical Theory of Investment Behaviour: A Comment," Review of Economics and Statistics, vol. 52 (May), pp. 216-222.

_______ and R. Strotz (1963), "Determinants of Investment Behaviour," in Commission on Money and Credit: Impacts of Monetary Policy, Prentice-Hall, Englewood Cliffs, pp. 60-338.

Evans, M. (1967), "A Study of Industry Investment Decisions," Review of Economics and Statistics, vol. 49 (May), pp. 151-164.

_______, (1969), Macroeconomic Activity: Theory, Forecasting and Control, Harper and Row, New York.

Fama, E. (1974), "The Empirical Relationships Between the Dividend and Investment Decisions of Firms," American Economic Review, vol. 64 (June), pp. 304-318.

Feldstein, M. (1970), "Corporate Taxation and Dividend Behaviour," Review of Economic Studies, vol. 37, no. 1, pp. 57-72.

_______ and J. Flemming (1971), "Tax Policy, Corporate Saving and Investment Behaviour in Britain," Review of Economic Studies, vol. 38, no. 4, pp. 415-434.

_______ and D. Foot (1971), "The Other Half of Gross Investment: Replacement and Modernization Expenditures," Review of Economics and Statistics, vol. 53 (Feb.), pp. 49-58.

_______ and M. Rothschild (1974), "Towards An Economic Theory of Replacement Investment," Econometrica, vol. 42 (May), pp. 393-423.

Fisher, I. (1930), The Theory of Interest, Macmillan, New York.

Fox, K. (1956), "Econometric Models of the United States," Journal of Political Economy, vol. 64, pp. 128-142.

Fromm, G. (1971), Tax Incentives and Capital Spending, Brookings Institution, Washington.

Gaudet, G., J. May and D. McFetridge (1976), "Optimal Capital Accumulation: The Neoclassical Framework in a Canadian Context," Review of Economics and Statistics, vol. 58 (August), pp. 269-273.

Glyn, A. (1973), "The Stock Market Valuation of British Companies and the Cost of Capital, 1955-1969," Oxford Economic Papers, vol. 25 (July), pp. 213-240.

Goode, R. (1955), "Accelerated Depreciation Allowances As A Stimulus To Investment," Quarterly Journal of Economics, vol. 69 (May), pp. 191-220.

Goodwin, R. (1948), "Secular and Cyclical Aspects of the Multiplier and Accelerator," in L. Metzler, et al (eds.), Income, Employment and Public Policy, Norton, New York.

_______, (1951), "The Non Linear Accelerator and the Persistence of Business Cycles," Econometrica, vol. 19 (Jan.), pp. 1-17.

Gould, J.P. (1969), "The Use of Endogenous Variables in Dynamic Models of Investment," Quarterly Journal of Economics, vol. 83 (Nov.), pp. 580-599.

_______ and R. Waud (1973), "The Neoclassical Model of Investment Behaviour: Another View," International Economic Review, vol. 14 (Feb.), pp. 33-48.

Gratton, G. (1979), "Capital Markets in Canada," Foreign Investment Review (Autumn), pp. 14-16.

Grunfeld, V. (1960), "The Determinants of Corporate Investment," in A.C. Harberger (ed.), The Demand For Durable Goods, University of Chicago Press, Chicago, pp. 211-266.

_______ and Z. Griliches (1960), "Is Aggregation Necessarily Bad," Review of Economics and Statistics, vol. 42 (Feb.), pp. 1-13.

Hagen, K. (1976), "Default Risk, Homemade Leverage and the Modigliani-Miller Theorem: Note," American Economic Review, vol. 66 (March), pp. 199-203.

Hall, R. and D. Jorgenson (1967), "Tax Policy and Investment Behaviour," American Economic Review, vol. 57 (June), pp. 391-414.

_______, (1969), "Tax Policy and Investment Behaviour: Reply and Further Results," American Economic Review, vol. 59 (June), pp. 388-401.

_______, (1971), "Application of the Theory of Optimal Accumulation," in G. Fromm (ed.), Tax Incentives and Capital Spending, Brookings Institution, Washington, pp. 9-60.

Harberger, A. (1962), "The Incidence of the Corporation Income Tax," Journal of Political Economy, vol. 52 (June), pp. 215-240.

_______, (1971), "Discussion" in G. Fromm (ed.), Tax Incentives and Capital Spending, Brookings Institution, Washington, pp. 256-269.

Harkins, E. and F. Walsh (1968), "Current Corporate Debt Practices," The Conference Board Record, vol. 5, no. 6, pp. 36-42.

Harman, F. (1977), An Analysis of Investment Incentive Policies in Canada, unpublished Ph.D. dissertation, McMaster University, Hamilton.

_______ and J. Johnson (1978), "An Examination of Government Tax Incentives for Business Investment in Canada," Canadian Tax Journal, vol. XXVI (Nov.-Dec.), pp. 691-704.

Helliwell, J. (1966), Taxation and Investment Study No. 3, Studies of the Royal Commission on Taxation, Ottawa.

_______, (1972), "Towards An Inflation Proof Income Tax," in Proceedings of the Twenty Fourth Tax Conference, Canadian Tax Foundation, Toronto, pp. 165-174.

_______, (1976), "Survey of Issues," in J. Helliwell (ed.), Aggregate Investment, Penguin Readings, pp. 13-53.

_______, (1978), "Industrial Strategy and Development: Assessing the Influence of Tax Policy and Incentives," in Issues in Canadian Public Policy I: Proceedings of a Conference, Institute for Economic Research, Queen's University, pp. 158-166.

_______, G. Sparks and J. Frisch (1973), "The Supply Price of Capital in Macroeconomic Models," in A. Powell and R. Williams (eds.), Econometric Studies of Macro and Monetary Relations, North Holland, pp. 261-283.

Hirschleifer, J. (1959), "On The Theory of The Optimal Investment Decision," in E. Solomon (ed.), The Management of Corporate Capital, Free Press, Glencoe, Illinois, pp. 205-208.

Jenkins, G. (1977), Inflation: Its Financial Impact on Business in Canada, Economic Council of Canada, Ottawa.

Johnson, J. and M. Scarth (1979), "Tax Expenditures For Business Investment: Their Effectiveness and Their Beneficiaries," Canadian Taxation, vol. 1 (Fall), pp. 4-8.

Johnston, D. (1974), "Leasing," in Corporate Management Tax Conference 1974, Canadian Tax Foundation, Toronto, pp. 107-123.

Johnston, J. (1972), Econometric Methods, McGraw Hill, New York (2nd edition).

Jorgenson, D. (1963), "Capital Theory and Investment Behaviour," American Economic Review, vol. 53 (May), pp. 247-259.

_______, (1965), "Anticipations and Investment Behaviour," in J. Duesenberry et al (eds.), The Brookings Quarterly Econometric Model of the United States, North Holland, Amsterdam, pp. 35-92.

_______, (1967), "The Theory of Investment Behaviour," in R. Ferber (ed.), Determinants of Investment Behaviour, N.B.E.R., Columbia University Press, New York, pp. 129-156.

_______, (1971), "Econometric Studies of Investment Behaviour: A Survey," Journal of Economic Literature, vol. 9 (Dec.), pp. 1111-1147.

_______, (1974), "The Economic Theory of Replacement and Depreciation," in W. Sellekaerts (ed.), Econometrics and Economic Theory: Essays in Honour of Jan Tinbergen, Macmillan, London, pp. 189-221.

_______ and C. Siebert (1968a), "A Comparison of Alternative Theories of Corporate Investment Behaviour," American Economic Review, vol. 58 (Sept.), pp. 681-712.

_______, (1968b), "Optimal Capital Accumulation and Corporate Investment Behaviour," Journal of Political Economy, vol. 76 (Nov.-Dec.), pp. 1123-1151.

_______ and J. Stephenson (1967), "Investment Behaviour in U.S. Manufacturing, 1947-1960," Econometrica, vol. 35 (April), pp. 169-220.

_______, (1969), "Issues in the Development of the Neoclassical Theory of Investment Behaviour," Review of Economics and Statistics, vol. 51 (August), pp. 346-353.

Kalecki, M. (1944), "Three Ways to Full Employment," in The Economics of Full Employment, Basil Blackwell, Oxford, pp. 39-58.

_______, (1971), Selected Essays in the Dynamics of the Capitalist Economy, 1933-1970, Cambridge University Press.

Kennedy, P. (1979), A Guide to Econometrics, Martin Robinson & Co., London.

Kesselman, J. (1977), "Non Business Deductions and Tax Expenditures in Canada: Aggregates and Distributions," Canadian Tax Journal, vol. XXV (March-April), pp. 160-179.

Kierans, E. (1960), "The Economic Meaning of Depreciation Policy," Canadian Chartered Accountant, (Nov.), pp. 417-424.

_______, (1972), "Contribution of the Tax System to Canada's Unemployment and Ownership Problems," Canadian Perspectives in Economics, Collier-Macmillan, Toronto.

King, M. (1974), "Taxation and the Cost of Capital," Review of Economic Studies, vol. 41 (Jan.), pp. 21-36.

_______, (1977), Public Policy and the Corporation, Chapman and Hall, London.

Knechtel, R. and P. Penny (1973), "Federal Manufacturing and Processing Incentives," Canadian Tax Journal, vol. XXI (Sept.-Oct.), pp. 391-409.

Knox, A. (1952), "The Acceleration Principle and the Theory of Investment: A Survey," Economica, vol. 19 (August), pp. 269-297.

Kollintzas, T. and R. Rowley (1980a), Nonstatic Expectations, Nonexponential Decay and the Post Tax Rental Cost of Capital, Research Paper No. 80-1, Social Sciences Statistical Laboratory, McGill University, Montréal.

_______, (1980b), Financial Constraints and the Post Tax Rental Cost of Capital. Research Paper No. 80-2, Social Sciences Statistical Laboratory, McGill University, Montréal.

Koyck, L. (1954), Distributed Lags and Investment Analysis, North Holland, Amsterdam.

Kraus, M. (1972), "Differential Tax Incidence: Large Versus Small Tax Changes," Journal of Political Economy, vol. 80 (Jan.-Feb.), pp. 346-353.

Kuh, E. (1963), "Theory and Institutions in the Study of Investment Behaviour," American Economic Review, vol. 53 (May), pp. 260-268.

_______, (1971), Capital Stock Growth: A Microeconomic Approach, North Holland, Amsterdam (2nd edition).

Laing, A. (1973), "Tax Incentives For Manufacturing and Processing and the Steel Industries," Report of the Proceedings of the Twenty-Fifth Tax Conference, Canadian Tax Foundation, Toronto, pp. 136-143.

Lange, O. (1936), "The Place of Interest in the Theory of Production," Review of Economic Studies, vol. 3 (June), pp. 159-192.

Latané, H. (1967), "Comment," in R. Ferber (ed.), Determinants of Investment Behaviour, N.B.E.R., Columbia University Press, New York, pp. 468-471.

Lent, G. (1976), "Adjusting Taxable Profits For Inflation: The Foreign Experience," in H. Aaron (ed.), Inflation and the Income Tax, Brookings Institution, Washington, pp. 195-213.

Lintner, J. (1956), "Distribution of Income of Corporations Among Dividends, Retained Earnings and Taxes," American Economic Association Papers and Proceedings, vol. 46 (May), pp. 97-113.

_______, (1959), "The Financing of Corporations," in E. Mason (ed.), The Corporation in Modern Society, Harvard University Press, Cambridge, pp. 166-201.

_______, (1962), "Dividends, Earnings, Leverage, Stock Prices and the Supply of Capital to Corporations," Review of Economics and Statistics, vol. 44 (August), pp. 243-269.

_______, (1967), "Corporation Finance: Risk and Investment," in R. Ferber (ed.), Determinants of Investment Behavior, N.B.E.R., New York, pp. 215-254.

Litvak, I. and C. Maule (1977), Corporate Dualism and the Steel Industry, Study No. 19, Royal Commission on Corporate Concentration, Ottawa.

Loranger, J.G. (1976), "Problems of Identification and Estimation of the Demand For Capital," Review of Economics and Statistics, vol. 58 (May), pp. 173-180.

Lund, P. (1976), "The Econometric Assessment of the Impact of Investment Incentives," in A. Whiting (ed.), The Economics of Industrial Subsidies, HMSO, pp. 245-265.

Maddala, G. (1977), Econometrics, McGraw Hill, New York.

Matziorinis, K., T. Kollintzas and R. Rowley (1980a), Taxation of Canadian Manufacturing Industries: The Income Tax For Corporation, Research Paper 80-3, Social Sciences Statistical Laboratory, McGill University, Montréal.

_______, (1980b), Taxation of Canadian Manufacturing Industries: Depreciation Rules For Investment Expenditures, Research Paper 80-4, Social Sciences Statistical Laboratory, McGill University, Montréal.

May, J. (1979), "Investment Incentives As Part of An Industrial Strategy," Canadian Public Policy, vol. V (Winter), pp. 70-79.

McClelland (1978), "How Competitive is Canada's Business Taxation System," in Report of Proceedings of the Thirtieth Tax Conference, Canadian Tax Foundation, Toronto, pp. 14-21.

McFetridge, D. and J. May (1976), "The Effects of Capital Cost Allowance Measures on Capital Accumulation in the Canadian Manufacturing Sector," Public Finance Quarterly, vol. 4 (July), pp. 307-322.

Mendelsohn, J. and C. Beigie (1976), Tax Concessions To Boost Investment, HRI Observations no. 13, C.D. Howe Research Institute, Montréal.

Meyer, J. and R. Glauber (1964), Investment Decisions, Economic Forecasting and Public Policy, Harvard University, Graduate School of Business Asministration, Division of Research, Boston.

_______ and E. Kuh (1957), The Investment Decision, Harvard University Press, Cambridge.

Modigliani, F. and M. Miller (1958), "The Cost of Capital, Corporation Finance and the Theory of Investment," American Economic Review, vol. 48 (June), pp. 261-297.

_______, (1963), "Corporate Income Taxes and the Cost of Capital: A Correction," American Economic Review, vol. 53 (June), pp. 433-443.

Murphy, G. (1972), "The Influence of Taxation on Canadian Corporate Depreciation Practices," Canadian Tax Journal, vol. XX (May-June), pp. 233-239.

Musgrave (1959), The Theory of Public Finance, McGraw Hill, New York.

National Bureau of Economic Research and the Brookings Institution, Foreign Rax Policies and Economic Growth, Columbia University Press, New York, 1966.

Nerlove, M. (1967), "Recent Empirical Studies of the C.E.S. and Related Production Functions," in M. Brown (ed.), The Theory and Empirical Analysis of Production, NBER, Columbia University Press, New York, pp. 55-122.

_______, (1972), "Lags in Economic Behaviour," Econometrica, vol. 40 (March), pp. 221-251.

Nickell, S. (1978), The Investment Decisions of Firms, James Nisbet & Co., Ltd.

Perry, D. (1976), "Fiscal Figures--Corporation Tax Expenditures," Canadian Tax Journal, vol. XXIV (Sept.-Oct.), 1976.

Pigou, A. (1952), A Study in Public Finance, Macmillan, London.

Rešek, R. (1966), "Investment by Manufacturing Firms: A Quarterly Time Series Analysis of Industry Data," Review of Economics and Statistics, vol. 48 (August), pp. 322-333.

_______, (1967), "Comment," in R. Ferber (ed.), Determinants of Investment Behaviour, NBER, Columbia University Press, New York, pp. 471-477.

Rowley, R. (1970), "Investment Functions: Which Production Function?" American Economic Review, vol. 60 (December), pp. 1008-1012.

_______ and P. Trivedi (1975), Econometrics of Investment, Wiley, London.

Salman, T. (1976), Canadian Pacific Investment Ltd., Study No. 5 of the Royal Commission on Corporate Concentration, Ottawa.

Schmidt, P. and R. Waud (1973), "The Almon Lag Technique and the Monetary Versus Fiscal Policy Debate," Journal of the American Statistical Association, vol. 68 (March), pp. 11-19.

Schramm, R. (1972), "Neoclassical Investment Models and French Private Manufacturing Investment," American Economic Review, vol. 62 (Sept.), pp. 553-563.

Shapiro, D. (1980), Foreign and Domestic Firms in Canada. A Comparative Study of Financial Structure and Performance, Butterworths, Toronto.

Shoup, C. (1972), Quantitative Research in Taxation and Government Expenditure, Part IV, Fiftieth Anniversary Colloquium, National Bureau of Economic Research, New York.

Shelton, J. and G. Ohlin (1952), "A Swedish Tax Provision For Stabilizing Business Investment," American Economic Review, vol. 42 (June), pp. 375-380.

Shoven, J. and J. Bulow (1975), "Inflation Accounting and Nonfinancial Corporate Profits: Physical Assets," Brookings Papers on Economic Activity, 3:1975, pp. 557-598.

_______, (1976), "Inflation Accounting and Nonfinancial Corporate Profits: Financial Assets and Liabilities," Brookings Papers on Economic Activity, No. 1: 1976, pp. 15-57.

Silberman, C. (1956), "How Much Can Business Borrow," Fortune, (June), pp. 131-135.

Slitor, R. (1953), "Liberalization of Depreciation" in Proceedings of National Tax Association 46th Annual Conference on Taxation (October), pp. 466-474.

Smith, R. (1979), Tax Expenditures: An Examination of Tax Incentives and Tax Preferences in the Canadian Federal Income Tax System, Canadian Tax Foundation, Toronto.

Smith, V.L. (1970), "Corporate Financial Theory Under Uncertainty," Quarterly Journal of Economics, vol. 84 (August), pp. 451-471.

_______, (1972), "Default Risk, Scale and the Homemade Leverage Theorem," American Economic Review, vol. 62 (March), pp. 66-76.

Solomon, E. (1959), The Management of Corporate Capital, Free Press, Glencoe, Illinois.

Stigilitz, J. (1969), "A Reexamination of the Modigliani-Miller Theorem," American Economic Review, vol. 59 (December), pp. 784-793.

_______, (1972), "Some Aspects of the Pure Theory of Corporate Finance: Bankruptcy and Takeover," Bell Journal of Economics and Management Science, vol. 3 (Autumn), pp. 458-483.

_______, (1973), "Taxation, Corporate Financial Policy and the Cost of Capital," Journal of Public Economics, vol. 2, pp. 1-34.

_______, (1976), "The Corporation Tax," Journal of Public Economics, vol. 5, pp. 303-312.

Sullivan, D. (1974), "Current Methods of Corporate Financing," in Corporate Management Tax Conference 1974, Canadian Tax Foundation, Toronto.

Sumner, M.T. (1973a), "Announcement Effects of Profits Taxation," in M. Parkin (ed.), Essays in Modern Economics, Longmans, pp. 27-32.

_______, (1973b), "Investment and Corporate Taxation," Journal of Political Economy, vol. 81 (July-August), pp. 982-993.

Surrey, S. (1973), Pathways To Tax Reform: The Concept of Tax Expenditures, Cambridge University Press, Massachusetts.

The Tax Legislative Process Committee (1978), "The Tax Legislative Process," Canadian Tax Journal, vol. XXVI (March-April), pp. 157-182.

Theil, H. (1965), Economic Forecasts and Policy, North-Holland, Amsterdam.

_______ and T. Kloek (1960), "The Operational Implications of Imperfect Models," in K. Arrow and S. Karlin (eds.), Mathematical Methods in the Social Sciences, Stanford University Press, pp. 105-128.

Thurow, L. (1969), "A Disequilibrium Neoclassical Investment Function," Review of Economics and Statistics, vol. 51 (Nov.), pp. 431-435.

Tobin, J. (1961), "Money Credit and Other Stores of Value," American Economic Association Papers and Proceedings, vol. 51 (May), pp. 26-37.

_______, (1969), "A General Equilibrium Approach to Monetary Theory," Journal of Money, Credit and Banking, vol. 1 (Feb.), pp. 15-29.

_______ and W. Brainard (1977), "Asset Markets and the Cost of Capital," in B. Belassa and R. Nelson (eds.), Economic Progress, Private Values and Public Policy, Essays in Honour of William Fellner, North Holland, Amsterdam, pp. 235-262.

Ture, N. (1967), Accelerated Depreciation in the United States, 1954-1960, NBER, New York.

Vickers, D. (1968), The Theory of the Firm: Production, Capital and Finance, McGraw Hill, New York.

_______, (1970), "The Cost of Capital and the Structure of the Firm," Journal of Finance, vol. 25 (March), pp. 35-46.

Wallis, K. (1969), "Some Recent Developments in Applied Econometrics," Journal of Economic Literature, vol. 7 (Sept.), pp. 771-796.

Walters, A. (1963), "The Accelerator and Technical Progress," Review of Economic Studies, vol. 45 (Feb.), pp. 1-15.

Waverman, L. (1970), "Fiscal Instruments and Pollution: An Evaluation of Canadian Legislation," Canadian Tax Journal, vol. XVIII (Nov.-Dec.), pp. 505-513.

Wertheimer, R. (1957), "Tax Incentives For Saving and Investment in West Germany," National Tax Journal, vol. 10 (December), pp. 325-338.

Weston, F. (1961), "The Management of Corporate Capital: A Review," Journal of Business, vol. 34 (April), pp. 129-139.

_______, (1963), "A Test of Cost of Capital Propositions," Southern Economic Journal, vol. 30 (October), pp. 105-112.

Wold, H. (1960), "Ends and Means in Econometric Model Building," in U. Grenander (ed.), Probability and Statistics: The Harald Cramér Volume, Wiley, New York, pp. 355-434.

Woodside, K. (1979), "Considerations in Governmental Choice," Canadian Public Policy, vol. V (Spring), pp. 248-256.

Government Publications

Canada. Department of Finance. Government of Canada: Tax Expenditure Account, December 1979, Ottawa.

Canada. Department of Finance. Rates of Return on Investment Profitability, April 1980, Ottawa.

Canada., Department of Industry, Trade and Commerce. Sector Profiles: The Canadian Forest Products Industry and The Primary Iron and Steel Industry, 1978, Ottawa.

Canada. House of Commons Debates, Ottawa, 1945-1979.

Canada. Tax Measures Review Committee. Corporate Tax Measures Review Final Report June 1975, Information Canada, 1975, Ottawa.

The Steel Profits Inquiry, Information Canada, October 1974, Ottawa.

Statistics Canada, Ottawa.

Cat.: 61-205 Private and Public Investment in Canada: Outlook (1964-1980).

Cat.: 61-208 Corporation Taxation Statistics (1965-1977).

Cat.: 61-207 Corporation Financial Statistics (1965-1977).