INVESTMENT INCENTIVES

IN CANADA

AN ANALYSIS OF INVESTMENT
INCENTIVE POLICIES IN CANADA

By

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ABSTRACT

Investment incentive policies have been major policy instruments used in Canada and elsewhere to achieve economic growth and stabilization. In this study an attempt is made to isolate the specific effects contained in these policies, and to measure their impact on investment expenditures in Canada. There are three major sections to the study. First, various well-known models of investment behaviour are used to illustrate how investment incentive policies may be expected to influence investment expenditures. Secondly, a group of major Canadian incentive policies are described in detail, together with an outline of the institutional framework in which the policies were conceived and operated. Thirdly, these major policies are incorporated into investment functions to test for their impact on investment expenditures. From the empirical analysis, the investment incentive policies do not appear to have influenced investment expenditures to any substantial degree. At the same time the cost of these policies in terms of revenue foregone has been substantial. The major conclusion is that the case for investment incentive policies as instruments of short run stabilization policy is extremely weak.

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CHAPTER I

AN OVERVIEW OF INVESTMENT INCENTIVES

I.1 INTRODUCTION

In the Budget Speech of June 23, 1975, the federal Minister of Finance announced that taxpayers would be able to claim a tax credit of 5 per cent of expenditures made in the next two years on fixed assets in eligible industries. This investment tax credit policy is one of the latest in a long series of similar tax policies undertaken by both federal and provincial governments to influence the volume, type, timing or location of private investment expenditures in Canada.

Investment incentive tax policies have also been introduced by governments in other countries to achieve similar objectives. The use of these policies, however, has always been controversial. Critics of the policies question their effectiveness in achieving desired objectives, their cost in terms of tax revenues foregone, their income distributional consequences, and their impact on resource allocation.[1] Recently, however, econometric studies have indicated that investment incentive policies do have a significant impact on investment expenditures. Examples are papers by Hall and Jorgenson (1967) in the United States; Boatwright and Eaton (1972) in the United Kingdom; and McFetridge and May (1976) and Gaudet, May and McFetridge (1976) in Canada.

All of these studies have used, to a greater or lesser degree, the basic neo-classical model of capital accumulation as reformulated by Jorgenson, and set out, for example, in Jorgenson (1963). An attractive feature of the Jorgenson model from the point of view of assessing incentive policies, is the rental cost variable. This is a shadow price for capital services, and it directly reflects the impact of incentive policies on the cost of capital services. Other aspects of the Jorgenson model have not been as well received. In particular, critics have objected to his assumption of Cobb-Douglas technology, the assumption (at least in the theoretical model) of immediate adjustment by firms to changes in factor prices, the inclusion of output as an independent variable, and the use of a composite variable combining output and factor prices to estimate the impact of incentives. These problems with the basic theory and specification in the Jorgenson model have tended to cast doubt on the accuracy of empirical results derived from the use of the model to evaluate investment incentive policies.

Several of the specific objections to the use of the Jorgenson model in this context are a manifestation of a general uneasiness over the applicability of the concepts of long-run analysis -- putty-putty capital and a high degree of factor substitution -- to the analysis of short-run phenomena. In countries other than Canada, investment incentive policies have generally been introduced for indefinite periods, and with long-run growth as an objective. Nevertheless, there has been a strong tendency for these policies to be suspended, or changed in form, in response to short-run economic conditions. In Canada, incentive policies are, in fact, often deliberately limited to prespecified time periods ranging from eighteen months to three years. The limit is imposed because the policies are directed towards short-term stabilization objectives. Therefore, while tests for the significance of substitution effects must remain central to any empirical analysis of incentive policies in Canada, it is unlikely that their actual impact is substantial. Consequently it would seem inappropriate to use a model which explicitly assumes that full long-run substitution effects are possible in the context of short-term incentive policies.

In this study an attempt is made to assess the impact on investment expenditures of a particular group of Canadian investment incentive tax policies. Rather than using the Jorgenson model for this purpose, an alternative model developed by Coen (1968, 1971) for an evaluation of incentive policies in the United States is utilized. The Coen model has the advantage of being able to incorporate several effects, other than the substitution effect, that are inherent in investment incentive policies and are also capable of influencing investment behaviour. These other effects include the impact on the cash flow of firms, and the response of firms, in terms of the timing of investment expenditures, to the fact that a policy is in existence for only a limited, known period. The inclusion of these other effects in the model makes it possible to empirically test for their significance in Canadian policies. Because the influence of timing factors is given special consideration in this study, quarterly data are used in the empirical analysis.

I.2 INVESTMENT INCENTIVE TAX POLICIES IN CANADA

The empirical analysis in this study is confined to the five investment incentive tax policies introduced by the federal government since 1963 and directed towards the manufacturing sector.[2] These policies are listed in Table 1, with complete details on their design given in Chapter V. The selection of these particular policies was influenced by data availability, especially because of the desire to use quarterly data. This prohibited an extension of the analysis to manufacturing sector policies introduced in 1950, 1960 and 1961.[3]

The policies shown in Table 1 were introduced in Budget Speeches, and at the time of their announcement a termination date was also indicated. The one exception was the 1972 package of tax reduction and accelerated allowances. Although introduced for an indefinite period, the government was subsequently forced to place an initial time limit on the operation of the programs to permit a review of the effectiveness of the policies.

While the income tax system can be adjusted in a variety of ways to produce investment incentives, the most common method used in Canada has consisted of an acceleration in the rate at which capital costs may be deducted from taxable income. Other methods have included reductions in

TABLE 1

FEDERAL GOVERNMENT STABILIZATION
INVESTMENT INCENTIVE TAX POLICIES,
MANUFACTURING SECTOR, 1963-1975

Policy	Announced Duration	Extension To	Date Extension Announced
Canadian Ownership	June 13, 1963 to June 30, 1965	Dec. 31, 1966	Apr. 26, 1965
Deferred Allowances	Mar. 29, 1966 to Oct. 1, 1967	-	-
Increase in Cost Base	Dec. 3, 1970 to Mar. 31, 1972	-	-
Accelerated Allowances and Tax Cut*	May 8, 1972 to Dec. 31, 1974	Indefinite	Nov. 18, 1974
Tax Credit	June 23, 1975 to July 1, 1977		

*The tax cut ultimately applied only from January 1, 1973.

tax rates, special deductions from taxable income, and tax credits.

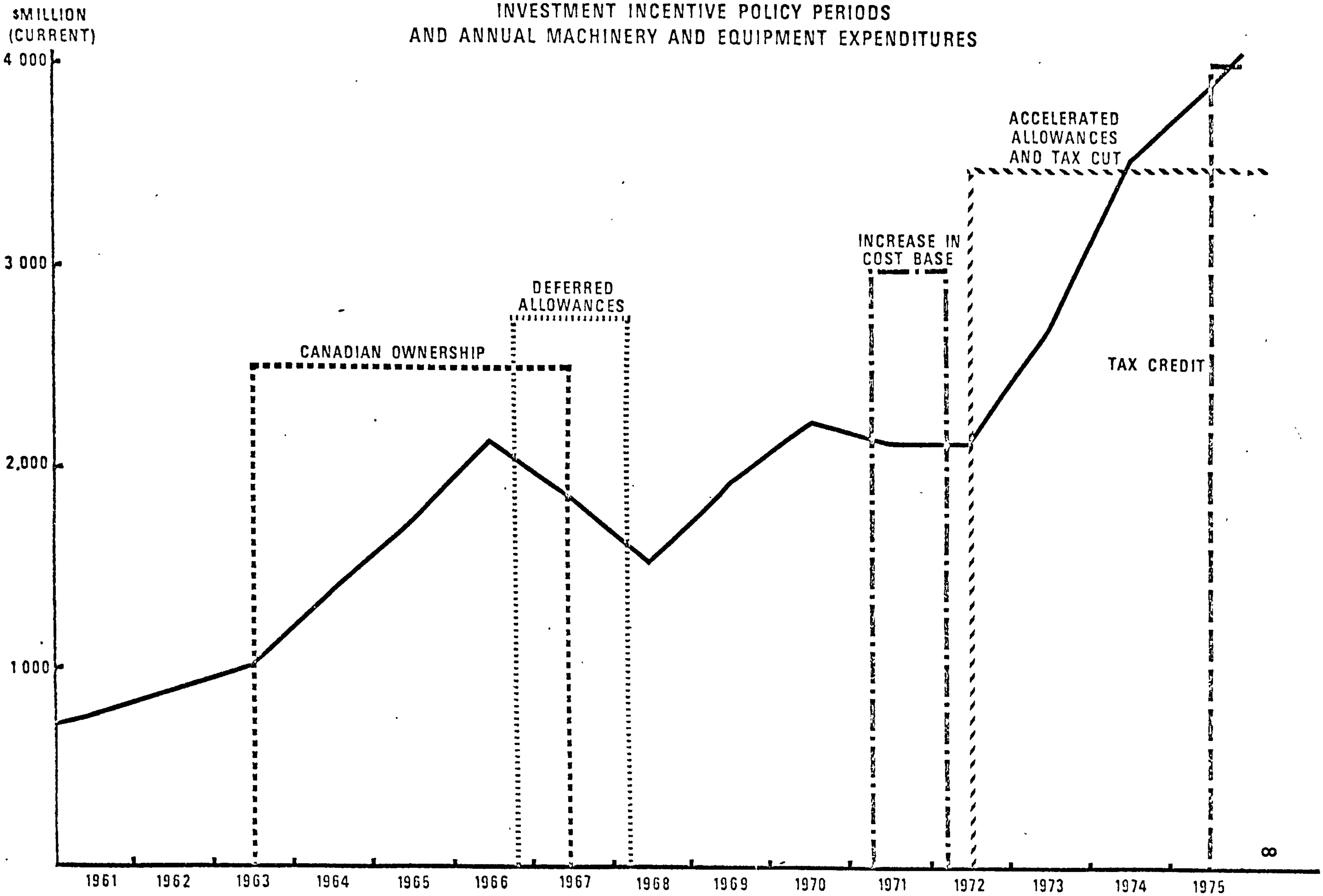
Although incentive policies are most often designed to increase capital expenditures, at times explicit dis-incentive policies have been introduced that operate through a reversal of the usual form of the incentive. For example, in 1966 capital cost allowances on certain types of new capital goods were reduced temporarily in an attempt to discourage certain types of capital outlays. The 1950 policy mentioned earlier was also an investment dis-incentive policy.

The relationship between annual estimates of total machinery and equipment expenditures in the manufacturing sector since 1961 and the introduction and termination of incentive policies, is shown in Figure 1. While there does appear to be some correspondence between expenditures and policies, a direct cause and effect relationship cannot, of course, be assumed. Many other factors were also at work influencing investment expenditures during this period.

Amongst these were a number of provincial government incentive policies which are listed in Table 2. In addition, the federal government has, since 1963, offered investment incentives for manufacturing investment in particular regions, and these policies are also indicated in Table 2. Although data limitations precluded an empirical analysis of these provincial and regional policies, some theoretically interesting aspects are mentioned in subsequent chapters, together with

FIGURE 1

INVESTMENT INCENTIVE POLICY PERIODS
AND ANNUAL MACHINERY AND EQUIPMENT EXPENDITURES



an analysis of situations where there is interaction with the policies shown in Table 1.

TABLE 2

FEDERAL AND PROVINCIAL GOVERNMENT REGIONAL INVESTMENT INCENTIVE TAX POLICIES MANUFACTURING SECTOR, 1963-1975

Policy	Announced Duration	Extension To	Date Extension Announced
Tax Exemption and Accelerated Allowances	Dec. 5, 1963 to Dec. 5, 1965	Apr. 1, 1967 Apr. 1, 1968	Mar. 16, 1964 Mar. 29, 1966
ADIA Grants and Accelerated Allowances	July 1, 1963 to Mar. 31, 1971	-	-
RDIA Grants	Aug. 7, 1969 to Dec. 31, 1976	Dec. 31, 1981	
Quebec Investment Deduction	Apr. 1, 1968 to Mar. 31, 1971 Apr. 1, 1971 to Mar. 31, 1974		
Ontario Tax Credit	Apr. 26, 1971 to Mar. 31, 1973	-	-

I.3 A REVIEW OF THE LITERATURE

The econometric studies mentioned in the Introduction represent only one approach used by researchers in the analysis of investment incentives. An alternative is to use survey or interview techniques to determine the factors that influence investment decisions, including the role of investment incentives. A summary of the findings from surveys in the United States and the United Kingdom is given in Lund (1971). The results usually show that entrepreneurs tend to ignore the variables that are important in economic theory, and instead place greater emphasis on factors whose theoretical support is less sound. Surveys also report that few of the surveyed firms use techniques such as discounted cash flow that would enable them to assess the impact of incentives. In Canada, Helliwell (1966) surveyed a group of firms to determine their response to incentive policies. More recently the federal government Tax Measures Review Committee (1974, 1975) undertook a survey on the impact of the 1972 policies of accelerated capital cost allowances and tax reduction which are under review in this study.

Survey results, however, are subject to a host of problems. The samples are often small and the responses not subject to parametric statistical analysis. Often the accompanying interviews are unstructured and merely a record of loose impressions or conventional wisdom. In small firms the investment decision may not be clearly articulated, while in large firms the decision-making may be too diffuse for any one respondent to accurately assign cause and effect.

As a second approach, and in the absence of sufficient data for econometric analysis, researchers have had to make use of less refined empirical analysis. This has generally taken the form of a crude economic indicators approach. Moore and Rhodes (1973), for example, use actual and "expected" employment as a measure of policy effectiveness for British regional policies. Usher (1975) adopts a similar approach with respect to investment and the Canadian regional development incentives. The results of these analyses, however, are usually suggestive rather than definitive.

Thirdly, the analysis of incentive policies themselves provides some indication of the likely impact of policies. This can be done, for example, by estimating the impact of the policy on the rate of return. Examples of this approach are Brown (1954) where the effects of the 1954 changes in U.S. depreciation allowances are examined, and Chase (1962), Wiseman (1963) and White (1962) where the analysis is applied to the investment tax credit introduced in the U.S. in 1962. In Canada, Helliwell (1966), Bucovetsky (1966) and Hyndman (1974) have analyzed Canadian policies along similar lines. Once again, however, these studies are not capable of estimating the actual impact of a particular incentive policy.

Returning to the econometric approach, the seminal paper by Hall and Jorgenson led to a number of similar studies in the United States, the major examples being Coen (1968, 1971), Bischoff (1970, 1971) and Klein and Taubman (1971). In the United Kingdom, Argwala and Goodson (1969), Feldstein and Fleming (1971) and Boatwright and Eaton (1972) carried out similar research on incentive policies in the United Kingdom. For Canadian policies, May (1972) used the Hall-Jorgenson model to assess the impact of several of the policies under review in this study. More recently McFetridge and May (1976) and Gaudet, May and McFetridge (1976) have extended May's original analysis.

Despite the number of empirical studies, the verdict on the effectiveness of investment incentives is far from clear. Generally, researchers who have used the Jorgenson model, or a close approximation to it, have found relatively significant effects on investment expenditures. On the other hand, the use of alternative models, for example by Coen, leads to less significant results. As indicated, the Jorgenson model has been the subject of considerable controversy and the particular problems will be discussed in Chapter III. It was mentioned in the Introduction, however, that one particular problem was the question of the time period in which incentive policies are allowed to operate and the impact which may be expected within a limited period.

This factor arises again in the most recent studies, for example McFetridge and May. Their estimates of the impact of several policies are set out in the table below.

TABLE 3

CHANGE IN INVESTMENT EXPENDITURES RESULTING FROM INVESTMENT INCENTIVE POLICIES - ESTIMATES BY McFETRIDGE AND MAY (1976)

Current Dollars (millions)

	1951 Measure	1961 Measure	1963 Measure	1966 Measure	1970 Measure	1972 Measure
1951						
1952	-1.41*(.64%)					
1953	-2.42(1.39%)					
...						
1961						
1962		1.70(.72%)				
1963		3.95(1.10%)				
1964		4.55(.77%)	5.26(1.07%)			
1965		47.13(5.79%)	21.14(2.65%)			
1966			28.79(4.06%)			
1967			27.56(13.37%)	-2.87(1.06%)		
1968			- 4.15(2.91%)	-5.25(3.15%)		
1969			-11.13(2.18%)			
1970			-13.39(2.11%)			
1971			-12.94(1.94%)			
1972			-10.51(1.267)		51.40(9.06%)	
1973			- 7.05(.46%)		57.03(3.83%)	68.66(3.55%)
1974						122.83(6.42%)
1975						148.64(7.15%)

Numbers in brackets refer to the percentage change in net investment due to the policies.

On the basis of these results, McFetridge and May remark that:

> The actions of fiscal policy authorities indicate a belief that the measures have a strong and almost immediate impact. Our model indicates that no effect will be felt for the fiscal year of the measure and that the modal impact occurs in the third year. The results indicate that the Canadian government should be interested in medium term forecasting in order to determine the economic situation over the next two or three years. The government may also wish to look for other fiscal policy instruments which might have a more immediate impact for short term stabilization purposes. For other objectives primarily designed to

alter the long term flow of investment expenditures, capital cost allowance measures can be very useful.

One of the problems with the results in Table 3 is that in every case the maximum effect from a particular policy occurs in the year subsequent to the one in which the policy had actually terminated. To be eligible for the benefits of a particular policy (or the costs in the case of the 1951 and 1966 policies), capital goods have to be acquired before the termination date. While, as will be seen in Chapter II, acquisition for tax purposes and actual delivery and payment for capital goods are not necessarily coincidental, the relative size of the induced investment occurring beyond the termination date is a source of concern. McFetridge and May offer no explanation for this aspect of their results. Furthermore, no comment is made on why the 1963 policy should actually reduce investment in the five years subsequent to the termination date of the policy. It will be shown in Chapters VI and VII that this carryover of induced investment into periods subsequent to the termination date of an incentive policy is an outcome of the use of distributed lags on variables that include the effects arising out of incentive policies.

I.4 APPROACH TAKEN IN THIS STUDY

While a major part of this thesis is concerned with the econometric approach to the analysis of investment incentive policies, considerable attention is given to the institutional framework in which the policies are conceived and operated. This follows from a belief that a knowledge of these details is important in the evaluation of results from econometric analysis. In addition, the policies themselves are given close attention to discover the full range of possible effects they may have on investment expenditures. As part of the analysis of individual policies, the revenue costs associated with each policy are estimated. A knowledge of these costs forms part of the overall assessment of the effectiveness of incentive policies.

Chapter II sets out the details of the Canadian tax framework, and discusses the range of policy options available from the system. Particular attention is paid to various institutional constraints that act to reduce the effectiveness of incentive policies. Chapter III discusses the ways in which from both economic theory and policy design, it may be expected that incentive policies will influence investment expenditures. This theoretical discussion extends into Chapter IV where the subject of the neutrality of investment incentive policies is examined.

Chapter V examines each of the policies under review in considerable detail and sets out the various incentive effects in each of the policies together with estimates of their revenue costs.

The specification of investment functions that explicitly include investment incentives is discussed in Chapter VI. In this Chapter the shortcomings of the Jorgenson model are outlined, together with a description of the alternative Coen model and the adjustments necessary to the Coen model to incorporate special features of Canadian incentive policies. The Coen model is then tested empirically and the results reported in Chapter VII, along with a description of the data used, and the simulation results for each of the policies.

Finally, Chapter VIII sets out the conclusions of this study and offers some suggestions for further research in this area.

A key to the symbols used in the text follows Chapter VIII.

FOOTNOTES TO CHAPTER I

1. For comprehensive critiques of Canadian policies along these lines see Kierans (1972), and the Report of the Royal Commission on Taxation (1966), particularly volume 2. In addition, studies prepared for the Royal Commission by Helliwell (1966) and Bucovetsky (1966) look at incentive policies in the manufacturing and mining sectors respectively. Hyndman (1974) is a critical review of recent policies.

2. For a thorough description of the range of investment incentive policies in Canada see the various annual tax guides such as A.W. Gilmour, Income Tax Handbook, and Commerce Clearing House, Canadian Depreciation Guide.

3. Details of these policies may be found in the tax guides mentioned above.

CHAPTER II

INSTITUTIONAL FRAMEWORK FOR INCENTIVE POLICIES

II.1 INTRODUCTION

The purpose of this Chapter is to describe the details of the Canadian income tax system so as to give a clear picture of the institutional environment in which Canadian investment incentive policies are conceived and operated.

By far the greater part of private investment expenditures in Canada is undertaken by corporations, so the emphasis will be on the corporation tax system. In addition, as indicated in Chapter I, the policies under review are federal government policies, so that the description generally applies to the federal income tax system. Where necessary, specific institutional details relevant to provincial government investment incentive programs are mentioned.

The final section of the Chapter outlines the policy options available to the federal government given the institutional structure. Some further comments are also made on the appropriateness of particular policies in the light of the objective of incentive policies and other considerations.

II.2 THE CORPORATION INCOME TAX

a) The Federal Corporation Income Tax System

Some of the Canadian provinces had taxed income in the nineteenth century but it was not until 1917, with the Income War Tax Act, that a federal income tax was introduced. Although many revisions were made to this original legislation, it was not until 1948 that it was completely overhauled by the Income Tax Act of that year, effective from the beginning of 1949. Following the Report of the Royal Commission on Taxation in 1966 and the White Paper on tax reform proposals in 1969, tax reform legislation was enacted in 1971 that saw the emergence of a substantially different Income Tax Act, effective from January 1972. While the legislation sets out the statutory basis for the taxation of incomes, The Income Tax Regulations made by Order-in-Council contain much of the detail relevant to tax policy. Changes in tax rates require specific legislative authority, but because capital cost allowances are part of the Regulations, changes in capital cost allowances are made by Order-in-Council.

In the original Income War Tax Act depreciation deductions were allowed only at the discretion of the Minister. The 1948 Income Tax Act removed the discretionary aspect of depreciation allowances and simplified the system.

The major change was a shift to a system explicitly based on the recovery of outlays on depreciable assets. Because of this, the amounts allowed are best described as capital cost allowances rather than depreciation allowances. The capital cost allowance system was untouched by the 1972 tax reform legislation. In outline, the main features of the present system are:

1) All depreciable assets are grouped into separate classes, with the assets in each class having comparable service lives. Details of the contents of asset classes mentioned in this study may be found in Appendix A. The capital cost of the assets in each class, less any capital cost allowances claimed as deductions, constitutes the undepreciated capital cost pool for that asset class. The purchase of additional assets in the class increases the undepreciated capital cost of the pool by the capital cost of the new assets. The sale of assets in the pool reduces the undepreciated capital cost by the proceeds of the sale up to the original capital cost of the assets.

2) Each class has a maximum allowance rate which a taxpayer may apply to the undepreciated capital cost in that class. Allowances claimed are then deducted from the undepreciated capital cost in the class. Thus capital cost allowances are determined by the diminishing balance system. As the class rate is a maximum rate, lesser

amounts can be claimed in any tax year.

3) Since the system is based on capital cost recovery, provision is made for the recapture of allowances in situations where the undepreciated capital cost is less than the sale proceeds. The proceeds, up to the original cost, from the sale of an asset in a class must be used to reduce the undepreciated capital cost of that class. If, however, the proceeds from disposition are in excess of the undepreciated capital cost of the pool then the excess is recaptured by adding it to taxable income. Where the proceeds of the sale are below the undepreciated capital cost, and there are no other assets in the pool, the difference is deductible as a terminal loss in computing taxable income.

4) Any proceeds from the sale of an asset above the original capital cost are treated as a capital gain. Prior to 1972 capital gains were tax free, but the 1972 reform brought one-half of capital gains into taxable income.

5) Farmers and fishermen were not obliged to move to the diminishing balance system in 1949 as long as they always claimed allowances on the straight-line basis explicitly introduced for them in Part XVII of the Regulations. Part XVII has since been revised to allow farmers and fishermen to take advantage of investment incentive policies originally introduced by way of amendments to Part XI of the Regulations.

6) The definition of capital cost has been taken to mean acquisition price or fair market value, including costs associated with the purchase of an asset.

In addition to these general features of the capital cost allowance system, there are some specific aspects of the system directly relevant to the design of investment incentive policies in Canada.

First, the feature of the Canadian capital cost allowance system that distinguishes it from the depreciation system in the United States is that for tax purposes firms in Canada have no choice over the method of calculating capital cost allowances, though they are free to claim any amount up to the allowable maximum. Because of this feature there should be no delay in firms using the capital cost allowance rates introduced in an incentive policy for their own tax calculations if they have acquired eligible assets. By contrast the accelerated depreciation systems allowed in the United States after 1954 were only adopted with a considerable lag. Coen (1971) believes that this lag is responsible for substantial measurement errors in the cost of capital variable used in empirical studies in the United States.

Second, one aspect of the system which has particular significance in the evaluation of incentives is the requirement that assistance given a taxpayer by any government for the acquisition of assets be deducted from undepreciated capital cost allowances. As originally drafted, Section 13(7)(e) of the Income Tax Act reads as follows:

> "where a taxpayer has received or is entitled to receive from a government, municipality or other public authority, in respect of or for the acquisition of property, a grant subsidy or other assistance...the capital cost of the property shall be deemed to be the capital cost thereof to the taxpayer minus the amount of the grant, subsidy or other assistance."

The Department of National Revenue had always considered that the term "other assistance" would cover the benefits provided by the Ontario and Quebec investment incentive policies mentioned in Chapter I. There was, however, an appeal to the courts based on the belief that the benefit of the Quebec scheme, because it was in the form of a deduction from taxable income, did not constitute a "grant, subsidy or other assistance". The courts went along with this viewpoint, and the government was forced to change Section 13(7)(e), and a new Section, 13(7.1), was added in 1974 reading in part:

> "Where a taxpayer has received or is entitled to receive assistance from a government, municipality or other public body in respect of, or for the acquisition of, depreciable property, whether as a grant, subsidy, forgiveable loan, deduction from tax, investment allowance or as any other form of assistance...the capital cost of the property to the taxpayer shall be deemed to be the amount by which...the capital cost thereof to the taxpayer exceeds...the amount of the assistance."

Section 13(7.1) only applies to assets acquired after November 18, 1974, so that taxpayers who had deducted amounts received under the Ontario and Quebec incentive plans could increase undepreciated capital costs by the amount previously deducted.

The federal government is insistent on the deductibility requirement in the case of provincial government incentive policies, because failure to do so would mean that there would be no uniformity in the treatment given to federal taxpayers under incentive policies offered by federal and provincial governments.

At the federal level, certain types of federal assistance have been specifically excluded from the deductibility requirement. For example, grants paid under the Program for the Advancement of Industrial Technology (PAIT) are not deducted from undepreciated capital costs. Another example was the grants paid under the Area Development Incentives Act (ADIA).

Despite the existence of the deductibility requirement, recent incentive policies gave rise to the possibility that certain firms could effectively escape the deductibility requirement. This was due to a combination of the two-year straight line write-off allowed for machinery and equipment in the manufacturing and processing sector and the practice of the Department of National Revenue with respect to grants received in a year subsequent to the one in which the acquisition of assets occurs. Interpretation Bulletin IT-49R of the department states that:

> "If a taxpayer has not received assistance nor is entitled to receive any in the year in which the depreciable property was acquired, he may claim capital cost allowance based on the cost of the property to him without making any deduction under subsection 13(7.1). The amount of assistance that a taxpayer receives or is entitled to receive in a subsequent year is deducted from the capital cost of the property for that and subsequent years, but not for any year prior to that in which the assistance was made."

In the case of a firm that has been offered a grant under the Regional Development Incentives Act (RDIA), but is not entitled to receive the grant until commercial production is achieved, the full value of machinery and equipment assets may be deducted before the grant payment is made. In this situation the value of the RDIA grant then enters undepreciated capital costs as a negative amount to be deducted from any future asset acquisitions, if any. If there were no future acquisitions, then the deductibility requirement would be effectively avoided. To close off this possibility, the Budget of May 25, 1976 announced that in the future any negative balance in an asset class must be included in taxable income.

Third, one of the problems always associated with investment incentive tax policies such as accelerated capital cost allowances is that they are available only to firms with a taxable income. This situation may be avoided, however, if the benefits of an incentive policy are made available to lessors of machinery and equipment to firms in an industry favoured by an incentive policy. In a competitive situation amongst lessors, the rates paid by lessees of machinery and equipment should be lower in exchange for the reduction in the taxable income of lessors. While there may be other reasons for the decision to lease rather than buy, the ability to gain some benefit from incentive policies will be one factor.

An analysis of the lease or buy decision with respect to incentive policies is set out in Miller and Upton (1976). In commenting on the U.S. situation they remark that:

> "Our tax laws in sum have created a new source of gains from specialization over and above those considered in the standard neo-classical analysis. Whether eliminating the waste of lost tax subsidies is a social gain is far from clear as indeed is the case for the subsidies themselves. But the private gains are substantial as witness the explosive growth of the equipment leasing industry after the introduction of the investment tax credit in 1962."

In Canada the 1972 policy of accelerated capital cost allowances explicitly allowed eligible assets to include those leased by certain corporations to a lessee who is expected to use the assets primarily in manufacturing and processing activities. This fact, together with the already generous capital cost allowance rates for equipment such as aircraft, appears to have led to an expansion in the volume of leasing business in Canada. A further contributing factor may have been the limitations introduced with 1975 tax credit policy. The maximum value of the credit in any period was set at $15,000 plus one-half of the tax payable in excess of $15,000. A firm that could not claim the full amount of the credit because of this limitation may have found it worth-while to lease from a firm not affected by the limitation.

In the Budget of May 25, 1976 it was stated that:

> "At the corporate level, there has been an extremely rapid growth in recent years of transactions which in substance are of a financial nature and yet in form are drawn up as a lease in order to give the financing corporation the benefit of deducting capital cost allowances which the person using the property cannot utilize either because of tax exemption or lack of taxable income."

The government's reaction to this situation was to announce that from May 26 on, capital cost allowances from leased equipment could only be deducted from income derived from leasing operations. This put an end to the practice of sheltering non-leasing revenue with capital cost allowances from leased machinery and equipment, a major factor in the expansion of leasing activity in Canada.

To the extent that these lease-shelter arrangements were reducing the cost of machinery and equipment for firms that could not take advantage of investment incentives directly, then the new policy clearly goes against the objective in introducing incentives in the first place. This ambivalence on the part of the Canadian authorities is evident in the design of other incentive policies. The desire to, on the one hand, offer incentive policies, and on the other, to minimize the revenue losses from these policies, may lie behind the practice of introducing policies for short periods, as well as insisting on the deductibility requirement, and the $15,000 restriction with the tax credit.

There are two additional institutional details directly relevant to the design and operation of incentive policies.

First, where policies have a termination date, to be eligible for the benefits of the policy, assets have to be "acquired" prior to the termination date of the policy. Acquisition does not have to correspond with delivery so that capital cost allowances may be claimed on assets acquired but not actually put into use. The principles outlining acquisition are set out in Interpretation Bulletin IT-50. In general, acquisition occurs when the purchaser obtains title or the incidents of title to a specific asset in a deliverable state. The actual date of delivery and payment are immaterial. A contract to purchase an unmade asset, or one that is not capable of being identified, for example by a serial number, would not count as an acquisition. In the case of a building being erected on land owned by a taxpayer, acquisition occurs at any particular time to the extent of construction costs incurred at that time. In the case of leased assets, to be eligible they must actually be in use before the expiry date of the policy. These timing requirements give rise to what has been called the termination date timing effect. This effect is fully outlined in the next chapter.

Second, the definition of both the eligible assets and the industrial sector for the purposes of incentives policies may differ markedly from other conventional definitions of these items. On the definition of eligible assets, the usual practice in the policies under review is, at least for machinery and equipment, to confer accelerated allowances on assets that would otherwise be included in Class 8. While the greater part of the conventional definition of machinery and equipment may be included in Class 8, there are other items of machinery and equipment in other classes. Investment data obtained from Statistics Canada's annual survey of investment identifies machinery and equipment as a major category, but it would be wrong to assume that the machinery and equipment total would be included in Class 8. Similar considerations hold over the definition of the manufacturing sector. While manufacturing or processing are not defined in the tax legislation, it was made clear, at least for the policies announced in the 1972 Budget, that manufacturing or processing did not include: (a) farming or fishing, (b) logging, (c) construction, (d) operating a gas or oil well, (e) extracting minerals from a mineral resource, (f) processing of mineral ore to the prime metal stage, (g) producing industrial minerals (h) producing or processing electrical energy or steam for sale, and (i) processing gas in the course of operating a public utility. At the same time, however, these excluded activities appear to be narrowly defined. For example, many activities carried out on a farm such as the cleansing, sorting and aging of farm products are considered to be processing and hence eligible for manufacturing sector investment incentives. On the other hand, the processing of mineral ores in smelters and blast furnaces has traditionally been classed in the Canadian Standard Industrial Classification (S.I.C.) as a manufacturing activity. The reason for the exclusion of this activity from the notion of manufacturing and processing used by Revenue Canada is that investment incentives given to mining in the natural resource sector apply to all activities through to the prime metal stage. Not to have excluded this activity from manufacturing sector incentives would have given it a double endowment of tax relief.

The extent of this definitional problem is indicated in Table 4 where capital cost allowances claimed on Class 29 assets in 1972 and 1973 by corporations in nine industrial divisions based on the 1960 Standard Industrial Classification are indicated. The greater part come from the manufacturing sector, but there are significant amounts in the mining and service sectors. At the same time expenditures on machinery and equipment in the manufacturing sector, as recorded in the annual survey by Statistics Canada, amounted to $2,119 million in 1972 and $2,682 million in 1973. These amounts are substantially higher than the amounts of eligible machinery and equipment expenditures that could be inferred from the $205 million and $913 million claimed in the same years. There are two explanations for the extent of this

TABLE 4

CAPITAL COST ALLOWANCES
CLAIMED ON CLASS 29 ASSETS
BY MAJOR SECTORS

$M

	1972	1973
Agriculture, forestry and fishing	-	1.2
Mining	2.4	19.9
Manufacturing	204.9	912.7
Construction	1.4	2.5
Transportation	.1	.5
Wholesale Trade	2.5	26.3
Retail Trade	.3	1.6
Finance	.3	7.7
Services	2.2	9.4
Total, All Industries	214.2	981.8

Source: Corporation Taxation Statistics (SC 61-208)

*Class 29 assets consist of machinery and equipment which would normally be in Class 8 but are eligible for the 1972 accelerated capital cost allowances.

divergence: first, eligible Class 29 assets are only a proportion of all machinery and equipment expenditures in the manufacturing sector, and second, firms may not have had sufficient taxable income to claim full allowances on all purchases of eligible assets. This difference between the tax definitions of eligible assets and activities, and the traditional definitions on which investment data are actually collected is a source of measurement error in any empirical analysis of the impact of tax policy. This fact should be remembered when considering the estimates of the cost and impact of incentive policies presented in Chapters VI and VII.

b) Provincial Corporation Income Tax Systems

In the period from 1952 to 1961, only Quebec and Ontario levied a corporation income tax, with the other provinces waiving their right to do so in return for participation in tax rental agreements with the federal government. Federal tax abatements were given to Quebec and Ontario to allow room for the provincial taxes.

Beginning in 1962 all of the provinces entered the corporation income tax field, and the federal government initially allowed an abatement of 9 per cent of corporation taxable income. The federal government offered to collect the corporation income tax on behalf of the provinces as long as they adopted the same definition of the tax base as used in the federal Income Tax Act. Quebec and Ontario did not want to be constrained to federal government definitions of income and exemptions, and so they chose to collect their own corporation income tax from a base similar to that defined by the federal Income Tax Act. Thus it is only these two provinces that have the power to adopt tax investment incentive policies through changes in their own tax legislations. The provinces utilizing the federal tax base are, of course, free to adjust their own tax rates. Alberta has recently indicated that it is considering setting up its own distinct tax legislation to permit the introduction of a number of investment incentive policies.

II.3 INVESTMENT INCENTIVE POLICY OPTIONS

The Jorgenson rental cost variable (c) mentioned in Chapter I is defined as

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

where

q = market price of capital goods

r = rate of interest

δ = rate of depreciation

u = tax rate

z = present value of capital cost allowances

If the object of an incentives policy is to reduce c, then the policy choices are as follows:

1. The value of the tax rate u may be reduced. This effect is unambiguous where r is defined as the before tax rate. If r was on an after tax basis a tax reduction increases the effective rate of interest, leading to a possible perverse outcome.
2. The value of z, the present value of capital cost allowances, may be increased. This can be accomplished by
   a) Increasing the capital cost allowance class rate;
   b) Switching to a straight-line system for a particular asset, and creating a new class with its own rate;
   c) Increasing the value of undepreciated capital costs on which capital cost allowances are based.
3. A tax credit or grant system based on the value of investment outlays may be introduced. With such a policy

a further choice is open to the policy-maker: whether to require the deduction of the grant from undepreciated capital costs or not.

If the grant is required to be deducted

$$c = \frac{q(r+\delta)[1-uz(1-k)-k]}{(1-u)} \tag{2}$$

where

k = value of the tax credit as a percent of investment outlay.

The value of c in (2) will be k per cent lower than in (1). On the other hand where the grant is not required to be deducted

$$c = \frac{q(r+\delta)(1-uz-k)}{(1-u)} \tag{3}$$

and the value of c in (3) will be $\frac{k}{1-uz}$ per cent lower than in (1). As uz < 1, the value of c in (3) will be lower than in (2).

4. An additional deduction from taxable income may be allowed. The amount of the deduction may be arbitrary, as for example with the percentage depletion allowance where a certain proportion of taxable income was deductible, or it may be based on some proportion of investment outlays as in the Quebec scheme. Once again the decision has to be made as to whether the value of the additional deduction should reduce undepreciated capital costs.

In this situation, with the deductibility requirement

$$c = \frac{q(r+\delta)[1-uz(1-uj)-uj]}{(1-u)} \qquad (4)$$

or without the requirement

$$c = \frac{q(r+\delta)(1-uz-uj)}{(1-u)} \qquad (5)$$

Where

j = proportion of taxable income deductible before calculation of taxes payable

or

= proportion of investment outlay that may be deducted from taxable income

If policy required the application of an investment dis-incentive, then an increase in tax rates, a reduction in the present value of capital cost allowances, and the reduction or removal of grants, tax credits and special deductions would achieve an increase in the rental cost of capital. In addition, as has been done with certain rental buildings in Canada, each asset acquired could be placed in a separate class, though with the same class rate. On disposition of the asset, any recapture of capital cost allowances would enter income directly and be taxed, rather than reducing undepreciated capital costs of remaining assets.

The choices outlined above represent the range of tax investment incentive policies that this study is concerned with. Clearly, however, there are two other means by which the rental cost of capital could be reduced:

a) Interest rates on borrowed funds could be reduced, either by general monetary policy, or by specific interest subsidies; and

b) The part of the market price of investment goods that represents taxes such as import duties or sales taxes could be reduced or eliminated.

The variety of policies outlined above are all equally capable of reducing the rental cost of capital by a certain percentage, but this fact does not make the choice of policy a matter of indifference. Indeed the experience both in Canada and in other countries shows that the design of incentive policies is subject to frequent change. Several factors in the design of different incentives, as well as debate over how incentive policies actually operate, have given rise to this continuous experimentation.

For example, with a policy like a tax rate reduction, or a tax holiday, the benefits of the policy are received by all taxpayers, including those who undertake no investment or no additional investment despite the policy change. In this situation the revenue costs of the tax cut are substantial, and give rise to charges that the only effect from investment incentive policies is to confer windfall gains on firms. On the other hand policies such as accelerated capital cost allowances and investment tax credits may involve substantial revenue losses, but the benefits are distributed only to firms that at least undertake investment. Windfall gains still accrue to firms that would have undertaken investment even without the incentive, but the revenue losses to the government will be lower than with a tax rate reduction that would achieve the same reduction in the rental cost of capital. From this perspective the ideal incentive policy is one that is able to confine the benefits of the policy to those outlays which would not have occurred in the absence of the policy.

In contrast to the above analysis which focuses on reductions in the rental cost of capital variable as the means by which investment is influenced, there is the other perspective of the liquidity effects of incentive policies. From this viewpoint the constraint on investment is not profitability or cost, but the availability of funds with which to finance investment. In this situation, rather than minimize revenue losses, the optimal policy would be to expand revenue losses up to something close to the level of investment expenditure increase desired by the government. Tax reductions would appear to be the most appropriate policy under this condition. For this reason it is important to be able to identify the contribution of liquidity and profitability effects for the design of efficient incentive policies.

A further consideration to the revenue loss aspect is the manner in which the revenue losses of the different policies are accounted for. Surrey (1973) has emphasized that incentive policies that operate through changes in tax payable ought to be judged in the same budgetary process which allocates expenditures from revenues for direct expenditure programs. Government budgetary statements of revenue and expenditure, however, do not include the outlays on these "tax expenditure" policies as Surrey has labelled them.

By short-circuiting the normal budgeting process the outlays on tax expenditure policies are not weighed alongside competing demands for government expenditures. Furthermore, outlays on tax investment incentives are open-ended in that the revenue losses are determined by the reaction of firms to the incentive policy, and not by the government.

Nevertheless tax investment incentive policies remain popular, perhaps in part because they do obscure the real cost of the policies. In addition, there is a strong belief that tax investment incentive policies reward only the profitable firms. By contrast, it is claimed, policies such as direct grants may support unprofitable investments. The attractive feature of direct grants is that for new firms the benefits of the investment incentive policy are obtained early in the life of the firm. Normally it may take several years for a new firm to develop the taxable income necessary before the benefits of tax investment incentive policies can be realized. In this way tax investment incentive policies favour established firms with a taxable income sizeable enough to take advantage of the incentive policies.

An additional attractive feature of grants is that they are usually based on some proportion of the investment that is taking place. In this way the value of the incentive to the firm, and its cost to the government, are easily identified.

In some circumstances the very visibility of direct grants may be a detrimental factor. This occurs where the use of such grants promotes the expansion of a firm or sector that engages heavily in international trade. An obvious subsidy opens the possibility of retaliation by another country that feels the subsidy has caused material injury to the trade prospects of its own industries.

Despite the advantages of direct grants, in Canada only the later regional development programs operated by the federal government have utilized this approach. In all of the policies with general applicability to the manufacturing sector the government has preferred to utilize the tax system.

CHAPTER III

THE IMPACT OF INVESTMENT INCENTIVES ON INVESTMENT BEHAVIOUR

III.1 INTRODUCTION

The purpose of this chapter is to set out the ways in which it may be expected that investment incentive policies will influence the demand for capital goods. Section III.2 considers the role of investment incentives within the general theories of investment found in the literature, in particular the neo-classical and accelerator theories. It will be shown that the possible impact of incentive policies implied by economic theory is constrained by the short-term nature of Canadian policies. Section III.3 indicates that this short-term nature in turn gives rise to an impact on investment behaviour by influencing the timing of investment expenditures. The concepts developed in this section are used in Chapter VI in the specification of investment functions.

III.2 INVESTMENT THEORY AND THE ROLE OF INVESTMENT INCENTIVES

To open this section it should be pointed out that in the literature on investment theory the most widely held approach to the analysis of investment behaviour consists of a two-stage process. In the first stage the discussion is basically on the determinants of the desired capital stock of the firm, while in the second stage the emphasis is on the process by which the firm adjusts to changes in the desired stock of capital. In this framework capital theory determines the desired capital stock, while investment theory becomes more narrowly concerned with the determinants of the rate of acquisition of capital goods. This formal structure is strongly adhered to in the neo-classical approach, but it is also found, though in a less rigid form, in other theories of investment behaviour.

This two-stage approach is not without its critics, and Gould and Waud (1973), amongst others, have pointed out the inconsistency involved in determining a desired capital stock independently of the constraints involved in achieving such a stock. One of the few investment studies to use a single-stage approach is that of Eisner and Strotz (1963).

Within the context of this two-stage framework, most of the controversy in the literature on investment theory is concerned with the determinants of the capital stock. In this study, however, particular attention will be paid to the factors that influence the adjustment to any level of desired capital stock. It is in this area that investment incentive policies of the Canadian type may be influential, rather than in influencing the desired capital stock.

To start on an extremely pessimistic note with regard to the effect of incentives, the accelerator theory gives little scope for investment incentive policies to influence the desired capital stock. A strong statement of the acceleration principle would maintain that the elasticity of the capital stock with respect to output is unity. Underlying this assertion are the following assumptions: (1) fixed factor proportions, (2) a fixed level of capacity utilization, and (3) immediate unconstrained adjustment of the capital stock to attain the desired stock as determined by the current level of output. In this form, however, the theory has little contact with reality, though the underlying premise is intuitively attractive. When put to the empirical test, this rigid version does not hold with the facts.

Just as Jorgenson has defended neo-classical theory against empirical evidence by arguing that the tested specification did not reflect the theory, so too Eisner (1963) has defended the acceleration principle by rephrasing the hypothesis in terms of "permanent" income along the lines of Friedman's (1957) consumption theory. In addition, the work of Chenery (1952) and Koyck (1954) enabled the reformulation of the acceleration principle as a partial stock adjustment model through the introduction of lags into the adjustment process. In this way the so-called "flexible accelerator" model is derived in which it is maintained that net investment in any period is some part of the difference between the desired stock in that period, and the actual stock in the previous period. This partial adjustment model and the acceleration theory come together when it is the level of output that determines the desired capital stock. The partial adjustment framework, however, is still consistent with other theories of the determinants of the desired capital stock.

If output, or expected levels of output, determine the desired capital stock, and production entails constant factor proportions in old and new equipment, then there would seem to be little scope for investment incentives to influence investment. In this framework the appropriate policy to increase investment would be to stimulate the level of demand for the goods produced by capital-using industries. To the extent that an investment incentive policy reduces the government budget surplus, or increases the deficit, then it will, through the accelerator effect, increase investment (assuming that the change in demand is viewed as "permanent").

Nevertheless the possibility remains that the speed of adjustment could be influenced by some of the effects arising out of incentive policies. In this way investment incentives may influence the adjustment to a desired capital stock determined by output, and in so doing alter the time pattern of capital expenditures.

The other major stream in investment theory has been the so-called neo-classical approach. Prior to the work of Jorgenson in the early 1960's, neo-classical theory was usually associated with Fisher and Keynes. The theory, as then expounded, was basically a theory of optimal capital accumulation with investment continuing until the point where the discounted sum of future expected (with certainty) net receipts was equal to cost, or, in symbols, to the point where

$$\sum_{i=1}^{n} \frac{R_i}{(1+r)^i} = q \qquad (1)$$

In the Keynesian framework, adjustment to the desired capital stock was influenced by a rising supply price for capital goods, q. Far less stress was placed on the notion of a reduction in the marginal productivity of capital reducing expected yields at the macro level. However, there was clearly an attempt to come at the question from both sides and the notion of an optimal capital stock is eventually derived through a process of adjustment from both the demand and supply sides, with the emphasis on supply conditions in the capital goods industries.

Early empirical tests of neo-classical theory centred on the significance of the rate of interest in investment decisions, only to find a lack of statistical significance for this variable. Jorgenson considers that this was due to two factors: First, the underlying theory was not sufficiently rigorous in that it did not include all of the components of the cost of capital, the interest rate being only one of several. Secondly, the lag structures used did not correctly specify the relationship between changes in the demand for capital services and actual investment expenditures. The subsequent reformulation by Jorgenson attempted to cover these deficiencies through the specification of a more complete model of optimal capital accumulation.

Assuming that firms act so as to maximize the present value of the firm, the marginal productivity conditions derived by Jorgenson for maximization are, in the absence of taxes,

$$\frac{\partial Q}{\partial L_t} = \frac{w}{p} \tag{2}$$

and

$$\frac{\partial Q}{\partial K_t} = \frac{q(r+\delta)}{p} = \frac{c}{p} \tag{3}$$

and these conditions are required at every point in time. Equation (3) includes the rental cost term mentioned in earlier chapters, though expressed in this case on a no-tax basis.

If the form of the production function is assumed to be a Cobb-Douglas one, such that

$$Q = K^{\alpha} L^{\beta} \tag{4}$$

Then, substituting (3) in (4) gives the desired capital stock as

$$K^* = \alpha \left(\frac{p}{c}\right) Q \tag{5}$$

The relationships in equations (3) and (5) are at the heart of Jorgenson's reformulation of neo-classical theory, and they are discussed in some detail below, beginning with the rental cost expression.

Although this variable can be developed in several ways, the incremental method set out below, and adopted from Coen (1968), shows the link with the Fisher-Keynes analysis of capital accumulation. In that early analysis, additions to the capital stock would be made as long as

$$\sum_{i=1}^{n} \frac{R_i}{(1+r)^i} > q \tag{6}$$

If net receipts are defined as the value of the marginal product less amounts for deterioration and taxes then

$$R_i = \frac{\partial Q}{\partial K} p - q\delta - T_i \tag{7}$$

If

$$T_i = u\left(\frac{\partial Q}{\partial K} p - D_i\right) \tag{8}$$

then

$$R_i = \frac{\partial Q}{\partial K} p - q\delta - u \frac{\partial Q}{\partial K} p + uD_i \tag{9}$$

$$= (1-u)p \frac{\partial Q}{\partial K} - q\delta + uD_i \tag{10}$$

Substituting (10) into (6), investment outlays continue as long as

$$\sum_{i=1}^{n} \frac{\left[(1-u)p\,\frac{\partial Q}{\partial K} - q\delta + uD_i\right]}{(1+r)^i} > q \qquad (11)$$

and since

$$\sum_{i=1}^{n} (1+r)^{-i} = \frac{1}{r}\,, \quad n \rightarrow \infty \qquad (12)$$

then (11) can be written as

$$\frac{1}{r}\left[(1-u)p\,\frac{\partial Q}{\partial K} - q\delta\right] + u\sum_{i=1}^{n} \frac{Di}{(1+r)^i} > q \qquad (13)$$

The increase in capital cost allowances, D_i, is related to both the allowances on the initial outlay q, and the allowances on replacement outlays $q\delta$. Defining d_i as the capital cost allowances on the original outlay then

If

$$z = \sum_{i=1}^{n} \frac{d_i}{(1+r)^i} \qquad (14)$$

so that from the initial outlay the present value of capital cost allowances is given by qz.

Allowances on replacement outlays consist of an infinite series of amounts which can be given a present value in each period as the outlay is made.[1]

$q\delta z + q\delta z + \ldots$

The present value of future allowances on replacement outlays is given by

$$q\delta z \sum_{i=1}^{\infty} (1+r)^{i} = \frac{q\delta z}{r} \quad (15)$$

The combined present value of the increase in capital cost allowances is then

$$\sum_{i=1}^{n} \frac{D_i}{(1+r)^i} = \left[qz + \frac{q\delta z}{r} \right] \quad (16)$$

Substituting (16) into (13), the condition for investment outlays can be written as

$$(1-u)p \frac{\partial Q}{\partial K} - q\delta + rqzu + q\delta zu > qr \quad (17)$$

by re-arranging terms, (17) may be expressed as

$$p \frac{\partial Q}{\partial K} > \frac{q(r+\delta)(1-uz)}{(1-u)} \quad (18)$$

The expression $\frac{q(r+\delta)(1-uz)}{(1-u)}$ is interpreted as the cost of capital for the firm that purchases its own capital equipment, or the minimum amount to be paid for the rental of capital equipment. Thus investment outlays in a neo-classical framework would continue up to the point where the value of the marginal product of capital would be equal to the cost of capital. Thus

$$c = \frac{q(r+\delta)(1-uz)}{(1-u)} \quad (19)$$

In the above expression it is important to note that r is the after-tax rate of interest. This assumes that all capital outlays are financed with borrowed funds and that the interest payments on them are tax deductible. It should also be noted that the present value of capital cost allowances (z) may be decomposed into the components:

a = maximum allowable rate of capital cost allowances

r = rate of discount

Under the diminishing balance system the stream of annual capital cost allowance is given by

$$a,\ a(1-a),\ a(1-a)^2,\ \ldots$$

Discounting these amounts to obtain the present value,

$$z = \frac{a}{(1+r)} + \frac{a(1-a)}{(1+r)^2} + \frac{a(1-a)^2}{(1+r)^3} + \ldots \qquad (20)$$

$$= \frac{a}{r+a}$$

With the straight line system,

$$z = \sum_{i=1}^{e} \frac{a}{(1+r)^i} \qquad (21)$$

where e is the minimum number of years in which the full value of a capital outlay can be deducted from taxable income. At the same time ae = 1.

Given that the rental cost of capital is critical in determining the demand for capital in the neo-classical framework, there are a variety of ways in which governments may influence this variable through tax policies.

As developed above, the basic expression for the value of the rental cost is given by

$$c = q \frac{(r+\delta)(1-uz)}{1-u} \qquad (22)$$

Rental cost may be reduced in the first instance through reductions in u, and in the limit where the tax is eliminated, and assuming no perverse effects

$$c = q(r^*+\delta) \qquad (23)$$

where r^* is the rate of interest in the absence of taxation. Increases in the present value of depreciation allowances also reduce rental cost, and in the limit where $z = 1$,

$$c = q(r+\delta) \qquad (24)$$

This expression differs from the previous one in that r, the after-tax rate of interest, is lower than r^* and so the rental cost of capital with immediate deduction of capital outlays will be reduced below the no-tax level, thus more than offsetting the dis-incentive effects of taxation.

Whether interest payments are deductible or not is an important assumption in the theoretical analysis of investment incentives, and the results with deductibility are very different from the non-deductible situation. Chapter IV elaborates on this point.

Reductions in rental cost may also be achieved through the provision of a tax credit as part of the net receipts in expression (7). If the tax credit has a rate of k per cent, and is available indefinitely, then one part of net receipts will be kq, and the value of the tax credits on replacement investment is given by a stream of receipts

$$(kq\delta)_t + (kq\delta)_{t+1} + \ldots$$

while the total present value of the tax credit is given by

$$kq + \frac{kq\delta}{r}$$

The inclusion of this value in expression (13) gives a rental value of

$$c = q\,\frac{(r+\delta)\ (1-uz-k)}{(1-u)} \tag{25}$$

which is lower than the value in (22).

Turning now to equation (5), once it has been established that tax policy is capable of reducing the value of the rental cost term,[2] the next task is to indicate how this reduction will lead to an increase in the demand for capital goods.

If equation (5) is further transformed to a reduced form then the desired stock of capital is given by

$$K^* = \alpha^{\frac{1-\beta}{1-\alpha-\beta}}\ p^{\frac{1}{1-\alpha-\beta}}\ c^{\frac{\beta-1}{1-\alpha-\beta}}\ \beta^{\frac{\beta}{1-\alpha-\beta}}\ W^{\frac{-\beta}{1-\alpha-\beta}} \tag{26}$$

As profit maximization implies decreasing returns to scale and hence an optimum size to the firm then $\beta-1<0$ so that there is an inverse relationship between the cost of capital and the desired capital stock. At the same time, however, the reduced form equation indicates that output is not amongst the determinants of the desired capital stock. Instead, output is determined by these same factor and output prices.

A demand for labour function derived under the same assumptions gives the desired input of labour services as

$$L^* = \alpha^{\frac{\alpha}{1-\alpha-\beta}} \; P^{\frac{1}{1-\alpha-\beta}} \; C^{\frac{-\alpha}{1-\alpha-\beta}} \; \beta^{\frac{1-\alpha}{1-\alpha-\beta}} \; W^{\frac{\alpha-1}{1-\alpha-\beta}} \qquad (27)$$

From this expression changes in rental cost also influence, in an inverse way, the demand for labour. Reductions in the cost of capital lead to an increase in the desired level of output, and the absolute level of desired labour services is expanded. The possibility for an expansion in output depends, however, on the elasticity of demand for the output of the firm.

If the price elasticity of demand for the output approaches zero, then the firm is more in the nature of a cost minimizing position, and output is determined exogenously. In this situation the cost minimizing demand for capital is

$$K^* = \alpha^{\frac{\beta}{\beta+\alpha}} \; Q^{\frac{1}{\alpha+\beta}} \; C^{\frac{-\beta}{\beta+\alpha}} \; \beta^{\frac{-\alpha}{\beta+\alpha}} \; W^{\frac{\beta}{\beta+\alpha}} \qquad (28)$$

and the demand for labour

$$L^* = \alpha^{\frac{-\alpha}{\alpha+\beta}} \; Q^{\frac{1}{\alpha+\beta}} \; C^{\frac{\alpha}{\alpha+\beta}} \; \beta^{\frac{\alpha}{\alpha+\beta}} \; W^{\frac{-\alpha}{\alpha+\beta}} \qquad (29)$$

As in the profit maximization case the demand for capital is inversely related to the rental cost term, but with cost minimization the desired capital stock is also determined by the exogenous level of output.

The demand for labour is directly related to the rental cost of capital so that reductions in the rental cost of capital lead to a reduction in the demand for labour. In this case a pure factor substitution effect is the only outcome of the reduction in the rental cost of capital.

The final case is the situation where there is significant price elasticity of demand but zero elasticity of factor substitution. In this fixed proportions case the effect of an incentive policy would be to produce what may be called a profitability effect. In response to the reduced price for capital, demand for both factors will expand as firms increase output.

Whether the response is a mixture of profitability and substitution effects, or either of these effects by themselves, the impact of investment incentives is to increase the desired capital stock. The extent of the increase depends on the size of the reduction in the rental cost variable. As additional capital flows into the favoured sector (or region or country for that matter) the value of the marginal product of capital will fall until at the new equilibrium level it is once again equal to the rental cost. The introduction of investment incentives then does not lead, after full adjustment, to higher observed profits, but rather to changes in levels of output and factor intensity. This, of course is a long-run effect and would not be an outcome of short-term incentive policies.

Most studies of investment incentive policies appear to have concentrated on the factor substitution effect. To the extent, however, that certain investment incentives policies are attempting to capture internationally mobile capital, the profitability aspect may be more critical. In the short run certain production processes may entail fixed factor proportions, but their location may be variable. In this situation investment incentives appear more in the nature of competitive bribes offered by countries to attract mobile capital. The more open a country is to international capital flows, the more sensitive it is to the existence of investment incentive policies in other countries, and the more likely it is to offer competitive incentives. Both the attraction and retaliatory aspects of incentive policies have been behind such programs as DISC (Domestic International Sales Corporations) in the United States, tax holidays in Puerto Rico and Ireland, and, in Canada, both the RDIA program and the 1972 accelerated allowances and tax cut policies. The 1972 policies were in part a direct response to the DISC program.

To return to the substitution effect, there are two entangled factors that need to be discussed. First, the size of the elasticity of substitution, and secondly, the time element in the adjustment to new factor prices. By assuming a Cobb-Douglas production function, Jorgenson adopts an elasticity of unity. To support this position he quotes a number of empirical studies that have estimated the elasticity of substitution to be around that level. Others, such as Eisner (1975) who are more skeptical of Jorgenson's analysis, quote studies that indicate a much lower value of the elasticity of substitution. In Canada Kotowitz (1968) has estimated the elasticity of substitution to be somewhere between .3 and .5. The last word on the elasticity of substitution clearly has yet to be written.

Studies of the elasticity of substitution are, however, usually concerned with long-run adjustment in factor proportions and factor prices. **Capital is assumed to have putty-putty characteristics -- in the long-run factor** proportions are perfectly variable. Jorgenson uses the same concept of capital in his analysis, but the adjustment speed is assumed to be instantaneous, at least in his theoretical work. Capital markets are assumed to be such that firms can acquire or dispose of capital goods at will, and with no adjustment costs. In addition, output is always assumed to correspond to desired output. This theoretical model of immediate adjustment has been strongly criticized by Brechling (1975) both because of the theoretical structure, and the failure to perform in empirical tests. Brechling's final statement on the subject is that:

> "In view of the present state of our knowledge, however, considerable caution should be exercised in using the neo-classical factor demand theory as a basis for the formulation of monetary and fiscal policy."

The alternative view of capital -- as a putty-clay phenomenon -- is a shorter term vision. In this situation the extent of the substitution brought about by a change in factor prices is liable to be relatively small, and well below the level that could be predicted from a knowledge of the long-term value of the elasticity of substitution. Atkinson (1975) gives two reasons for this lower short-term substitution effect. First, in the short run capital must be viewed in a putty-clay framework. Once installed, different techniques involving different capital/labour ratios will be adopted in response to a change in factor prices only if, according to Atkinson, the variable costs associated with the installed technique exceed the total cost of an alternative technique. Until this happens, no switch in technique would occur in response to a change in relative prices. This outcome reflects the non-malleable nature of installed capital, and the fact that installed capital is viewed as a sunk cost. Similar considerations apply, of course, to techniques installed during the period in which an incentive policy is in force. The removal of the policy does not cause a switching of techniques in response to the post-policy set of relative prices.

Second, if firms do not switch techniques, they may respond to changes in factor prices by adopting production techniques more appropriate to prevailing factor prices only when capital equipment comes up for replacement. Since changes in factor prices will affect equipment lives then the rate of replacement will itself be influenced by relative prices. The value of the short-run elasticity of substitution will, however, be determined by this rate of replacement.

As a final note, it should be indicated that the substitution effect is not only confined to capital/labour substitution but also involves substitution between different types of capital on the basis of their effective lifetimes. Incentive policies may at times bring about greater percentage reductions in certain capital goods than others. In this situation there will be an incentive to substitute between assets with different lifetimes. The nature and speed of this capital/capital substitution will be constrained in a similar fashion to capital/labour substitution by the factors outlined above.

To summarize this section, it was indicated that between the accelerator and neo-classical theories of investment, only within the neo-classical model did investment incentive policies have a significant role. There it was shown that investment incentives can influence the shadow price of capital, and in a profit maximizing or cost minimizing firm this will result in a change in the desired capital/labour ratio. The extent and speed of adjustment by firms to a change in the desired capital/labour ratio is however uncertain, particularly in the context of only short-run changes in the rental cost.

III.3 INVESTMENT INCENTIVES AND THE SPEED OF ADJUSTMENT

Although the level of output, or expected output, and the set of output and factor prices are important in determining the desired capital stock, the speed and costs associated with adjustment to changes in these determinants are influential in determining the actual time pattern of expenditures on capital goods. Jorgenson recognizes this in his empirical work by specifying lags to reflect the adjustment process. These lags are to take account of (a) the time taken to recognize the change in the determinants of the capital stock and (b) the time and costs involved in ordering and installing new equipment and in making changes in the firm's labour force. The object of this section is to examine the ways in which investment incentives may influence this adjustment process.

A further factor considered in this section is the treatment of replacement expenditures. In both theory and empirical work, replacement expenditures are generally considered to be fully anticipated and to be determined simplistically as a proportion of the existing capital stock (Jorgenson 1963). This mechanistic formula offers little scope for investment incentives to influence the effective lives of machinery and equipment. As will be indicated, however, replacement investment is susceptible to the influence of investment incentives.

a) Cash flow in the adjustment process

Amongst businessmen it is held strongly that the current availability of internal funds in the form of current profits, retained earnings and depreciation charges is a major influence on the level of investment expenditures. Many empirical studies have supported this role for internal funds by reporting a high degree of statistical association between liquidity variables such as profits or retained earnings and investment expenditures. Meyer and Kuh (1957), for example, after considering a large number of empirical studies of investment determinants, state that:

> "The profit principle and other liquidity manifestations have proven to be powerful, although by no means exclusively the best explanation of investment behaviour in previous studies."

The reported statistical association may, in Eisner's (1964) opinion, be more of an illusion than an indication of reality. Profits, he believes, may have served as a "proxy variable" capturing the influence of demand on investment behaviour. This is because periods of high profits have tended to coincide with periods when demand has been high relative to capacity.

Furthermore, from the perspective of a "pure" theory of investment behaviour, firms, faced with perfect capital markets, ought to be indifferent as to the source of funds used to finance investment expenditures; future profits rather than present profits ought to determine investment behaviour. From this perspective any role for present profits must rest on imperfections in capital markets, risk, or other institutional factors.

Rationalization of the role of retained earnings along these lines has been best developed by Duesenberry (1958). The major point made by Duesenberry is that the imputed cost of funds to firms may rise rapidly and be well above market rates of interest for expenditures in excess of available internal funds. This follows from an unwillingness on the part of firms to expand debt-equity ratios due to risk aversion, and a perception of the cost of expanding equity issues. Under these conditions the cost of external funds may be considerably higher than the opportunity cost of internal funds.

The critical point in the discussion on the role of internal funds is that the lack of such funds is seen as a constraint on the level of investment expenditures; these expenditures must be desired because of the other factors that might influence the desired stock of capital such as relative factor prices and output levels. If these factors are not present, then the supply of internal funds, and changes in the supply of those funds, will have no impact on investment behaviour. Incentive policies introduced at a time when firms feel the internal funds constraint could be expected to help expand investment expenditures, but policies introduced at times of excess capacity and plentiful supplies of internal funds, will not, in this respect, influence investment expenditures because the supply of internal funds constraint is not operative. If, however, incentive policies can create additional demands for capital, then by supplying additional cash flow they can also influence the subsequent speed of adjustment. In this way the separate effects of incentive policies can complement one another. With respect to replacement expenditures, empirical work by Feldstein and Foot (1971) has indicated that the timing of replacement expenditures is influenced by the supply of internal funds.

Investment incentive policies clearly do influence the supply of internal funds. Policies such as accelerated depreciation and investment tax credits will add to the level of internal funds in those firms that are actually undertaking investment expenditures. Tax reductions will increase profits for all firms with taxable incomes. To illustrate the way in which cash flow changes in response to investment incentive policies, if F_i is defined as the after-tax cash flow in period i then for a single asset outlay

$$F_i = (1-u_1)(R_i-d_i) + d_i \qquad (i = 1...e) \qquad (30)$$

For a change in both the tax rate and the way in which capital cost allowances are calculated, then

$$F_i^* = (1-u_2)(R_i - d_i^*) + d_i^* \qquad (i = 1...e) \qquad (31)$$

and the changes in cash flow in period i from these two policy measures is

$$F_i^* - F_i' = (1-u_2)(R_i - d_i^*) + d_i^* - \left[(1-u_1)(R_i - d_i) + d_i\right] \quad (32)$$

$$= R_i(u_1 - u_2) - u_1 d_i + u_2 d_i^* \quad (33)$$

while the sum of the changes in cash flow is

$$\sum_{i=1}^{e} (F_i^* - F_i') = \sum_{i=1}^{e} R_i(u_1 - u_2) - u_1 d_i + u_2 d_i^* \quad (34)$$

From (33) if there is no change in capital cost allowances, then the change in cash flow in period i is given by

$$F_i^* - F_i = R_i(u_1 - u_2) - d_i(u_1 - u_2) \quad (35)$$

$$= (R_i - d_i)(u_1 - u_2) \quad (36)$$

and the sum of the changes amounts to

$$\sum_{i=1}^{e} (F_i^* - F_i) = \sum_{i=1}^{e} (R_i - d_i)(u_1 - u_2) \quad (37)$$

In the extreme case where $u_2 = 0$ (tax exemption) then

$$\sum_{i=1}^{e} F_i^* - F_i = u_1 \sum_{i=1}^{e} (R_i - d_i) \quad (38)$$

Again, if from (33) there is no change in tax rates, then the change in cash flow in period i is expressed as

$$F_i^* - F_i = u_1 (d_i^* - d_i) \quad (39)$$

and the sum of the changes amounts to

$$\sum_{i=1}^{e} (F_i^* - F_i) = u_1 \sum_{i=1}^{e} (d_i^* - d_i) \quad (40)$$

It is important to realize that for changes in either capital cost allowance rates, or the method used to determine allowances, as long as the cost base is constant then

$$\sum_{i=1}^{e} F_i^* - F_i = \sum_{i=1}^{e} u(d_i^* - d_i) = 0 \tag{41}$$

In this situation, only the timing of capital cost allowances, and hence that of tax payments, is altered. Over the depreciable life of the asset the sum of capital cost allowances, in current value terms, will always amount to the original cost of the asset. The benefit to the firm from changes in the timing of tax payments is that, in effect, the firm receives an interest-free loan.

If an investment incentive policy consists of a tax credit based on some proportion k of capital expenditures, then the increase in cash flow in each period is the amount of the tax credit received in each period. If, however, the tax credit is required to be deducted from the cost of capital expenditures before determining capital cost allowances, then the cash flow in periods 2...e is influenced by the tax credit received in period 1. Thus if $\tilde{d}$ represents capital cost allowances after the deduction of the tax credit, then cash flow in period 1, when the credit is paid, is given by:

$$F_1^* = (1-u_1)(R_1-\tilde{d}_1) + \tilde{d}_1 + k_1 \tag{42}$$

while in the absence of the tax credit

$$F_1 = (1-u_1)(R_1-d_1) + d_1 \tag{43}$$

so that

$$F_1^* - F_1 = (1-u_1)(R_1-\tilde{d}_1) + \tilde{d}_1 + k_1 - \left[(1-u_1)(R_1-d_1) + d_1\right] \qquad (44)$$

and

$$F_i^* - F_i = u_1(\tilde{d}_i - d_i) + k_1 \qquad (45)$$

Over the depreciable life of the asset

$$\sum_{i=1}^{e} F_i^* - F_i = k_1 + u_1 \sum_{i=1}^{e} (\tilde{d}_i - d_i) \qquad (46)$$

and as $\sum_{i=1}^{e} \tilde{d}_i < \sum_{i=1}^{e} d_i$,

then $\sum_{i=1}^{e} (F_i^* - F_i) < k,$ so the value of the increased cash flow, with the deductibility requirement, is less than the amount of the tax credit.

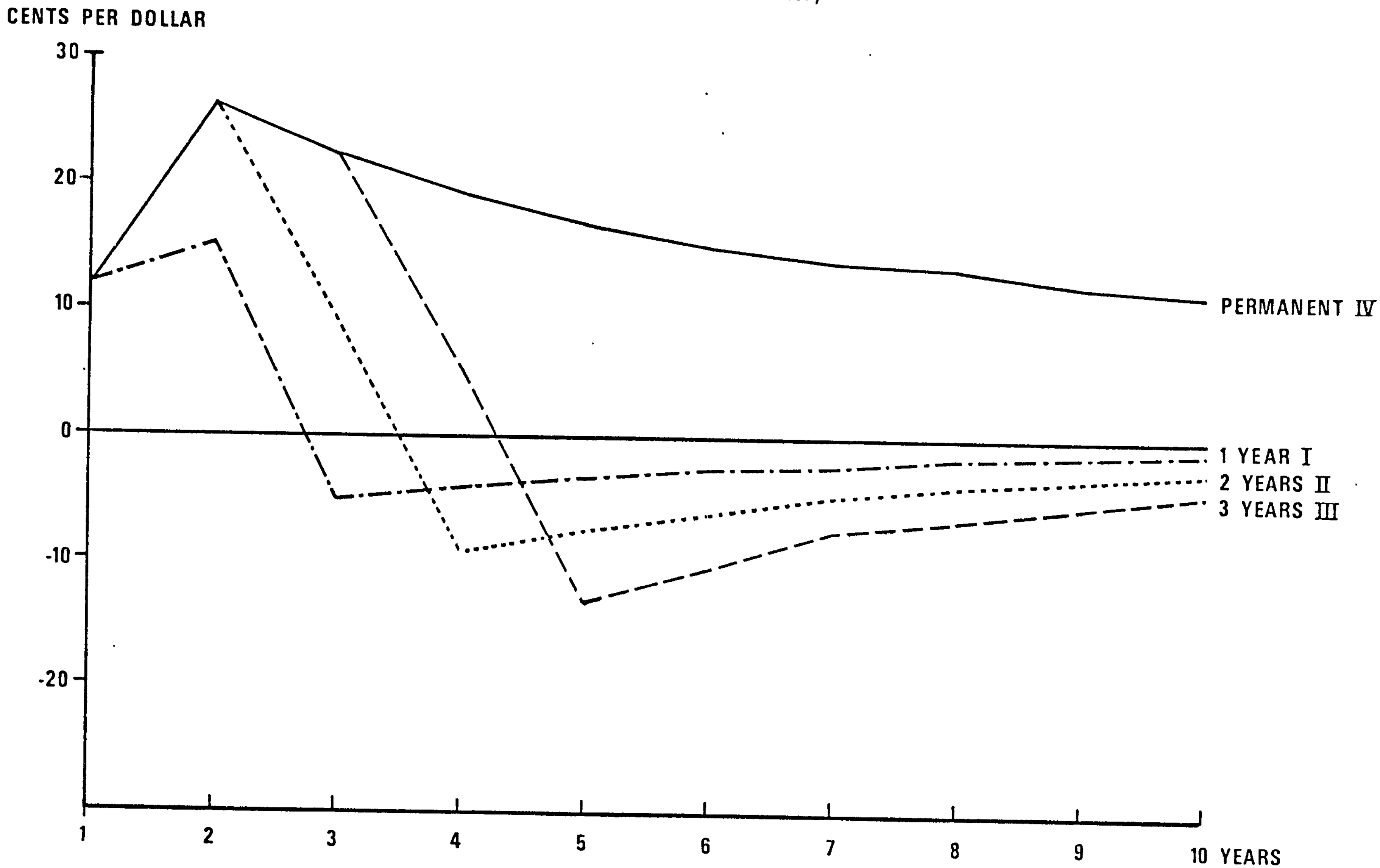
Obviously at the micro level it is relatively easy to assess the cash flow effects of changes in capital cost allowances and the introduction of tax credits along the lines of equations (39) and (45). However, measuring the effect of changes in tax rates as in (36) produces problems because of the introduction of the R term. At an aggregate level a knowledge of the actual outlays on assets that are subject to policy as well as gross profits will give an idea of the aggregate cash flow effects arising out of particular policies. The detailed discussion of individual policies in Chapter V will provide estimates of both the micro and macro cash flow effects.

FIGURE 2

ADDITIONAL TAX SAVINGS FROM ACCELERATED CAPITAL COST ALLOWANCES UNDER GROWTH CONDITIONS

(U = .4, G = .05)

(CENTS PER DOLLAR OF OUTLAY)



The above analysis is based, however, on the acquisition of a single asset. Eisner (1952) long ago showed that a switch from one method of depreciation accounting to a more accelerated method will, as long as investment continues to grow, lead to permanent tax savings. Figure 2 illustrates the change in tax savings when a policy of accelerated capital cost allowances is introduced for one, two and three years, and then permanently, in a situation where investment outlays are growing by 5 per cent per annum. The horizontal line at zero is the base from which deviations from the normal level of tax savings are measured. Line I shows the impact of allowing a 50 per cent straight-line allowance on investment expenditures in the first year, and then returning to a 20 per cent diminishing balance rate for outlays in subsequent years. The additional tax savings are considerable in the first two years, and then drop to below normal levels for subsequent years. A similar picture holds when the accelerated allowances are introduced for two and three years. Figure 2 illustrates why short-term accelerated capital cost policies can be conceptualized as situations where the government extends interest-free loans to firms with repayments made over extended periods through higher than normal tax payments after the expiry of the policy. On the other hand, as line IV shows, permanently accelerated allowances lead to permanent additional tax savings as long as investment expenditures continue to grow.

The converse of a change in cash flow for a firm is of course the change in tax receipts by the government. The increase in cash flow, either temporarily or permanently, that follows from an investment incentive policy is a measure of the revenue losses incurred by the program. This is, however, only a first round effect. To the extent that the policy leads to an increase in GNP then income tax receipts will also rise.

b) Policy timing effects

As indicated in Chapter I, the unique feature of Canadian policies has been that a termination date is announced for an incentive policy at the time the policy is introduced. In several instances these termination dates have been extended, but only in one case has a policy been extended indefinitely.

Three distinct effects flow from this timing aspect of Canadian policies. First, because the average policy duration is some two to three years, where an incentive policy would otherwise lead to an increase in the desired capital stock, with a termination date its influence will be limited to only those investment opportunities that can be completed within the policy period. This effect can be called the time constraint effect of Canadian policies.

Second, there is an effect flowing from the fact that firms which intend to add to their capital stock at some point in the future may do so during the period in which an incentive policy is in operation rather than when originally planned, if the original date was beyond the period in which the incentive policy applied. This effect is called the general timing effect.

The third effect is a more specific and shorter run case of the general timing effect. This occurs when firms respond to a policy termination date by purchasing assets immediately prior to the termination date so as to obtain the benefits of the incentive policy. The cost of earlier-than-planned acquisitions may only be the interest cost of funds and this can be matched against the benefits of the incentive policy to see how much future investment should be acquired in the incentive policy period. This phenomenon is called the termination date effect.

The role of these timing effects is that as a consequence firms change the timing of planned investment expenditures so as to capture the benefits of incentive policies. Thus the timing effect does not influence the size of the long run desired capital stock in any way, but simply alters the time path over which the optimal capital stock is acquired. Similar considerations apply to the timing of replacement expenditures. It would seem realistic to assume that firms would alter the timing of replacement expenditures to enable them to take advantage of any incentive policies which may be in operation for a short period. Indeed, there is a substantial body of theory in the literature (Smith 1963; Kelly, 1971; Chisholm, 1974; and Feldstein and Rothschild, 1974) indicating that the optimal lives of capital goods are influenced by investment incentive policies.

An investment incentive policy then, by inducing earlier than otherwise scrappage can change the rate of replacement. Jorgenson has ignored this possibility by assuming a constant rate of replacement regardless of the existence of incentive policies. In so doing he understates the theoretical impact of investment incentive policies on total investment.

An examination of the comments made by the various Ministers of Finance at the time policies were introduced indicates that they expected their policies to have a strong impact on the timing of investment expenditures. For example, when introducing his deferred allowances dis-incentive policy in the Budget Speach 1966, Mitchell Sharp (Department of Finance, 1966) stated that;

> "We have for many years used increased rates of capital cost allowances as inducements for accelerating business investment. Indeed we have been using them recently. It is logical that we should now use reductions in these allowances to induce business to defer a part of its investment."

Similarly when Edgar Benson announced his increase in cost base policy in the Budget Speech 1970 (Department of Finance, 1970) he remarked:

> "I am confident that it will encourage new capital projects and speed up the implementation of capital outlays planned for the future."

In the literature, the timing effect of short-term fiscal policies has been recognized as a potent influence on investment expenditures. Eisner (1969b) for example has suggested that intertemporal substitution of investment expenditures might be achieved through a system of taxes and subsidies on investment in periods of high and low investment activity. The Economic Council of Canada in a study of the building industry recommended that an investment levy be applied during boom periods and subsidies in slumps as a means of changing the timing of investment expenditures. Nickell (1974) has integrated timing considerations with the role of expectations in the investment process and indicated that in situations where firms cannot easily dispose of capital once acquired, timing factors, particularly the announcement and termination of government policies, become highly significant in the investment process. Kierans (1972) is highly critical of investment incentive policies because of this timing effect. His complaint is that the incentive policy tends to bunch investment decisions and create a short-lived boom.

As was the case with cash flow, however, any impact from the timing effects in incentive policies is conditional upon the state of expectations about the future course of the economy. Intertemporal substitution will occur only where there are definite investment plans for the future based upon expectations about the long-run levels of income and demand.

Finally, even in the absence of incentive policies, because a full year's capital cost allowances is permitted on assets acquired at any time in the year, firms have an incentive to advance the date of acquisition to allow them to obtain assets late in the year which they would otherwise have acquired early in the next year. This could be of particular importance in avoiding any recapture of capital cost allowances resulting from the disposal of assets during the year (Strain, 1975).

The strength of the general timing effect associated with Canadian policies may be gauged by the difference between the rental cost of capital with and without the policy. The difference will indicate the benefit to firms from changing their general investment plans.

For the termination date effect it is possible to be more precise by introducing the cost of changing the timing of expenditures. In the simplest case the strength of the effect is given by the tax saving on the difference between the present value of capital cost allowances with and without the incentive policy less the interest cost of transferring the expenditure from a later period to an earlier one. This may be represented as

$$u(z_1-z_o)-r$$

where r is the interest cost for the period over which the timing has been altered.

In the case of a tax credit policy with the deductibility requirement the benefit is

$$(k-kuz)-r$$

In the more complex case the timing effect is spread over several periods both before and after the period in which the policy terminates.

Figure 3

TERMINATION DATE TIMING EFFECT

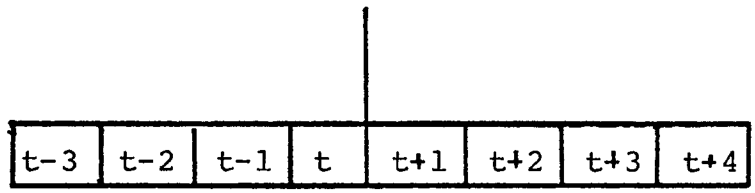


Figure 3 shows that if the policy terminates at the end of period t the full timing effect consists of an incentive to move acquisitions from periods t+1, t+2, ... into periods t, t-1, ... The larger the number of periods over which the switch occurs, the larger will be the interest cost of switching so that the maximum effects will be felt in periods t and t+1. Symbolically, the full impact of the timing effect in period t will be the sum of the benefits of moving investment from periods t+1, t+2... to period t so that if B is the size of the timing effect,

$$B_t = \left[u_t(z_t - z_{t+1}) - r_1\right] + \left[u_t(z_t - z_{t+2}) - r_2\right] + \dots \qquad (47)$$

Similarly

$$B_{t-1} = \left[u_{t-1}(z_{t-1} - z_{t+1}) - r_2\right] + \left[u_{t-1}(z_{t-1} - z_{t+2}) - r_3\right] + \dots \qquad (48)$$

Because there is a negative effect on investment in periods t+1, t+2 ..., this should be reflected in some notion of the cost of not taking advantage of the termination of the incentive policy. The cost of not altering the timing would then be the difference between the interest costs saved by not undertaking the earlier than planned for investment, and the loss of not taking advantage of the incentive policy by switching investment from, for example, period t+1, to period t, t+1, ..., so that if C is the negative timing effect

$$C_{t+1} = \left[u_t(z_t - z_{t+1}) - r_1\right] + \left[u_{t-1}(z_{t-1} - z_{t+1}) - r_2\right] + \dots \quad (49)$$

and again

$$C_{t+2} = \left[u_t(z_t - z_{t+2}) - r_2\right] + \left[u_{t-1}(z_{t-1} - z_{t+2}) - r_3\right] + \dots \quad (50)$$

In the calculation of these effects, since the decision to change the timing is made before the expiry date, the interest rate in any period before the expiry date is assumed to hold in periods after the expiry date.

Because most of the investment incentive policies in Canada have commenced operation on the day following the announcement of the policy there has been little opportunity for what may be called a starting date timing effect. If there was a time gap between the announcement and commencement, then firms could be expected to defer investment expenditures until the policy was actually in force.

The impact of the positive and negative termination date timing effects may be considered as factors that influence the speed of adjustment and provide the explanation for short-term fluctuations in investment expenditures around the end of an incentive policy period. The ways in which this effect and the general timing effect can enter the specification of an investment function will be set out in Chapter VI.

III.4 SUMMARY

Of the two major approaches to investment theory, the accelerator and the neo-classical model, it is only the neo-classical framework which incorporates a significant role for the impact of investment incentive policies. Even there, however, the impact of investment incentives on relative factor prices and the consequent factor substitution effect has its full impact only in the long run, while the incentive policies under review are strictly of a short-term nature. Another way in which short-term incentive policies may have an impact on investment expenditures is by influencing the speed of adjustment to changes in the desired capital stock, regardless of whether the desired capital stock is determined by output or by factor prices. In addition, the influence should not be confined to just the rate at which additions are made to the capital stock, but also to the rate of replacement expenditures. It is suggested that two possible ways in which incentive policies can influence the speed of adjustment are by influencing the cash flow position of firms, and by altering the timing of planned acquisitions and replacements. These influences on adjustment will be incorporated into the specification of an investment function in Chapter VI and tests made for the empirical significance of these effects in Chapter VII in addition to tests for the substitution effect.

FOOTNOTES TO CHAPTER III

1. See Appendix A for a discussion of the outcome if the allowances on the initial outlay are not identical with those on replacement outlays.

2. Chapter IV has a discussion on the possibility that tax reductions could actually increase the value of the rental cost term.

CHAPTER IV

NEUTRALITY AND INVESTMENT INCENTIVES

IV.1 INTRODUCTION

The object of this chapter is to set out the theoretical ways in which Canadian investment incentive policies may introduce, extend or diminish neutralities or non-neutralities in the Canadian economy with respect to the volume or type of assets acquired. Section IV.2 discusses neutrality with respect to the desired capital stock, while Section IV.3 looks at the relationship between asset choice and neutrality.

One of the first to make the connection between the concept of neutrality and investment incentives was Brown (1948). Musgrave (1959) contributed to further refinement of the relationship, while Samuelson (1964) provided valuable theoretical insights enabling an alternative notion of neutrality in taxation to be developed. The relationship between the Brown and Samuelson analysis is explored in detail by White and White (1974), and other important theoretical contributions have been made by Sandmo (1974), Smith (1963) and Sumner (1975). Sunley (1973) has applied some of the theoretical results to an analysis of the investment tax credit in the United States.

Much of the discussion of neutrality is in the context of the absence or presence of a tax system and the consequent biases induced by the tax system. More important for this study is the impact of changes in a tax system regardless of whether or not the basic system was neutral or non-neutral. Changes in a non-neutral tax system, for example, may in themselves be neutral or non-neutral in that they preserve the existing state of non-neutrality, or they expand or diminish the existing non-neutralities. Hence it is possible to have the notion of neutral or non-neutral changes in a non-neutral tax system.

Investment incentive policies by their very design are meant to be non-neutral in their impact. The whole point is that the policy is attempting to change investors' choice of assets in the way policy-makers desire. In doing so, however, policy-makers must be aware that each investment incentive policy gives rise to several non-neutral effects, only one of which may be the desired one. For example, accelerated capital cost allowances for machinery and equipment in the Canadian manufacturing sector given in 1972 to encourage investment in manufacturing, could, since they only applied to machinery and equipment, change the relative proportions of machinery and equipment and construction in total manufacturing outlays.

IV.2 NEUTRALITY AND THE CAPITAL STOCK

The emphasis in this section is on examining the impact of investment incentive policies on the overall size of the capital stock. To simplify the analysis it is assumed that capital is a homogeneous commodity, with constant economic and tax depreciation rates, and that there is only one tax rate. Furthermore, investment incentive policies are assumed to be applicable to all sectors of the economy.

Equations (26) and (28) in Chapter III.2 indicated that the desired capital stock is determined, in part, by the cost of capital which is in turn influenced by the taxation system. In this way the imposition of a general tax on the earnings of capital leads to a reduction in the desired stock of capital for the firm. If the stock of capital for the economy is viewed as the sum of the desired stocks of capital for individual firms, the result of a tax on the earnings of capital is a lower capital stock than would be the case in the absence of the tax. In this sense the tax system is non-neutral with respect to the stock of capital, and it causes a change in the aggregate capital-labour ratio.

Brown (1948) was the first to attempt to demonstrate that in fact a tax on capital could be neutral if the tax was accompanied by an appropriate depreciation allowance policy. To illustrate Brown's argument, if the cost of capital in the absence of a tax is given by

$$c = q(r+\delta) \tag{1}$$

while with the tax, and assuming that interest payments are not deductible from taxable income, or alternatively that all capital acquisitions are financed from equity funds, then

$$c = \frac{q(r+\delta)\ (1-uz)}{1-u} \tag{2}$$

Clearly, if z = 1, i.e. the immediate deductibility of capital expenditures is allowed, then (2) becomes the same as (1). Hence, immediate deductibility offsets the impact of the tax on the desired stock of capital, and the overall tax system is neutral.

The problem with Brown's analysis is that in the situation where interest payments are deductible

$$c = \frac{q\left[r(1-u) + \delta\right](1-uz)}{1-u} \tag{3}$$

so that where z = 1

$$c = q(r+\delta)-qur \tag{4}$$

In this situation the cost of capital is lower than in (1), giving rise to a larger capital stock than would be indicated by the value of c in (1).

Despite the problem caused by the restrictive assumption of non-interest deductibility, Brown's analysis provided a perspective on investment incentives in that measures of accelerated capital cost allowances were seen as a means of offsetting the disincentive effect of taxation on investment.

It is not always the case, however, that investment incentive policies lead to an increase in the desired capital stock. Musgrave (1959) indicated that an increase in the tax rate that was believed to be temporary could lead to an increase in investment. This follows because firms realize greater tax savings from depreciation allowances during the high tax period, and taxable income is then shifted into the future low rate period. Sumner (1975) has formalized this possibility using the rental cost of capital variable, and by assuming that the investment incentive policy consists of a reduction in taxes. He was able to show that under certain conditions a reduction in the tax rate would lead to a reduction in the desired capital stock. This occurs because of the reversal of the effect mentioned by Musgrave - a reduction in the tax rate reduces the value of depreciation allowances. To illustrate, if

$$c = \frac{q(r+\delta)(1-uz)}{1-u} \qquad (5)$$

and assuming that r is independent of the tax rate then

$$\frac{\partial c}{\partial u} = \frac{q(r+\delta)\ (1-z)}{(1-u)^2} \tag{6}$$

If z was greater than unity then the rental cost of capital would rise with a reduction in the tax rate. The perverse outcome is more probable if a tax credit policy is in operation at the same time as the tax reduction. Assuming that the tax credit is not deductible from the depreciable base then

$$c = \frac{q(r+\delta)\ (1-uz-k)}{1-u} \tag{7}$$

and

$$\frac{\partial c}{\partial u} = \frac{q(r+\delta)\ (1-z-k)}{(1-u)^2} \tag{8}$$

In this case the perverse outcome requires $z+k>1$.

Sumner finds this situation a distinct possibility in the case of British regional investment incentives policies. The Canadian regional investment incentive policies between 1965 and 1969 are also an area where this perverse effect could be expected. If, however, the amount of any grant for regional development is required to be deducted from undepreciated capital costs before determining capital cost allowances (as is the case with present Canadian regional incentives) then a perverse outcome is impossible. This is because if

$$c = \frac{q(r+\delta)\ (1-uz(1-k)-k)}{(1-u)} \tag{9}$$

then

$$\frac{\partial c}{\partial u} = \frac{q(r+\delta)\ \ (1-z-k-zk)}{(1-u)^2} \qquad (10)$$

As long as $z<1$, then regardless of the size of k, $(z-k-zk)<1$.

The above results, however, are dependent upon the assumption that interest payments are not deductible from taxable income.

Samuelson (1964) provided the theoretical insight to solve the problem of neutrality in a world of tax deductible interest payments. According to Samuelson, neutrality for the tax system is achieved when tax depreciation allowances are determined by the true loss in the economic value of assets. If the rate of decline in economic value is given by δ, then, with tax-deductible interest,

$$z = \frac{\delta}{r(1-u)+\delta} \qquad (11)$$

and substituting this value of z into equation (5)

$$c = q\left[r(1-u)+\delta\right]\left[1-\frac{u\delta}{r(1-u)+\delta}\right] \qquad (12)$$

$$= q(r+\delta)$$

which is identical to (1), the cost of capital in the absence of taxation. From this it may be concluded that the tax system would be neutral with respect to the capital stock if the depreciation allowances for tax purposes are set at the rate of economic depreciation of assets.

The problem with both approaches to neutrality is that they are "either-or" cases. In practice, capital purchases are made with both interest deductible debt funds, and equity funds with non-deductible dividends. Thus an actual description of the tax system in terms of its neutrality or non-neutrality is very difficult.

The revenue implications of a neutral tax have been the subject of some confusion. For example, Hyndman (1974), in discussing the 1972 investment incentive policies in Canada, uses the Brown version of a neutral tax system (immediate tax deductibility of capital outlays) and remarks that with such a system the effective rate of tax on the income from new investments would be zero. A similar claim is made by Surrey (1974) again when discussing the implications of immediate deductibility. The confusion arises because while it is clear that at the margin immediate deductibility will generate no revenue for the government, new intra-marginal investments will do so. For intra-marginal investments it is assumed that

$$(1-u)\sum_{i=1}^{n} \frac{R_i}{(1+r)^i} + uzq > q \qquad (13)$$

So that when z=1, this condition becomes:

$$\sum_{i=1}^{n} \frac{R_i}{(1+r)^i} - u\left(\sum_{i=1}^{n} \frac{R_i}{(1+r)^i} - q\right) > q \qquad (14)$$

As

$$\sum_{i=1}^{n} \frac{R_i}{(1+r)^i} > q,$$ the above formulation indicates that taxes, at rate u, will be levied on that part of the income from an intra-marginal addition to the capital stock that is in excess of the cost of the asset when immediate deductibility is allowed. Clearly, only income up to the cost of the asset will escape taxation.

The advantages of this escape from taxation, however, may not be substantial. Under normal capital cost allowances a large proportion of income up to the cost of an asset escapes taxation. This may be illustrated with the aid of the cost of capital expression. In the absence of any depreciation allowances, and with a tax rate u,

$$c_1 = \frac{q(r+\delta)}{1-u} \qquad (15)$$

With depreciation allowances

$$c_2 = \frac{q(r+\delta)(1-uz)}{1-u} \qquad (16)$$

The effective rate of taxation on net receipts up to the cost of the asset will be given by that rate, u*, which makes $c_1 = c_2$. That is where

$$\frac{q(r+\delta)}{(1-u^*)} = \frac{q(r+\delta)(1-uz)}{1-u} \tag{17}$$

or, on cancelling and re-arranging terms, where

$$u^* = \frac{u(1-z)}{1-uz} \tag{18}$$

The larger the value of z, the closer will u* be to zero. Of course, where z=1, u*=0.

This type of reduction in the effective tax rate as a consequence of the introduction of depreciation allowances should be carefully distinguished from the reduction in the effective tax rate that follows from the introduction of changes in the rates of depreciation allowances. The phenomena measured are conceptually different. For this latter concept, the formula is developed as follows:

If prior to a change in policy

$$c_1 = \frac{q(r+\delta)(1-uz)}{1-u} \tag{19}$$

and the change in policy consisted of the introduction of a new value for z, $\bar{z}$, then

$$c_2 = \frac{q(r+\delta)(1-u\bar{z})}{1-u} \tag{20}$$

The question then becomes: what tax rate $\bar{u}$ in (19) would give the same value for the cost of capital as does (20)? By substituting $\bar{u}$ in (19)

$$c_2 = \frac{q(r+\delta)(1-\bar{u}z)}{1-\bar{u}} \quad (21)$$

so that equating (20) and (21), and cancelling

$$\frac{1-\bar{u}z}{1-\bar{u}} = \frac{1-u\bar{z}}{1-u} \quad (22)$$

and

$$\bar{u} = \frac{u(1-\bar{z})}{(1-z)} \quad (23)$$

Obviously, if $\bar{z}>z$, then $\bar{u}<u$. Once again, it should be indicated that the value of $\bar{u}$ is a measure of the effective tax rate on income only up to the cost of an asset as a consequence of a change in depreciation allowances.

IV.3 NEUTRALITY BETWEEN ASSETS AND TAXPAYERS

The discussion in Section IV.2 focussed on the influence of the tax system, and changes in the tax system on the total capital stock. Implicit in the discussion is the assumption that all units of capital are homogeneous in that they are equally durable, so that the rate of economic depreciation is constant. Additional assumptions are: one tax depreciation rate for all units of capital; and one tax rate for all taxpayers. In this section these assumptions are dropped and the effects of the tax system and investment incentive policies on the relative prices of different types of assets are investigated. Changes in relative prices will, where substitution possibilities exist, induce switches between different types of assets. Thus this section is primarily concerned with the impact of investment incentive policies on the composition of the capital stock, rather than the overall size of the capital stock.

The first possibility of a change in the composition of the capital stock arises if homogeneous assets are allocated into specific sectors. A change in the tax rate or the tax depreciation rate in one sector, for example the manufacturing sector, will result in two distinct effects. First, if the tax system is non-neutral in the sense discussed in the previous section, then the desired stock of assets in the manufacturing sector will be increased through capital/labour substitution. Secondly, the simultaneous reduction in the cost of capital in the manufacturing sector will increase the rate of return on manufacturing capital. In this situation capital will be attracted out of other sectors to the manufacturing sector. The expansion of the stock of manufacturing capital will continue until the marginal product of capital in manufacturing is equal to the marginal product of capital in other sectors. In this way the investment incentive policy in the form of a tax or depreciation policy alters the sectoral allocation of capital, as well as the total capital stock.

If, instead of homogeneous capital, it is assumed that there are two types of capital goods, with the difference based on durability, and each has its own rate of economic and tax depreciation, then changes in tax depreciation rates will induce substitution between assets. To illustrate, before a tax incentive policy is introduced the rental cost of each type of asset is given by

$$\text{Asset (1)} \quad c_1^o = q_1\frac{(r_1+\delta_1)(1-uz_1^o)}{1-u} \tag{24}$$

$$\text{Asset (2)} \quad c_2^o = q_2\frac{(r_2+\delta_2)(1-uz_2^o)}{1-u} \tag{25}$$

where u is the common tax rate, and z_1 and z_2 the respective present values of tax depreciation allowances calculated at the prevailing depreciation rates, and, for simplicity, r is the before tax yield.

If the capital cost allowance rate is changed for asset (1), the new rental cost of capital, c_1^1, is given by

$$c_1^1 = q_1 \frac{(r_1+\delta_1)(1-uz_1^1)}{1-u} \tag{26}$$

and the percentage change in the rental cost of capital is

$$\frac{u(z_1^1-z_1^o)}{(1-uz_1^o)} \tag{27}$$

Similarly for asset (2) a change (in the same direction) in the tax depreciation rate gives a percentage change in the rental cost of capital of

$$\frac{u(z_2^1-z_2^o)}{1-uz_2^o} \tag{28}$$

Thus changes in the tax depreciation rates will be neutral between assets if

$$\frac{u(z_1^1-z_1^o)}{(1-uz_1^o)} = \frac{u(z_2^1-z_2^o)}{(1-uz_2^o)} \tag{29}$$

Otherwise there will be a change in the relative price of the two assets, leading to a change in the proportion of each in the desired capital stock.

With two types of assets in the capital stock, changes in the tax rate will also induce a change in the relative prices of assets. This effect may be illustrated by considering the rental cost value for an asset

$$c = \frac{q(r+\delta)(1-u_1 z)}{(1-u_1)} \tag{30}$$

If the tax rate changes to u_2, the new rental cost value is

$$c = \frac{q(r+\delta)(1-u_2 z)}{(1-u_2)} \tag{31}$$

and the percentage difference is

$$\frac{z(u_2-u_1)}{1-u_1} \tag{32}$$

Clearly the larger the value of z, the greater is the change in the rental cost of capital. Since larger values of z are associated with short-lived assets, reductions in tax rates will lead to a greater proportion of short-lived assets in the capital stock.

An investment incentive policy may also take the form of allowing different tax rates for different classes of tax-payers. For example, lower rates of corporation income tax have applied to corporation income up to a certain level. By allowing different rates, the taxpayers' choice of assets is altered from the one rate situation. To illustrate, the ratio of asset prices for the high rate taxpayer with rate u_1 is given by

$$\frac{1-u_1 z_1}{1-u_1 z_2} \qquad (33)$$

while for the low rate taxpayer with rate u_2 the ratio is

$$\frac{1-u_2 z_1}{1-u_2 z_2} \qquad (34)$$

Clearly the ratio of factor prices is not the same for the two taxpayers, leading to each taxpayer using different combinations of the assets, with the taxpayer with the higher tax rate using a greater proportion of short-lived assets than the taxpayer with the lower tax rate.

Finally, the use of an investment incentive policy such as an investment tax credit can, under the assumption of two assets and two tax rates, lead to further changes in relative prices. It is possible, however, to design an investment tax credit policy that will be neutral in that particular assets or taxpayers are not given a greater reduction in rental cost than other assets. For example, if a tax credit at rate k is allowed, with no other condition, the cost of capital is given by

$$c = \frac{q(r+\delta)(1-uz-k)}{1-u} \qquad (35)$$

so that the percentage change in the rental cost of capital from the no-credit position is given by

$$\frac{k}{1-uz} \tag{36}$$

The larger are u and z, the greater will be the percentage reduction in the rental cost of capital. This type of incentive reduces the cost of short-lived assets proportionately more than for long-lived assets, and the difference is greater if the taxpayer is paying the higher rate rather than the lower rate. The tax credit encourages the acquisition of short-lived assets, particularly by high rate taxpayers.

If, however, the value of the investment tax credit is required to be deducted from the market cost of an asset before determining capital cost allowances, then

$$c = \frac{q(r+\delta)\left[1-uz(1-k)-k\right]}{1-u} \tag{37}$$

and the percentage reduction in the rental cost will be k per cent. In this situation the investment tax credit does not influence relative asset prices, and only operates to increase the desired capital stock.

To summarize the points made in this section, an incentive policy that applies to only one sector of the economy will, as long as the system is non-neutral, cause a re-allocation of capital from other sectors, as well as growth in the favoured sector's capital stock. Furthermore, if an investment incentive policy applies to only one type of asset, then substitution between assets may be expected to occur. In addition, the existence of a number of tax rates in the economy may also cause further adjustments in asset choice in response to investment incentive policies. Finally, it was indicated that investment incentive policies could be designed that would be neutral with regard to asset choice.

CHAPTER V

CANADIAN POLICIES AND THEIR INCENTIVE EFFECTS

V.1 INTRODUCTION

In this chapter the precise form of the Canadian policies under review will be outlined, together with estimates of the strengths of the various incentive effects contained in each of the policies. The calculations shown in this chapter are based on the various formulae and concepts developed in Chapter III.

The impact on the price of capital is indicated by the percentage change in the rental cost term. Because of the existence of two rates of corporate tax in Canada, calculations are made for both rates to illustrate the impact of incentive policies on different classes of taxpayer. The cash flow effect of incentive policies is calculated on the basis of the impact per dollar of outlay on capital goods, with the assumption that the tax rates in force at the time each policy is introduced are maintained indefinitely. Where applicable the impacts on rental cost and cash flow from incentive policies are shown for both machinery and equipment, and buildings. This shows the different treatment received by different assets from incentive policies.

By contrast the estimates of tax revenue losses from incentive policies are based only on machinery and equipment expenditures, and are calculated with reference to actual tax rates. A number of assumptions are necessary to allow the construction of these revenue losses, so the estimates shown are to be taken as approximate only. Finally the termination date timing effect for each policy is shown on a per dollar of outlay basis as described in Chapter III.

The estimates derived in this chapter provide a perspective on the likely impact of policies given the size of their incentive effects. However, it is necessary to undertake the estimation and simulation procedures in Chapter VII before estimating the actual impact of policies.

V.2 THE CONTENTS OF CANADIAN POLICIES

a) Canadian Ownership, 1963

1. General Description

In the Budget of June 13, 1963, the Minister of Finance announced that manufacturing and processing enterprises with a required degree of Canadian ownership were to be allowed a 50 per cent straight line rate of capital cost allowances on machinery and equipment acquired in the two-year period up to June 13, 1965. This incentive policy had two objectives. First to encourage greater Canadian participation in the ownership of manufacturing assets in Canada, and secondly to stimulate economic activity after several recessionary years.

In the Budget of April 26, 1965 this two-year period was extended to December 31, 1966, after which it was supposed to be reviewed in the light of the Royal Commission on Taxation Report. The Budget Speech of March 29, 1966 announced that this particular measure would not be extended beyond its intended expiry date.

2. Coverage

The incentive policy was to apply only to assets which otherwise would have been included in Class 8, the asset class that includes most machinery and equipment (see appendix A). Eligible assets were to be placed in a new class, Class 19. For corporations to satisfy the Canadian ownership requirement the corporation had to be resident in Canada, at least 25 per cent of the voting stock had to be owned by Canadians, and at least 25 per cent of the directors had to be Canadian residents. For individuals claiming the accelerated allowances they were required to be resident for at least 183 days of the taxation year for which a claim was made. For corporations the 25 per cent rules for voting stock and directors had to be complied with for a sixty-day period in the taxation year in which claims were being made. A firm meeting the ownership standards could claim the deductions on Class 19 assets as long as at least two-thirds of the gross revenue of the firm is derived from the sale or rental of goods processed or manufactured in Canada, or from advertising in a newspaper or magazine produced by the business.

Because the policy was limited only to firms with a required degree of Canadian ownership, this policy could apply only to a proportion of total manufacturing expenditures on machinery and equipment. Estimates of the actual proportion of expenditures covered by the policy are developed in section 4 dealing with the cash flow effect.

In total it would appear as though 29.5 per cent of machinery and equipment expenditures in the period in which the policy was in operation were covered by the policy. This proportion is used to weight the changes in rental cost and the timing effects that followed from this policy.

3. Change in Rental Cost

The diminishing balance rate for Class 8 assets is .2, and with that rate the present value of capital cost allowances is given by

$$z_o = \frac{.2}{r + .2}$$

With a switch to the straight line system, and a two-year allowance, the present value of the allowances would be

$$z_1 = \frac{.5}{(1 + r)} + \frac{.5}{(1 + r)^2}$$

The impact of these changes in the present value of capital cost allowances on the rental cost of capital term is shown in Table 5.

The greatest reduction clearly occurs with the higher tax rate and after-tax interest rate. The policy is obviously non-neutral between firms with different

TABLE 5

IMPACT OF INVESTMENT INCENTIVE POLICIES
ON RENTAL COST

(Percentage Change)

POLICY	LOWER TAX RATE[1]	UPPER TAX RATE
1. Canadian ownership, 1963		
Machinery and equipment	-2.94	-7.24
2. Deferred allowances, 1966		
Machinery and equipment	+1.23	+3.02
Buildings	+0.77	+1.94
3. Increase in cost base, 1970		
Machinery and equipment	-2.91	-11.24
Buildings	-1.55	-6.00
4. Accelerated allowances, 1972		
Machinery and equipment	-4.30	-8.87
5. Tax rate reduction, 1973		
Machinery and equipment	-0.55	-1.06
Buildings	-3.52	-8.33
6. Combined accelerated allowances and tax cut, 1973		
Machinery and equipment[2]	-5.53	-12.03
7. Tax credit, 1975		
Machinery and equipment	-5.00	-5.00
Buildings	-5.00	-5.00

[1] The actual tax rates in force at the time the policies were introduced are shown in Tables 6, 12, 16, 20 and 26.

[2] The combined value has been calculated on the basis of both policies being introduced together.

tax rates, providing a larger incentive to firms with higher tax rates. Not only would these reductions in rental cost provide a capital/labour substitution effect, but to the extent that buildings and machinery may be substitutes, the policy might be expected to produce a bias in favour of machinery and against buildings, given that the policy did not provide any assistance for building expenditures.

4. The Cash Flow Effect

The switch to a two-year straight line write off produces substantial tax savings in the first two years in the case of a single asset purchase. Table 6 shows the change in the flow of tax payments as a result of the policy. For a one dollar outlay, and with a .5 tax rate a total of thirty-two cents in taxes are saved in the first two years. This tax saving is however in the nature of an interest free loan, and is repaid in subsequent years through tax payments higher than if the policy had not been in effect. As indicated in Chapter III these tax savings could have been permanent if the policy was introduced permanently, and the purchases of capital assets by the firm continued to grow each year.

TABLE 6

CHANGES IN CASH FLOW[1,2]
CANADIAN OWNERSHIP, 1963
MACHINERY AND EQUIPMENT

TAX RATE	u = .21	u = .50
PERIOD		
1	.063	.15
2	.0714	.17
TOTAL (1 + 2)	.1344	.32
3	- .02688	- .064
4	- .02150	- .0512
5	- .01720	- .04096
6	- .01376	- .03277
7	- .01101	- .02621

1 Per dollar of outlay on capital goods

2 The negative sign indicates an increase in taxes payable.

5. Revenue Losses

Details of capital cost allowances claimed on Class 19 assets may be found in the various issues of Corporation Taxation Statistics (S C 61-208). Amounts claimed by year are given below. Clearly maximum allowances were not claimed during the policy period due to insufficient profits.

Year	$M
1963	58.0
1964	153.1
1965	454.0
1966	577.8
1967	336.1
1968	71.5
1969	30.1
1970	12.6
1971	6.0
TOTAL	1,699.2

These data indicate that the total value of assets on which accelerated allowances were claimed was some $1.7 billion. From these capital cost allowance claims data it is possible to obtain a picture of the time pattern of the investment expenditures eligible for the allowances. Assuming that maximum capital cost allowances are claimed in the year of acquisition, a claim of $58.0 million for 1963 implies acquisition of at least $116.0 million in that year. The claim of $153.1 million in 1964 reflects acquisitions in both 1963 and 1964. Deducting $58.0 million from the $153.1 million to eliminate 1963 purchases implies acquisition of at least $190.2 million of eligible assets. Carrying this procedure through 1965 and 1966 gives the following implied acquisition pattern.

	Year	$M
	1963	116.0
	1964	190.2
	1965	717.8
	1966	437.8
TOTAL		1,461.8

As may be expected, this procedure accounts for only some 86 per cent of total investment expenditures. Clearly the assumption of maximum claims is only an approximation. The problem is further compounded by the fact that these are probably firms with tax years ending in 1967 so that 1967 claims figures will represent acquisitions in 1966 as well as earlier years. Since this bias is present in earlier years, the simplest procedure for allocating the balance of the investment expenditures ($1,699.2 - $1,461.8) is proportionately. In this way the approximate investment pattern will be that given in Table 7 .

TABLE 7

INVESTMENT PATTERN: CANADIAN OWNERSHIP, 1963

(1) YEAR	(2) ESTIMATED CLASS 19 ACQUISITIONS $M	(3) TOTAL MANUFACTURING MACHINERY AND EQUIPMENT EXPENDITURES $M	(4) CLASS 19 AS PERCENT OF TOTAL
1963	134.8	501.4*	26.9
1964	221.1	1,387.9	15.9
1965	834.4	1,765.7	47.3
1966	508.9	2,125.9	23.9
TOTAL	1,699.2	5,780.9	29.4

* One-half of the annual total to correspond with the policy period.

Using this estimated pattern of Class 19 acquisitions it is possible to indicate the impact of this policy on government tax receipts. The comparison is with the situation in the absence of the policy (i.e. that the allowance rate is .2 on the diminishing balance system).

As mentioned earlier, these calculations of revenue losses are only estimates of the first round effects of incentive policies on tax receipts. To the extent that the policies do increase investment and hence GNP, then tax receipts will also expand. Furthermore these estimates are based on the assumption that the level of investment expenditures is unchanged despite the existence of the policy. Again, to the extent investment is increased as a result of the policy the revenue cost is correspondingly lower. The actual estimation of tax receipt changes depends on the proportion of taxable income eligible for the low income rate amongst firms that have the required degree of Canadian ownership. If Canadian firms were typically smaller than the average, then a greater proportion of taxable income than the average would qualify for the low tax rate. In the absence of detailed information it is assumed that eligible firms had the same proportion as the total of all firms of taxable income eligible for the lower rate. With this assumption the average tax rate is determined by the ratio of tax receipts to taxable income. The calculated rates are shown in Table 8 below. Data on tax receipts and taxable income are not available for years beyond 1973, and so, where necessary, the tax rate for those years is assumed to be the top rate, 40 per cent. This assumption will, of course, overstate revenue losses, but the effective rates calculated in the table below are sufficiently close to the top corporation tax rates to warrant the belief that any overstatement will be minimal.

TABLE 8

EFFECTIVE TAX RATES FOR THE CALCULATION OF REVENUE LOSSES

YEAR	RATE (per cent)	YEAR	RATE (per cent)
1963	43.3	1969	49.3
1964	48.5	1970	49.8
1965	48.0	1971	48.4
1966	46.2	1972	46.4
1967	48.6	1973	42.8
1968	49.3		

SOURCE: Corporation Taxation Statistics (SC 61-208).

The final column of Table 9 indicates the change in tax receipts when the effective tax rates are applied to the differences in capital cost allowances claimed as a result of the policy. To summarize, and subject to the caveats mentioned earlier in this section, total corporation tax receipts in the period from 1963 to 1967 are estimated to be $419.7 million lower than if the policy had not been introduced. As the policy only involved accelerated capital cost allowances for a short period, these money amounts would be recovered in future periods, assuming that the tax rate remained constant. Using the effective tax rates calculated in Table 8, by the end of 1975 some $350.3 million would have been recovered, with further amounts still to come in future years. This change in the timing of tax payments is not without cost to the government. In periods of inflation a deferment of taxes to some future period will involve a fall in the real value of those receipts.

In addition a deferment of corporation tax receipts means that alternative sources of funds are required by the government if the level of expenditures is to remain unchanged. The costs involved may be approximated by discounting the revenue losses and gains back to the year in which the policy is introduced. Table 10 shows the outcome when the money values of changes in tax receipts shown in Table 9 are deflated by the machinery and equipment price index, and discounted by a rate of 10 per cent.[1] The outcome suggests that the real cost of the policy to the government was the ability to purchase some $114.5 ($239.8-$125.3) million dollars of machinery and equipment at 1960 prices in 1963. In real terms then short term policies of accelerated capital cost allowances do involve substantial costs to the government. Furthermore this estimate of costs provides a useful means of gauging the cost effectiveness of the policy in that an equivalent cost policy would have been for the government to acquire machinery and equipment directly up to an amount of $114.5 million.

TABLE 9

CHANGES IN TAX RECEIPTS
CANADIAN OWNERSHIP, 1963
($M)

Class 19 Acquisitions	1963		1964		1965		1966		TOTAL CCA	TOTAL CCA		
	134.8		221.1		834.4		508.9					
	CCA		CCA		CCA		CCA					
	Policy On	No Policy	Policy On	No Policy	Policy On	No Policy	Policy On	No Policy	Policy On	No Policy	Differences In CCA	Differences In Tax Receipts
1963	67.4	27.0							67.4	27.0	40.4	- 17.5
1964	67.4	21.6	110.5	44.2					177.9	65.8	112.1	- 54.4
1965		17.2	110.5	35.4	417.2	166.9			527.7	219.5	308.2	-149.9
1966		13.8		28.3	417.2	133.5	254.4	101.8	671.6	277.4	394.2	-182.1
1967		11.0		22.6		106.8	254.4	81.4	254.4	221.8	32.6	- 15.8
											887.5	-419.7
1968		8.8		18.1		85.4		65.1		177.4	-177.4	87.5
1969		7.1		14.5		68.4		52.1		142.1	-142.1	70.1
1970		5.6		11.6		54.7		41.7		113.6	-113.6	56.6
1971		4.5		9.3		43.7		33.4		90.9	- 90.9	44.0
1972		3.6		7.4		35.0		26.7		72.7	- 72.7	33.7
1973		2.9		5.9		28.0		21.4		58.2	- 58.2	24.9
1974		2.3		4.7		22.4		17.1		46.5	- 46.5	18.6
1975		1.9		3.8		17.9		13.7		37.3	- 37.3	14.9
												350.3

TABLE 10

REVENUE LOSSES IN REAL, DISCOUNTED VALUES
CANADIAN OWNERSHIP, 1963

($M)

YEAR	DIFFERENCES IN TAX RECEIPTS (from Table 9)	REAL VALUE OF THE DIFFERENCES (1960 dollars)	DISCOUNTED VALUE OF THE REAL DIFFERENCES (10 per cent rate)
1963	-17.5	-15.4	-14.0
1964	-54.4	-44.8	-37.0
1965	-149.9	-116.4	-87.4
1966	-182.1	-137.4	-93.8
1967	-15.8	-12.3	-7.6
	-419.7	-326.3	-239.8
1968	87.5	68.8	38.8
1969	70.1	53.1	27.2
1970	56.6	41.4	19.3
1971	44.0	31.3	13.3
1972	33.7	23.4	9.0
1973	24.9	16.2	5.7
1974	18.6	10.3	3.3
1975	14.9	7.1	2.1
1975 value of the balance[1]	47.9	22.9	6.6
	398.2	274.5	125.3

[1] This amount is the discounted value of tax receipts beyond 1975.

6. The Timing Effect

This policy offered two separate possibilities for the operation of the timing effect. The first occurred with the initial expiry date of June 13, 1965. It was not until April 26, 1965 that it was announced that the policy would be extended to the end of 1966. Given a lag of more than a month between orders and acquisitions, firms that did not expect the policy to be extended would have adjusted the timing pattern of their acquisition of assets eligible for Class 19 designation.

The next opportunity for the timing effect was the second expiry date for the policy. In the Budget Speech of March 29, 1966 it was announced that the Canadian Ownership policy would not be extended again beyond the December expiry date. In this same Budget Speech the investment dis-incentive policy that was to apply for eighteen months from March 29, 1966 to October 1, 1967 was announced. In this situation the second timing effect would be even stronger than the first because the dis-incentive policy did not apply to Class 19 assets. Firms that would normally be acquiring Class 8 assets in the first three quarters of 1967 would be subject to the dis-incentive policy, but if they were acquired prior to the end of 1966 then, where other conditions were appropriate, they could be classed as Class 19 assets and both receive the benefits of accelerated capital cost allowances, and avoid the costs of deferred capital cost allowances under the dis-incentive policy.

The strengths of the two timing effects connected with this policy are shown in Table 9. Because of the relatively short interval between the expiry dates, there is some overlap which tends to diminish part of the second effect. Column (1) in Table 11 shows that in the second quarter of 1965, the final quarter in which the policy was initially to be in operation, there was a 10 cent per dollar advantage to be gained by eligible firms from bringing forward investment planned for future quarters. In the fourth quarter of 1966, the final quarter of the extended policy period, this advantage rises to 16 cents per dollar due to the parallel existence of the investment dis-incentive policy. As indicated by column (4) the impact of this timing effect in terms of total machinery and equipment expenditures will be reduced in the proportion to which Class 19 assets are to total machinery and equipment expenditures (29.5 per cent).

TABLE 11

POLICY TERMINATION DATE TIMING EFFECTS
CANADIAN OWNERSHIP, 1963

(per dollar of outlay on machinery and equipment)

	First Expiry	Second Expiry	Total	Weighted Total
	(1)	(2)	(3)	(4)
1964 Q3	.019		.019	.006
4	.039		.039	.012
1965 Q1	.065		.065	.019
2	.101		.101	.030
3	- .098		- .098	- .029
4	- .065		- .065	- .019
1966 Q1	- .038	.020	- .018	- .005
2	- .019	.093	.073	.022
3	- .007	.129	.122	.036
4		.169	.169	.050
1967 Q1		- .166	- .166	- .049
2		- .128	- .128	- .038
3		- .097	- .097	- .029
4		- .072	- .072	- .021
1968 Q1		- .024	- .024	- .007

b) Deferred Allowances, 1966

1. General Description

With the objective of moderating investment expenditures a policy of capital cost allowance deferment was introduced in the Budget of March 29, 1966. The policy applied to assets acquired between March 29, 1966 and October 1, 1967 in Classes 3, 6, 8, 9, 10, 11, and 16. The deferment was to apply for a three year period following the acquisition of such assets, and was to operate by applying the normal maximum rates for each of the affected classes to only a part of the undepreciated capital cost of such assets. Thus for assets in Classes 3, 6, and 8, 50 per cent of the capital costs had to be deducted from the undepreciated cost before capital cost allowances could be calculated. For the other asset classes affected, the proportion of the capital cost to be deducted from undepreciated capital cost was as follows:

Class 9	2/5
Class 10	1/3
Class 11	2/7
Class 16	1/4

The overall effect of these complicated regulations would be the same as if the capital cost allowance rates for classes 3, 6, and 8 were reduced by half, and the rates on other classes by 10 percentage points.

2. Coverage

Unlike the previous policy this policy did not apply to any specific industry, but rather affected all industries that use buildings (Classes 3 and 6) and machinery and equipment (Class 8). One exception, as noted earlier, was that assets acquired by firms eligible for Class 19 designation would escape the deferment. In addition assets acquired by firms under the Area Development Incentives Act (Classes 20 and 21) were not subject to deferment. Because of these two exceptions, and the timing of the policy, the annual investment intentions data give little indication of the volume of investment expenditures in the manufacturing sector that were subject to this policy. Because of the exceptions noted, it is still necessary to weight the rental cost of capital for the second, third and fourth quarters of 1966 by the proportion of investment not covered by the deferment policy. In this case it is assumed that 29.5 per cent of the machinery and equipment acquisitions escaped the deferment policy. With these weightings, the impact of the deferment policy on rental cost during 1966 appears to have been almost offset by the existence of the Canadian Ownership policy untouched by the deferment. Thus the full effect of the deferment policy on rental cost was probably only felt during the first three quarters of 1967.

3. Change in Rental Cost

With the capital cost allowance rate reduced by half for the first three years, the present value of capital cost allowances is determined by

$$Z_1 = \frac{.5a}{(1+r)} + \frac{.5a(1-.5a)}{(1+r)^2} + \frac{.5a(1-.5a)^2}{(1+r)^3} + \frac{a(1-.5a)^3}{(1+r)^4} + \frac{a(1-a)(1-.5a)^3}{(1+r)^5} \ldots$$

$$= \frac{a}{r+a} \quad \frac{(1-.5a)^3}{(1+r)^3} + \frac{.5a}{1+r} + \frac{.5a(1-.5a)}{(1+r)^2} + \frac{.5a(1-.5a)^2}{(1+r)^3}$$

The impact of this change in present values on rental cost is given in Table 5.

The greatest dis-incentive effect is felt by purchasers of machinery and equipment in the 50 per cent tax group. Rental cost on buildings increases somewhat less than for machinery, giving rise to the possibility that machinery and equipment would be deferred ahead of buildings, and a change in the machinery/buildings ratio would occur for the period the policy is in operation.

4. Cash Flow Effect

With the effective class allowance rate reduced by one-half in the first three years for assets in classes 3, 6 and 8, (i.e., buildings and machinery and equipment) the stream of capital cost allowances would be written .5a, $.5a(1-.5a)$, $.5a(1-.5a)^2$, $a(1-.5a)^3$, $a(1-a)(1-.5a)^3 \ldots$

TABLE 12

CHANGES IN CASH FLOW[1,2]
DEFERRED ALLOWANCES, 1966

	MACHINERY AND EQUIPMENT		BUILDINGS	
PERIOD	u =.21	u =.5	u =.21	u =.5
1	-.021	-.05	-.00375	-.0114
2	-.0147	-.035	-.00347	-.01055
3	-.00987	-.0235	-.00320	-.00937
TOTAL (1-3)	-.04557	-.1085	-.00320	-.03132
4	.00911	.0217	.00052	.00158
5	.00729	.01736	.00049	.00150
6	.00583	.01388	.00047	.00143
7	.00466	.01111	.00045	.00136

1 Per dollar of outlay on capital goods.

2 The negative sign indicates an increase in taxes payable.

This pattern of capital cost allowances produces almost an 11 cent increase in taxes per dollar of outlay in the first three years for a firm in the upper tax bracket when machinery and equipment are purchased. Repayments in this case are made in subsequent years starting with 2 cents per dollar in the first year, and declining amounts thereafter.

5. Revenue Gains

With the Canadian Ownership policy the calculation of revenue losses was based on an investment series derived from a knowledge of the actual amount of machinery and equipment expenditures that were eligible for the benefits of the policy. By contrast the Deferred Allowances policy did not introduce a separate capital cost allowance class, so the coverage of the policy in terms of the proportion of total machinery and equipment expenditures affected by the deferment is more uncertain. As a number of asset classes were subject to the deferment policy, though not all to the same extent, the best approximation is to assume that all of the machinery and equipment expenditures reported by Statistics Canada in Public and Private Investment (SC 61-206) for the manufacturing sector for the period of the policy were subject to the deferment, after the exclusion of the amount eligible for the benefits of the Canadian Ownership policy. Thus for 1966 total machinery and equipment expenditures in manufacturing are reported to be

$2,216 million. Table 7 shows that some $508.9 million of this was eligible for the Canadian Ownership policy, and in addition the policy was only in operation for three quarters of 1966. Making adjustments for the Canadian ownership amounts and the limited timing of the policy leads to an amount of $1212.8 million as subject to the deferment policy in 1966. Similarly total investment in machinery and equipment in manufacturing during 1967 amounted to $1,857 million, so for the first three quarters the amount is approximately $1,392.8 million. Table 13 shows the differences in tax receipts assuming the amounts calculated above were subject to the deferment policy, and that firms always claimed maximum capital cost allowances from these expenditures. The final column of Table 13 shows that, assuming investment did not decline as a result of the policy, some $258.3 million was received in additional revenue as a result of the policy up to the end of 1969. Because the policy involved a temporary reduction in capital cost allowances, tax receipts were reduced in subsequent years when allowances were higher than otherwise, and by the end of 1975 some $144.5 less had been collected than would have been the case in the absence of the policy.

In the converse situation to the experience with the Canadian Allowances policy, this re-arrangement of the timing of tax receipts in the government's favour confers some real benefits on the government at the expense of the

TABLE 13

CHANGES IN TAX RECEIPTS
DEFERRED ALLOWANCES, 1966

($M)

	1966		1967					
Acquisitions Subject to Deferment[1]	1,212.8		1,392.8					
	CCA		CCA		Total CCA	Total CCA		
	Policy On	No Policy	Policy On	No Policy	Policy On	No Policy	Differences In CCA	Differences In Tax Receipts
1966	121.3	242.6			121.3	242.6	-121.3	56.0
1967	109.2	194.1	139.3	278.6	248.5	472.7	-224.2	109.0
1968	98.3	155.2	125.3	222.9	223.6	378.1	-154.5	76.2
1969	155.0	124.2	112.8	178.3	267.8	302.5	- 34.7	17.1
							-534.7	258.3
1970	124.0	99.4	203.1	142.6	327.1	242.0	85.1	- 42.4
1971	99.2	79.5	162.5	114.1	261.7	193.6	68.1	- 33.0
1972	79.3	63.6	130.0	91.3	209.3	154.9	54.4	- 25.2
1973	63.5	50.9	104.0	73.0	167.5	123.9	43.6	- 18.7
1974	50.8	40.7	83.4	58.4	134.0	99.1	34.9	- 14.0
1975	40.6	32.6	66.6	46.7	107.2	79.3	27.9	- 11.2
								144.5

[1] Machinery and equipment only.

TABLE 14

REVENUE GAINS IN REAL DISCOUNTED VALUES, DEFERRED ALLOWANCES, 1966

($M)

Year	Differences In Tax Receipts (from Table 13)	Real Value Of The Differences (1960 Dollars)	Discounted Value of The Real Differences (rate 10 per cent)
1966	56.0	42.3	38.5
1967	109.0	84.8	70.1
1968	76.2	60.0	45.1
1969	17.1	13.0	8.9
	258.3	200.1	162.6
1970	- 42.4	- 31.0	19.2
1971	- 33.0	- 23.4	13.2
1972	- 25.2	- 17.5	9.0
1973	- 18.7	- 12.2	5.7
1974	- 14.0	- 7.8	3.3
1975	- 11.2	- 5.3	2.0
1975 value of the balance[1]	- 35.8	- 17.1	6.6
	180.3	114.3	59.0

[1] This amount is the discounted value of tax receipts beyond 1975.

private sector. Table 14 indicates that through this policy the government absorbed resources equivalent to just over $100 million dollars worth of expenditure on machinery and equipment at 1960 prices. This estimate of the benefit of the policy to the government may be compared with estimates, in Chapter VII, of the reduction in private investment expenditures that may have followed from the policy.

6. Timing Effect

The timing effect is the main feature of this policy although the usual effect is of course reversed. The benefit is obtained by putting back the acquisition of assets, and the cost is incurred by failing to defer acquisition. Table 15 indicates, however, that the timing effect from this policy was quite low, amounting to just over one cent per dollar of outlay.

TABLE 15

POLICY TERMINATION DATE TIMING EFFECTS
DEFERRED ALLOWANCES, 1966

(per dollar of outlay on machinery and equipment)

1967 Q2	- .001
3	- .012
4	.012
1968 Q1	.001

7. Evaluation

This policy was introduced during a period in which it was felt that some restraining influence was needed on investment expenditures. The policy was actually part of a package of policy measures involving changes in sales taxes on machinery and equipment and a refundable profits tax. Considered by itself, the disincentive policy was largely offset during 1966 by operation of the Canadian Ownership policy.

c) Increase in Cost Base, 1970

1. General Description

In the budget of December 3, 1970, the Minister of Finance, Mr. Benson, announced an investment incentive policy in the form of a 15 per cent increase in the cost base, for capital cost allowance purposes, of eligible capital assets. This policy was introduced as a response to a weakening in manufacturing investment observed earlier in the year. The Minister explicitly indicated that, in addition to encouraging new investment, he hoped that this policy would "speed up the implementation of capital outlays planned for the future". The policy was to go into effect immediately, and would apply to eligible assets acquired in the period ending March 31, 1972.

2. Coverage

This policy was limited in its application to firms where, as was the case with the Canadian Allowances policy, not less than two-thirds of the revenue comes from the sale, rental or leasing of goods processed or manufactured in Canada. The policy also applied to firms receiving two thirds of their revenue from advertisements in newspapers or magazines produced in Canada, or from construction carried on in Canada. The phrase "processed or manufactured" was not specifically defined in the

Act or Regulations, though examples of the ordinary sense meant by the phrase are given in Interpretation Bulletin IT-46 which deals with this policy. For firms which satisfied the above criteria, assets in Classes 3, 6 and 8 acquired in the prescribed period would be eligible for 15 per cent cost base increase. In this way the greater part of manufacturing investment in machinery and equipment was covered by the policy.

It is of interest to note, however, that this policy was not adopted by the Ontario government for incorporation in the provincial income tax. Unless otherwise specified, changes in capital cost allowances at the federal level are automatically introduced into the Ontario corporation tax. As an alternative the government of Ontario offered a 5 per cent tax credit on purchases of machinery and equipment to all corporations paying the Ontario corporation income tax. This policy was to operate until March 31, 1973. Unlike the federal policy, the provincial policy took a much broader view of machinery and equipment than simply Class 8 assets. In addition expenditures on buildings were excluded on the grounds of complementarity between machinery and equipment and building expenditures.

Further differences in the Ontario policy from the general nature of federal policies are first, to be eligible for the credit, machinery had to be actually used in Ontario before the expiry date of the policy. Second, corporations were not required to deduct the amount of the tax credit from undepreciated capital costs before determining capital cost allowances.

The parallel existence of this provincial incentive policy with the federal policy poses something of a problem for estimation purposes because the value of the tax credit to a firm will be different from the value of the increase in cost base policy if it had been included in the provincial income tax system.

3. Change in Rental Cost

With this policy the stream of discounted capital cost allowances is given by

$$Z_1 = \frac{a(1.15)}{(1+r)} + \frac{a(1.15)(1-a)}{(1+r)^2} + \ldots$$

$$= \frac{a}{r+a}(1.15)$$

The impact of this change in the present value of capital cost allowances on the rental cost of capital for both buildings and machinery and equipment is shown in Table 5.

4. The Cash Flow Effect

Unlike a policy of simple acceleration in the timing of capital cost allowances, this increase in the cost base results in a permanently higher level of capital cost allowances over the full period in which allowances are claimed. Tax savings will be made by firms then in every year in which allowances are claimed compared with the no-policy situation. The extent of these tax savings for different assets and tax rates is shown in Table 16. Maximum tax savings accrue to those firms in the upper tax rate which acquire machinery and equipment. In the first year the saving for such a firm would amount to $1.54 for every $100 of machinery acquired in that year, with declining amounts thereafter. Over the first seven years the tax savings would amount to some $6.11 on the initial $100 outlay. By contrast outlays on buildings by the same upper tax rate firm would generate only 38 cents in the first year, and $2.33 over a seven-year period. These calculations assume that the tax rates in operation at the beginning of the policy period are maintained indefinitely.

TABLE 16

CHANGES IN CASH FLOW[1]
INCREASE IN COST BASE, 1970

	MACHINERY AND EQUIPMENT		BUILDINGS	
PERIOD	u =.2154	.5141	.2154	.5141
1	.00646	.01542	.00161	.00385
2	.00517	.01234	.00153	.00366
3	.00413	.00987	.00146	.00348
4	.00331	.00803	.00138	.00330
5	.00265	.00632	.00131	.00314
6	.00212	.00505	.00125	.00298
7	.00169	.00404	.00119	.00284

1 Per dollar of outlay on capital goods.

5. Revenue Losses

Once again this policy did not involve the creation of a distinct asset class, so it is assumed that the total of machinery and equipment expenditures in the policy period benefitted from the policy. The policy period covered the whole of 1971, when expenditures totalled $2,121 million, and the first quarter of 1972, with one quarter of annual expenditures amounting to $529.8 million. Table 17 shows the changes in tax receipts by the government when capital cost allowances are calculated on 115 per cent of the cost of machinery and equipment instead of the actual cost to the purchaser. From the period 1971 to 1975 the total revenue loss is estimated at $115.4 million with further, though declining, losses still to occur in subsequent years. When account is taken of these further losses, and the annual amounts shown in Table 17 are deflated and discounted, then as Table 18 shows the present value of the losses in 1971 in terms of 1960 machinery and equipment prices is some $72.3 million.

TABLE 17

CHANGES IN TAX RECEIPTS
INCREASE IN COST BASE, 1970

($M)

	1971	1972
Acquisitions Eligible For Policy Benefits[1]	2,121.0	529.8

	CCA		CCA		Total CCA	Total CCA	Differences In CCA	Differences In Tax Receipts
	Policy On	No Policy	Policy On	No Policy	Policy On	No Policy		
1971	487.8	424.2		487.8	487.8	424.2	63.6	30.8
1972	390.3	339.4	121.9	106.0	512.2	445.4	66.8	31.0
1973	312.2	271.5	97.5	84.8	409.7	356.3	53.4	22.9
1974	249.8	217.2	78.0	67.8	327.8	285.0	42.8	17.1
1975	199.8	173.8	62.4	54.3	262.2	228.1	34.1	13.6
								115.4

[1] Machinery and equipment only.

TABLE 18

REVENUE LOSSES IN REAL DISCOUNTED VALUES
INCREASE IN COST BASE, 1970

$M

Year	Differences In Tax Receipts (from Table 17)	Real Value of The Differences (1960 dollars)	Discounted Value of the Real Differences (rate 10 per cent)
1971	30.8	21.9	19.9
1972	31.0	21.5	17.8
1973	22.9	14.9	11.2
1974	17.1	9.5	6.5
1975	13.6	6.5	4.0
1975 value of the balance[1]	43.6	20.8	12.9
	159.0	95.1	72.3

[1] This amount is the discounted value of tax receipts beyond 1975.

6. The Timing Effect

When this policy was introduced, it was clearly indicated that it would expire on March 31, 1972. If firms thought that no extension would be made, or alternative policies introduced, then the termination date timing effect would be operative. Table 19 below sets out the strength of the timing effect in this policy. From the table it can be seen that the policy offered a substantial timing effect in that there was a twelve cent per dollar outlay advantage in acquiring eligible assets in the first quarter of 1972 rather than in subsequent quarters.

TABLE 19

POLICY TERMINATION DATE TIMING EFFECTS
INCREASE IN COST BASE, 1970

(per dollar of outlay on machinery and equipment)

1971	Q1	.004
	2	.038
	3	.036
	4.	.076
1972	Q1	.121
	2	- .142
	3	- .085
	4	- .039
1973	1	- .016
	2	- .002

7. Evaluation

Relative to the other policies under review in this study, this policy of increasing the cost base of assets was one with substantial strength in each of the incentive effects. Evaluation of the impact of the policy is made difficult by the co-existence of the Ontario investment tax credit which was itself a relatively strong policy.

d) Accelerated Allowances and Tax Cut, 1972, 1973

1. General Description

The Budget of May 8, 1972 announced a two part investment incentive scheme for the manufacturing and processing sector. The first part consisted of permanently accelerated capital cost allowances for expenditures on machinery and equipment, with these assets being eligible for a two-year straight line write-off. The second component was a reduction in the corporate tax rate on profits from manufacturing and processing activities. From January 1, 1973 the top corporate rate on such profits was to be 40 per cent, with a 20 per cent rate for Canadian-controlled private corporations on the first $50,000 of eligible income.

Both these measures ran into considerable parliamentary opposition, and in the situation of a minority government, compromises were developed. With regard to accelerated capital cost allowances, these were to apply only to assets acquired during the period from May 9, 1972 to December 31, 1974. During this time a special study was to be made on the effectiveness of accelerated allowances in inducing increased investment. As a result of this study, and in the more convenient conditions of majority government, the Budget of November 18, 1974 announced that accelerated allowances would be extended indefinitely. The tax reduction was to be subject to review at any time after March 31, 1974 on a motion introduced into the House of Commons signed by not less than sixty members of the House. Such a motion was never introduced.

2. Coverage

The type of assets eligible to receive accelerated allowances are those used directly or indirectly in Canada, primarily in manufacturing or processing that would otherwise be in Class 8, plus oil or water storage tanks, industrial lift trucks and electrical generating equipment. These assets were placed in a new class, Class 29. Unlike the case with previous incentive policies which restricted their application only to assets which had not been used before, this policy permitted accelerated allowances on used property acquired in arm's length transactions and used in different premises. Property already in Class 29 would remain there when acquired even without these conditions. No direct definition of manufacturing and processing has been given by the revenue authorities, though Regulation

1104(9) indicates that activities not included are farming or fishing, logging, construction, and other mineral and energy activities. Interpretations by the courts with earlier incentive policies that applied only to manufacturing and processing also give some indication of the meaning of the phrase. For example, it has been held that preparing fresh vegetables on the farm for the market constitutes manufacturing and processing.

Even though a firm may have eligible Class 29 assets, there is a separate test for its income to see whether it qualifies for the reduced rate. The reduced rate only applies to Canadian manufacturing and processing profits of firms, so that firms that also engage in other activities are required to maintain a separate accounting of income from the manufacturing and processing activity. For example, fishermen who do substantial processing on board have this income treated separately from their fishing income. A formula is used to allocate income between eligible and non-eligible operations based on the shares of capital and labour costs in the eligible operations. For small corporations (less than $50,000 net active business income) the total income of the corporation is eligible if its activities are primarily manufacturing and processing, and it is not also engaged in any specifically excluded activity, (construction, farming, fishing, logging and mineral and energy activities) or earns any active foreign business income.

3. Change in Rental Cost

The introduction of two incentive policies at approximately the same time produces some interesting interaction effects. For 1972, only the accelerated allowances for machinery and equipment were in effect, and the reductions in rental cost from this policy are shown in Table 5. The tax reduction came into effect in 1973 and had the effect of reducing the rental cost on buildings as well as causing a further fall in the rental cost on machinery and equipment. These changes are shown in Table 5. It is important to note that the tax rate in 1972 includes a 7 per cent rebate on taxes due while the general tax rate for 1973 was not subject to any rebate. Item 6 in Table 5 indicates the change in rental cost if the accelerated allowances had been introduced at the same time as the tax cut, in the first quarter of 1973.

4. The Cash Flow Effect

Estimation of the cash flow effects of this policy package involves several separate considerations. In the first place the savings that result from the tax cut itself constitute one aspect of cash flow. Measurement of this effect involves examination of taxable income in the manufacturing sector, and an estimate is made on page 144.

TABLE 20

CHANGES IN CASH FLOW[1] [2]
ACCELERATED CAPITAL COST ALLOWANCES, 1972, 1973
SINGLE ASSET ACQUISITION

PERIOD	MACHINERY AND EQUIPMENT			
	1972		1973	
	u = .2325	u = .4650	u = .20	u = .40
1	.0697	.1395	.06	.12
2	.07905	.1581	.068	.136
TOTAL (1+2)	.14875	.2976	.128	.256
3	-.02976	-.05952	-.02560	-.0512
4	-.02381	-.04762	-.02048	-.04096
5	-.01905	-.03809	-.01638	-.03277
6	-.01524	-.03048	-.01311	-.02622
7	-.01219	-.02438	-.01049	-.02097

[1] Per dollar of outlay on capital goods.

[2] A negative sign indicates an increase in taxes payable.

Second, in 1972 the tax savings made through accelerated capital cost allowances for machinery and equipment were made against higher rates of taxation than in 1973 and subsequent years. Finally, the indefinite extension of the accelerated allowance program introduces consequences similar to those which growth in annual capital expenditures has for cash flow and revenue losses. Up to this point, only the effects related to the acquisition of single assets have been considered. Eisner (1952) showed long ago that when capital outlays are growing, a move to more accelerated allowances produces permanently higher tax savings. As all of the previous policies considered in this study involved only a short period in which accelerated or deferred allowances could be claimed, the growth case has not been important.

Table 20 sets out the cash flow consequences of accelerated allowances in 1972 and 1973. The amounts of tax reductions in the first two years, while substantial, are nevertheless below the savings generated by the Canadian Ownership policy of 1963. This is because the upper tax rate was set at .5. Clearly reductions in corporate tax rates reduce the impact of accelerated capital cost allowances.

Table 21 gives the pattern of tax savings when capital expenditures are growing at an annual rate. The

TABLE 21

TAX SAVINGS FROM ACCELERATED CAPITAL COST ALLOWANCES UNDER GROWTH CONDITIONS[1 2]
(u = .4, g = .05)

PERIOD	ACCELERATED ALLOWANCES			
	ONE YEAR	TWO YEARS	THREE YEARS	PERMANENT
1	.12	.12	.12	.12
2	.152 .272	.262	.262	.262
3	-.0512	.0916 .4736	.2239	.2239
4	-.0409	-.09473	.05521 .66111	.19414
5	-.03277	-.07578	-.13222	.17107
6	-.02618	-.06062	-.10578	.15341
7	-.02097	-.0485	-.08463	.14011
8	-.01678	-.03880	-.0677	.13795
9	-.01342	-.03104	-.05416	.12344
10	-.01074	-.02483	-.04332	.11887

[1] Per dollar of outlay on capital goods.

[2] A negative sign indicates an increase in taxes payable.

figures in the table are derived from the situation where outlays on machinery and equipment by a firm with .4 tax rate are growing at a rate of 5 per cent, and the normal diminishing balance system with a rate of .2 is replaced with a straight line .5 rate for one year, two years, three years and permanently. Figure 2 illustrates the paths of tax savings under these conditions. Clearly the benefits from a switch reach a peak in the second year, but with a permanent switch the resulting tax savings are positive in all periods. In these circumstances the possibility of growth influences the size of the cash flow effect depending upon the period in which the policy is in operation.

5. Revenue Losses

The 1972 accelerated capital cost allowance policy created a new class (Class 29) for eligible assets. Data on the amount of capital cost allowances claimed on Class 29 assets are only available for 1972 and 1973 (S C 61-208). For 1972 a total of $214.2 million was claimed, indicating an outlay of at least $428.4 million on eligible assets. This amount is 20 per cent of total manufacturing outlay on machinery and equipment for 1972. When account is taken of the fact that the policy was not introduced until May 8, 1972, then at least 35 per cent of machinery and equipment investment expenditure in the manufacturing sector in the latter seven months of the year were eligible for the benefits of this policy. In

TABLE 22

CHANGES IN TAX RECEIPTS
ACCELERATED ALLOWANCES AND TAX CUT, 1972, 1973

$M

Class 29 Acquisitions	1972: 428.4[1] CCA Policy On	CCA No Policy	1973: 1,525.2[1] CCA Policy On	CCA No Policy	1974: 2,051.7[1] CCA Policy On	CCA No Policy	1975: 2,216.2[1] CCA Policy On	CCA No Policy	1976: 2,362.4[1] CCA Policy On	CCA No Policy	Total CCA Policy On	Total CCA No Policy	Differences In CCA	Differences In Tax Receipts With Actual Tax Rates	With 1972 Rate
1972	214.2	85.7									214.2	85.7	128.5	59.6	59.6
1973	214.2	68.5	767.6	307.0							981.8	375.5	606.3	259.5	281.3
1974		54.8	767.6	245.6	1,025.8	410.3					1,793.4	710.7	1,082.7	433.1	502.4
1975		43.8		196.5	1,025.8	328.3	1,108.1	443.2			2,133.9	1,011.8	1,122.1	448.8	520.7
1976		35.1		157.2		262.6	1,108.1	354.6	1,181.2	472.5	2,289.3	1,282.0	1,007.3	402.9	467.4
1977		28.1		125.8		210.1		283.7	1,181.2	378.0	1,181.2	1,025.7	155.5	62.2	72.2
														1,666.1	1,903.6

1 Amounts for 1972 and 1973 are estimated from capital cost allowances claimed on Class 29 assets in those years. Estimates for other years are 57 per cent of total machinery and equipment expenditures in those years.

1973 capital cost allowances claimed on Class 29 assets amounted to $981.8 million. If $214.2 million of this amount reflects assets acquired in 1972, then the outlay on Class 29 assets in 1973 was at least $1,535.2 million, equivalent to 57 per cent of total machinery and equipment expenditures in the manufacturing sector. While the 57 per cent is probably an underestimate of actual expenditure on eligible machinery and equipment due to the fact that maximum capital cost allowances are not always claimed in the period in which assets are acquired, this figure is used to estimate expenditures on Class 29 assets in subsequent years. Table 22 shows these amounts for 1974, 1975 and 1976. Based on these amounts, estimates are calculated for the changes in tax receipts, one based on actual tax rates, including the 1973 cut, and the other based on the assumption that the 1972 rate shown in Table 8 extended into future years. A further insight into the impact of the tax cut itself may be obtained by applying the 1972 rate (46.4 per cent) to the total taxable income for the manufacturing sector in 1973 of $4,594.6 million. This results in an additional $163.1 million over the taxes actually paid in 1973. This latter estimate is tenuous because the proportion of manufacturing and processing profits eligible for the reduced rates to total manufacturing profits is unknown. Taxable income data for years subsequent to 1973 are not available.

TABLE 23

REVENUE LOSSES IN REAL DISCOUNTED VALUES

ACCELERATED ALLOWANCES AND TAX CUT 1972, 1973

($M)

Year	Differences In Tax Receipts[1] (from Table 22)	Real Value of the Differences (1960 Dollars)	Discounted Value of the Real Differences (10 per cent rate)
1972	59.6	41.4	37.6
1973	281.3	182.9	151.2
1974	502.4	279.1	209.7
1975	520.7	248.9	170.0
	1,364.0	752.3	568.5

[1] Assuming 1972 rate from Table 8 maintained in subsequent years.

It is also difficult, because of the permanent nature of this policy package, to place the revenue costs on a deflated discounted basis as was done with other policies. For a limited perspective on this subject, and bearing in mind that the empirical work in Chapter VII only deals with investment expenditures up to the end of 1975, the policy may be assumed to have terminated at the end of 1975. Table 23 shows that the cost to the government from the accelerated allowance policy, and the change in tax rate has a present value in 1972 of some $568.5 million in terms of 1960 prices for machinery and equipment. This estimate is of course an understatement because the full impact of the tax cut is not included, only the impact on tax savings through the deduction of increased capital cost allowances. An estimate of the full impact of the tax cut in the years mentioned will only be possible when data on taxable income for those years are published, and when the proportion of eligible manufacturing and processing profits to total manufacturing profits is known.

6. <u>The Timing Effect</u>

The policy of accelerated capital cost allowances offered two possibilities for the operation of the timing effect. First, firms knew that the tax rate would be reduced in 1973 compared with the 1972 rate, so they would benefit by acquiring and writing off assets against the higher 1972 tax rate. This is one example of the perverse effect that may be encouraged through prior knowledge of the timing of tax rate changes. The strength of this tax rate change induced timing effect is shown in Table 24.

The second opportunity for the timing effect was with the initial expiry date of the policy. It was not until November 18, 1974 that the Minister of Finance announced the indefinite extension of the policy due to terminate at the end of 1974. Although there appeared to be little doubt that the policy would be extended, for firms that did not think the extension would be made there was a significant timing effect. This is also shown in Table 24.

TABLE 24

POLICY TERMINATION DATE TIMING EFFECTS
ACCELERATED ALLOWANCES AND TAX CUT, 1972, 1973

(per dollar of outlay on machinery and equipment)

Change in tax rate effect	
1972 Q2	.051
3	.086
4	.140
1973 Q1	- .117
2	- .083
3	- .050
4	- .022

First Expiry	
1974 Q2	.014
3	.043
4	.088
1975 Q1	- .083
2	- .043
3	- .014

7. Evaluation

The two policies reviewed in this section constitute a major effort by the federal government to influence the level of investment in the manufacturing sector. Because of the political controversy surrounding these policies when first introduced the government was obliged to make an assessment of the impact of the policies before they could be continued indefinitely as originally proposed. The assessment took the form of a survey of firms as to their likely response to the incentive policies. On the basis of the replies estimates of the over-all impact of the policies were made and these are shown below in Table 25.

TABLE 25

SURVEY RESULTS ON THE IMPACT OF THE ACCELERATED ALLOWANCES AND TAX CUT POLICIES, 1972, 1973

(millions of current dollars)

Year	Induced Expenditures On Machinery And Equipment[1]	Total Machinery and Equipment Expenditures	Induced As Percent Of Total
1972	70	2,119	0.03
1973	300	2,683	11.2
1974	740	3,534	20.9
1975	880	3,888	22.6

[1] Final survey results

SOURCE: Corporate Tax Measures Review, Final Report, June 1975.

These estimates will form a useful basis for comparison with the results of the empirical work in Chapter VII.

e) Investment Tax Credit, 1975

1. General Description

The investment tax credit announced in the Federal Budget of June 23, 1975, formally consisted of a credit against federal taxes amounting to 5 per cent of outlays by individuals or corporations on eligible capital assets.

The maximum credit that could be claimed in any one year was limited to $15,000 and one-half of the federal tax payable in excess of $15,000. Any unused credit could be carried forward five years, though with the same annual limitations. Buildings under construction in eligible industries on June 23, 1975, were allowed the benefit of the tax credit on costs incurred after that date.

Because no explicit exemption from Section 13(7)(e) of the Income Tax Act accompanied the announcement of the policy, the amount of assistance received under this policy must be deducted from undepreciated capital costs before the determination of capital cost allowances.

2. Coverage

Eligible assets were defined as new buildings and machinery and equipment acquired for use in Canada between June 24, 1975 and July 1, 1977, and used in manufacturing and processing, mineral and petroleum exploration and development, logging, farming and fishing. Excluded from the benefits of the tax credit were capital outlays in the construction industry, utilities, trade, finance, commercial services, institutions, government departments and housing.

At the time the policy was announced, no indication was given as to whether, for taxpayers already receiving other forms of federal government assistance, the tax credit would be calculated with reference to the gross capital outlays of the taxpayers or only the net outlays after the deduction of government assistance. It was subsequently decided that the credit would apply to gross capital outlays even if this did involve giving a tax credit to firms on the government's contribution to capital formation through, for example, RDIA grants.

3. Reduction in Rental Cost

Because the tax credit applies to a wide variety of assets, and the amount of the tax credit is required to be deducted from capital costs before determining capital cost allowances, the investment tax credit is one of the most neutral investment incentive policies applied by the government. As shown earlier in the previous chapter, under the condition of deductibility, the percentage reduction in rental cost is five per cent, regardless of the tax rate, or the type of asset. This assumes, of course, that the amount of the tax credit is less than $15,000. Inability to use the full amount of the tax credit in the year it becomes available, of course, diminishes the value of the tax credit. On the opposite side of the coin, firms in receipt of other forms of government assistance receive an effective tax credit somewhat in excess of 5 per cent, depending on the size of the other government assistance.

4. The Cash Flow Effect

With a tax credit, most of the cash flow effect is concentrated in the period in which the tax credit is received. Where the tax credit is required to be deducted from capital costs before the determination of capital cost allowance the value of the tax credit is reduced through an increase in subsequent tax payments. As Table 26 shows, the net value of the tax credit under this condition is reduced to an effective value of three per cent for a firm with a .4 tax rate purchasing machinery and equipment in the manufacturing sector. Conversely the tax credit has a higher effective value for firms purchasing buildings. In present value terms the effective tax credit may be calculated using the formula:

$$\text{Effective Tax Credit} = \text{Nominal Tax Credit} - \frac{\text{P.V. of increased taxes}}{\text{asset value}}$$

$$= \text{Nominal Tax Credit} - uz\ \text{Nominal Tax Credit}$$

TABLE 26

CHANGES IN CASH FLOW[1,2]
INVESTMENT TAX CREDIT, 1975

	MACHINERY AND EQUIPMENT		BUILDINGS	
PERIOD	u =.20	u =.40	u =.20	u =.40
1	.045	.04	.0495	.049
2	-.005	-.01	-.00047	-.00095
TOTAL	.04	.03		
3			-.00045	-.00090
4			-.00043	-.00086
5			-.00041	-.00082

1 Per dollar of outlay on capital goods.

2 A negative sign indicates an increase in taxes payable.

For a pre-tax rate of discount of 10 per cent, the present value of a nominal 5 per cent tax credit under a variety of tax rates and assets is given below

	MACHINERY AND EQUIPMENT		BUILDINGS	
	u=.20	u=.40	u=.20	u=.40
Present Value of Tax Credit	.041	.032	.046	.041

Paradoxically perhaps, while the investment tax credit has the potential neutral effect on asset choice in terms of changes in rental cost, with the cash flow effect there is a wide variation in the treatment accorded different assets.

5. Revenue Losses

The investment tax credit is the first Canadian investment incentive policy whose coverage is not defined in terms of capital cost allowance classes, but rather in terms of broad industry groups. For this reason the revenue losses from this policy, at least for machinery and equipment in the manufacturing sector, may be more accurately estimated from the annual survey of investment data. The revenue losses involved in this policy are a product of the initial loss from the tax credit itself, and the revenue gains from the requirement that the amount of the credit be deducted from capital costs before the calculation of capital cost allowances. Table 27 sets out estimates of revenue losses

TABLE 27

CHANGES IN TAX RECEIPTS[1]
INVESTMENT TAX CREDIT, 1975

$M

	Machinery and Equipment Expenditures	Initial Change In Tax Receipts	1975 CCA Policy On	1975 CCA No Policy	1976 CCA Policy On	1976 CCA No Policy	Differences In CCA	Differences in Tax Receipts From Changes In CCA Only	From Initial Change and CCA
1975	1,944.1	- 97.2	923.5	972.1			- 48.6	+19.4	- 77.8
1976	4,144.6	-207.2	923.5	972.1	1,968.7	2,072.3	-152.2	+60.9	-146.3
1977	--				1,968.7	2,072.3	-103.6	+41.4	+ 41.4
									-182.7

[1] Assuming that all the machinery and equipment expenditures are eligible for two year straight line write-off, and that the tax rate is .4.

based on annual investment intentions for 1975 and 1976. In making these estimates the following assumptions have been made: (a) that the maximum credit limit of $15,000 is not reached by any firm; (b) that all of the machinery and equipment expenditures are eligible for the two-year straight line write-off under the 1972 policy; and (c) the tax rate is the special rate for manufacturing and processing profits. In the discussion on the 1972 accelerated allowances policy it was indicated that in 1973 at least 57 per cent of machinery and equipment expenditures in manufacturing was eligible for the two year write-off. Thus the use of assumption (b) above would tend to make the estimates in Table 27 underestimates of the real impact in in the years shown. This is because with a 20 per cent diminishing balance rate the recovery of some part of the tax credit through reduced capital cost allowances would not be as great as with the two-year write-off.

Estimates of the real discounted value of the revenue losses from this policy will only be possible when 1977 investment data and the relevant machinery and equipment price indexes are available.

6. <u>The Timing Effect</u>

As usual with policies whose expiry date has been announced, as long as the policy is not extended, there will be an incentive during the first half of 1977 to acquire eligible assets that would otherwise be acquired in the second half of 1977. The strength of the timing effect associated with this policy has not been calculated because the expiry date is beyond the data coverage.

7. Evaluation

Because only two quarters of the period in which the tax credit has been in force are included in the data, it will be impossible to simulate for the full effect of the tax credit in the estimated equations in Chapter VII.

V.3 SOME CONCLUSIONS ON CANADIAN POLICIES

The five policies described in the previous section show that the government has tried practically all of the variations possible with the tax structure to design investment incentive policies. The benefits derived from this diversity of policy designs over the use of a single flexible instrument, such as an investment tax credit, are unclear, and certainly not evident in any policy statements. In fact, the reverse probably holds in that the implications of each new policy will take time for firms to assess, whereas variations in a consistent policy may lead to a faster response on the part of firms. Furthermore, changes in effective capital cost allowance rates either through the creation of new asset classes or changes in the rates on existing classes add to the complexity of the income tax system.

The preference generally given to machinery and equipment expenditures in incentive policies needs some explanation. Machinery and equipment expenditures amount to around 70 per cent of capital expenditures in the manufacturing sector, so the great bulk of expenditures is assisted. Furthermore to the extent that buildings and machinery and equipment are complementary, incentives given to machinery and equipment expenditures will also have an expansionary impact on building construction. To the extent that they are substitutes then, if the policies are effective, we should expect to find a lot of new machinery and equipment housed in old structures. The employment generating effects of incentives to machinery and equipment are probably less than if incentives were only given to buildings because a large proportion of machinery and equipment purchases are on imports.

One of the paradoxes of Canadian incentive policies is that while on the one hand incentives are offered, there seems to be an attempt to minimize the revenue losses from the policy. This is suggested by the short-term nature of the policies, the existence of a limit on the amount of the tax credit that may be claimed in one year, the restriction of capital cost allowance deductions on leased property to leasing income and the requirement that amounts received in the form of tax credits or grants be deducted from capital costs before the calculation of capital cost allowances. While this latter provision may ensure that the rental cost of capital changes uniformly for all classes of taxpayer regardless of the assets they acquire, this neutrality consideration is neglected in policies of accelerated capital cost allowances.

The strongest policy in terms of the change in rental cost was the 1972 combined package of accelerated allowances and tax reductions. Closely behind though was the 1970 increase in cost base policy. This latter policy though created no controversy, unlike the 1972 policies, perhaps because the implications of a 15 per cent increase in the cost base on which capital cost allowances are calculated were not readily apparent to the critics of government policy.

Finally, it is observed that small businesses subject to the lower tax rate derived reduced benefits from investment incentive policies relative to the upper rate taxpayers. This is one situation where tax policies based on different objectives tend to offset one another.

FOOTNOTES TO CHAPTER V

1. The choice of a 10 per cent discount rate was guided by the fact that the federal Treasury Board uses rates of 5, 10 and 15 per cent to discount federal revenues and expenditures in benefit-cost studies undertaken in the Board.

CHAPTER VI

INVESTMENT INCENTIVES AND THE SPECIFICATION OF INVESTMENT FUNCTIONS

VI.1 INTRODUCTION

The purpose of this Chapter is to discuss the specification of investment functions that explicitly include the effects arising out of investment incentive policies. Section VI.2 gives special consideration to the Jorgenson neo-classical model, and discusses the approach taken by Gaudet, May and McFetridge. Serious theoretical objections are brought against the Jorgenson model, and the Gaudet, May and McFetridge analysis is shown to have neglected the timing aspect of Canadian policies. **These factors indicate that an** alternative model is necessary for the evaluation of Canadian investment incentive policies. A model developed by Coen is taken as the best alternative, and this model is described in Section VI.3. Both the Jorgenson and Coen models are, however, incapable of dealing with the short-term nature of Canadian investment incentive policies. The Coen model though is capable of being adapted in a way in which this feature of Canadian policies may be incorporated into the investment function. Section VI.4 sets out these modifications to the model. The Coen model in both its original and modified forms is then tested empirically in Chapter VII.

VI.2 THE JORGENSON SPECIFICATIONS

Jorgenson assumes that net investment in any period is a function of the differences between desired stocks of capital between periods so that

$$I^n_t = \sum_{i=o}^{n} B_i (K^*_{t-i} - K^*_{t-1-i}) \tag{1}$$

If K* is given by equation (4) in Chapter II.2 as

$$K^* = \frac{\alpha p Q}{c} \tag{2}$$

substituting this value in the above equation gives rise to the function estimated by Hall and Jorgenson in their 1967 paper.

$$I^n_t = \alpha\gamma_o \Delta \frac{p_t Q_t}{c_t} + \alpha\gamma_1 \Delta \frac{p_{t-1} Q_{t-1}}{c_{t-1}} - \omega I^n_{t-1} + \varepsilon_t \tag{3}$$

For their 1971 paper Hall and Jorgenson gave greater attention to the lag structure in (1) through the introduction of rational distributed lag functions. The specification of lags in the adjustment process combined with a static determination of the desired stock of capital as in (2) (where output is assumed to be fully adjusted to changes in the desired stock of capital) has been the source of considerable controversy. In addition, the specification of the desired capital stock has itself been highly contentious. Complete discussions of these points may be found in papers by Eisner and Nadiri (1968), Eisner (1969), Coen (1969), Gould (1969), Thurow (1969), Nerlove (1972), Brechling (1975) and Klein (1974). In summary, the major points made against the Jorgenson specification are as follows:

1. When the desired capital stock is specified as

$$K^* = \frac{\alpha pQ}{c} \tag{4}$$

this is contrary to the fact that, in a profit-maximizing model, Q cannot be considered as an exogenous variable. Output and the desired capital stock are themselves jointly determined by exogenous variables such as factor and output prices. As shown in equation (26) in Chapter III, output does not appear in a reduced form of the demand for capital function by a profit-maximizing firm.

2. By utilizing a composite variable, $\frac{p}{c}Q$, in regression equations, Jorgenson does not make an independent test of the influence of relative prices on the demand for capital. Empirical work by Eisner and Nadiri (1968) and Thurow (1969) indicates that the effect of joining the rental cost with the output term in effect gives the rental cost term significance that it would not have if left to stand by itself. Thurow, for example, held the rental cost term at its median value and found that this led to an improvement in the fit of the Jorgenson investment function. He concluded that the cost of capital variable in the Jorgenson framework is receiving a free ride.

3. One of the problems of using a Cobb-Douglas production function is that such a function implies an elasticity of

substitution between capital and labour of unity. An elasticity of this size, combined with a putty-putty concept of capital, would give a strong justification for the use of investment incentive policies. In the literature there is no agreement on the actual size of the elasticity of substitution, and both Jorgenson (1971) and Eisner (1974) quote studies that support their respective positions on this issue. Nonetheless, the important point is that if an investment function is specified in such a way that the assumption of unitary elasticity is already in the model, this casts some doubts on any empirical results. As Eisner (1974) points out, the more appropriate procedure may be to leave unspecified the relationships in the production function so that they may be inferred from the empirical results rather than imposed through the model.

4. As mentioned, there appears to be an inconsistency involved in specifying a desired capital stock in equilibrium terms, and then imposing lag structures which imply a lack of equilibrium. This inconsistency arises out of the adaptation of the Jorgenson model for empirical analysis. In the theoretical model, Jorgenson assumes that entrepreneurs are myopic in their outlook and, assuming perfect capital markets, that they will adjust their capital stocks immediately to changes in the determinants of the capital stock. The attachment of lag structures to this theoretical model is, as Nerlove points out, necessary if what he calls an econometri-

cally relevant theory is to be established. The specification of these lag structures though is generally devoid of any theoretical or institutional justification. Nerlove's criticism of Jorgenson for his ad-hoc introduction of lag structures may, of course, be applied to most investment studies to date. While delivery delays and adjustment costs are often cited as justification for lag structures, no additional information on the expected form of these lags is supplied, and they are left to be inferred from the data.

Given the above criticisms of the Jorgenson model, it would certainly appear to be difficult to justify using the original Jorgenson model in the evaluation of the impact of investment incentives. This was recognized by Gaudet, May and McFetridge (1975) in their study of investment incentives in Canada. Thus, while the model used is described as neo-classical, several departures are made from the model usually associated with Jorgenson. For example, (a) the production function is assumed to be of the CES variety so that no implicit assumptions are in the model as to factor and price substitution, (b) output is explicitly assumed to be exogenous, and not determined simultaneously with the desired capital stock as in the Jorgenson theory. In fact, through the production function, output is assumed by Gaudet, May and McFetridge to determine the desired capital stock. This latter specification sits uncomfortably with an earlier assumption in the model that firms act so as to maximize net worth. As pointed out in Chapter III, if firms are profit maximizers, then changes in the cost of capital will influence output. Gaudet, May and McFetridge nevertheless assume that the cost of capital and the level of output are independent.

The use of a CES production function, as shown earlier by Eisner and Nadiri (1968), enables the cost of capital and output to enter as separate variables in a regression equation when the terms are in logarithms. Assuming that the capital stock is a function of current and past values of rental cost and output, then the equation estimated is

$$\ln K_t = b_o + b_1 \ln\left(\frac{p}{c}\right)_t + b_2 \ln Q_t + b_3 \ln K_{t-1} + b_4 \ln K_{t-2} + \varepsilon_t \qquad (5)$$

The coefficient on the relative prices term b_1 was found to be significant when the equation was estimated with annual data on both machinery and equipment and buildings. The first year of the lag distribution on rental cost is dropped by Gaudet, May and McFetridge in the case of machinery and equipment, implying that current year values of the rental cost term have no impact on investment in that period. Not only is there no theoretical justification for this procedure, especially when the current year influence is maintained by the authors in the case of buildings, but this effectively prohibits certain investment incentive policies from ever influencing investment expenditures when the time constrained impact of these policies is recognized. For example, the 1970 increase in cost base policy was in force only during all of 1971 and the first quarter of 1972. By dropping the current value of the relative price (1971) so that it does not influence investment in that year, then any impact from the policy should appear negligible. Because of the continuous distributed lags in their model, the influence of the 1971 rental cost values is carried forward into future years, a procedure which, as shown in Chapter II, obscures the impact of limited period incentive policies. This point will be developed further in Chapter VII.

The simulation results reported by McFetridge and May (1976) and mentioned in Chapter I are derived from a similar model to the one used by Gaudet, May and McFetridge, but with the following differences: (a) the production function is assumed to be Cobb-Douglas, and (b) cost-minimization behaviour for the firm is assumed. This latter change means that the impact of incentive policies is embodied in the relative factor price term $\frac{w}{c}$, and not in the real rental cost $\frac{p}{c}$ as before.

The Brechling test (the reasonableness of the parameters in the estimated Cobb-Douglas function) may be applied to the McFetridge and May results. For a production function of the form

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

then from their results $\hat{\alpha} = .5061$, and $\hat{\beta} = .3805$.[1] If the parameters of a Cobb-Douglas production function reflect factor shares, these results would appear to fail the test.[2]

To conclude this section, on both theoretical grounds and policy design constraints, the neo-classical model does not provide a satisfactory framework within which the impact of Canadian investment incentive policies may be evaluated.

VI.3 COEN AND THE SPEED OF ADJUSTMENT

An alternative model for the analysis of investment incentives has been developed by Coen (1968, 1971). Some of the features that make the Coen model an attractive starting point for the evaluation of Canadian incentives include:

1) The investment equations are transformed in such a way as to avoid the need for capital stock data in any empirical estimation. Estimates of quarterly capital stocks in manufacturing are, of course, unavailable;

2) No particular assumption is made about the production function, except that it exhibits the usual neo-classical substitution properties, with the elasticity of substitution unspecified. This type of specification avoids the problem mentioned in Chapter III with regard to the use of the Cobb-Douglas production function and the elasticity of substitution implied by such a function;

3) The behavioural assumption for the firm in the Coen model is cost minimization rather than profit maximization. This provides a theoretical justification for the inclusion of output as a determinant of the desired capital stock.

4) In the Coen model relative prices and output are entered as separate determinants of the desired capital stock. In this way tests can be made for the influence of relative prices alone on the demand for capital;

(5) Speed of adjustment factors are introduced explicitly into the model, and it is through this mechanism that it is possible to test for the influence of a number of the incentive effects of policies. Models such as Jorgenson's focus only on the substitution effect.

The theoretical foundations of this model are based upon the work of Eisner and his permanent income approach to the demand for capital as set out for example in Eisner (1967). The basic element in Eisner's approach is that "transitory" changes in demand cannot be expected to influence current investment. Instead there should be a much more substantial relationship between capital expenditures and the change in demand over a considerable number of previous periods. Coen applies the same logic to relative factor prices. Thus in addition to long-term changes in demand entering the determination of the desired capital stock, the "permanent" changes in relative factor prices are included as a determinant of the desired capital stock. These "permanent" values are approximated by a lag distribution over current and past values of relative factor prices. The "transitory" elements excluded in this process are believed not to influence the desired capital stock. In the Canadian context, however, the impact of an incentive policy on relative prices may be registered as a transitory element because of its short term nature. By using a lag distribution of past values of relative prices, the discrete nature of the impact of policies on relative prices will be smoothed over. Recalling the discussion in Chapter III on the likely reaction of any substitution effect to short-term changes in relative prices, this would seem to be an appropriate procedure. On the other hand, the fact that policies are introduced and terminated means that a "permanent" component for relative prices is difficult to generate. This follows because when an incentive policy terminates at the end of period t, then the influence of relative prices on investment in periods t, t+1 and t+2 cannot be considered to be determined by relative prices in periods t, t-1, t-2, etc. The influence of reductions in the price of capital through an incentive on the demand for capital will cease when the policy terminates. To carry this influence over into future periods through a lagged distribution procedure will lead, as shown in the work of McFetridge and May, to a misstatement on the timing impact of incentive policies.

One way in which it could be hypothesised that factor prices resulting from short-term incentive policies do enter "permanent" values would be if entrepreneurs were aware of the recurring nature of these policies, and fully expected them at frequent intervals in future periods. Nevertheless, it should be recognized that the use of a lag distribution of actual values of relative prices to represent the "permanent" influence of factor prices on investment in any period tends to both diminish in size and extend in time the influence of short-term changes in relative prices brought about through an incentive policy. This point will be discussed further, from an empirical perspective, in the next chapter.

As mentioned in the Coen model, the determinants of the desired capital stock are derived from a mixture of the acceleration and neo-classical factor price theories of capital. The acceleration variable chosen is the level of new orders rather than output because of the nature of the model and the lag between orders and sales. In an annual model the orders-sales lag may not be significant, but in a quarterly model, the current state of demand, Coen feels, is best indicated by current new orders. The relative price variable is derived from the first order condition for cost minimization which requires that the ratio of factor prices be equal to the marginal rate of substitution between factors.

Thus, in general form

$$K^* = \phi(O, \frac{c}{w}) \tag{7}$$

where

O = new orders

$\frac{c}{w}$ = ratio of factor prices

Assuming that the function is linear, and that the desired capital stock in any period is determined by the permanent components of the values of new orders and factor prices in the same period, then

$$K^*_t = d_o + \sum_{i=o}^{n-1} \gamma_{t-i}\left[d_1 O_{t-i} + d_2 \left(\frac{c}{w}\right)_{t-i}\right] \tag{8}$$

where it is assumed that the permanent components of the current variables can be approximated by a weighted average of past and present values of the variables, with the γ's being the weights in the lag distribution.

Once the desired capital stock is specified, Coen makes use of the capital stock adjustment specification for gross investment so that where only net investment is subject to an adjustment lag then

$$I_t = b(K^*_t - K_{t-1}) + \delta K_{t-1} \tag{9}$$

Alternatively, if both net and replacement investment are subject to the same adjustment lag then

$$I_t = b\left[K^*_t - (1-\delta)K_{t-1}\right] \tag{10}$$

where b is interpreted as a constant speed of adjustment coefficient. The actual capital stock term in (9) and (10) may be eliminated through the use of the identity

$$K_t = \sum_{i=o}^{\infty} (1-\delta)^i I_{t-i} \tag{11}$$

In this way equation (9) becomes

$$I_t = b\left[K^*_t - (1-\delta)K^*_{t-1}\right] + (1-b)I_{t-1} \tag{12}$$

and (10)

$$I_t = b\left[K^*_t - (1-\delta)K^*_{t-1}\right] + (1-b)(1-\delta)I_{t-1} \tag{13}$$

The difference between (9) and (10) is in the parameter on the lagged dependent variable.

When the value for K* shown in (8) is substituted in (12) then

$$I_t = b\delta d_o + bd_1 M(s) O_t + bd_2 M(s) (\frac{c}{w})_t + (1-b) I_{t-1} \tag{14}$$

where

$$M(s) O_t = \sum_{i=o}^{n-1} \gamma_i \left[O_{t-i} - (1-\delta) O_{t-1-i} \right] \tag{15}$$

and

$$M(s) (\frac{c}{w})_t = \sum_{i=o}^{n-1} \gamma_i \left[(\frac{c}{w})_{t-i} - (1-\delta) (\frac{c}{w})_{t-1-i} \right] \tag{16}$$

Equation (14) makes no specific assumption about the factors determining the speed of adjustment. Coen inserts the lagged cash flow variable F_{t-1} by way of the adjustment coefficient b so that

$$b = \left[b_o + b_1 \left(\frac{F_{t-1} - \delta K_{t-1}}{K^*_t - K_{t-1}} \right) \right] \tag{17}$$

where the speed of adjustment is determined by the availability of funds for net investment relative to the desired expansion. Alternatively, the speed of adjustment may be determined by the availability of funds relative to gross investment so that

$$b = \left[b_o + b_1 \left(\frac{F_{t-1}}{K^*_t - (1-\delta) K_{t-1}} \right) \right] \tag{18}$$

Substituting these values for b in equations (9) and (10), eliminating K_{t-1}, and inserting the values for K* gives rise to

$$I_t = b_o\delta d_o + b_o d_1 M(s) O_t + b_o d_2 M(s) (\frac{c}{w})_t + (1-b_1\delta-b_o) I_{t-1} + b_1 \left[F_{t-1} - (1-\delta)F_{t-2}\right] \quad (19)$$

$$I_t = b_o\delta d_o + b_o d_1 M(s) O_t + b_o d_2 M(s) (\frac{c}{w})_t + (1-b_o)(1-\delta) I_{t-1} + b_1 \left[F_{t-1} - (1-\delta)F_{t-2}\right] \quad (20)$$

Equations (14), (19) and (20) are then estimated with quarterly data and various lag distributions for the M(s). The best lag distributions were selected by Coen on the basis of the expected signs of the variables and the R^2 value. Using this model Coen found, contrary to the results of Hall and Jorgenson, that investment incentive policies in the United States did not have a substantial impact on investment, and that the revenue cost of these policies was several times the amount of induced investment. Furthermore cash flow was found to have a significant impact on the speed of adjustment to changes in the desired capital.

The fixed speed version of the Coen model, however, is not able to cope with the short-period nature of Canadian policies. This is because relative prices enter the model in the form of distributed lags. The use of the variable adjustment speed mechanism in the Coen model is one way in which this timing aspect of Canadian policies may be introduced into the investment function, and the possibilities for this are discussed in the next section.

VI.4 CANADIAN POLICIES IN THE INVESTMENT FUNCTION

It was suggested in Chapter III that two effects in Canadian investment incentive policies, the general timing effect, and the termination date timing effect, may influence the speed of adjustment. Thus corresponding to the treatment of cash flow in the Coen model, these variables may be included in the speed of adjustment coefficient. If P_t is the general timing effect, and

$$P_t = (\frac{c}{w})_t(\text{policy off}) - (\frac{c}{w})_t(\text{policy on})$$

then the adjustment coefficient may be formulated as

$$b = b_o+b_1P_t \qquad (21)$$

indicating that the larger is the difference between the policy off and policy on values of the rental cost the faster will be the speed of adjustment by firms to changes in the desired capital stock.

Similarly if R_t is the termination date timing effect then the adjustment coefficient is

$$b = b_o+b_1R_t \qquad (22)$$

where the closer t is to the termination date of an incentive policy the larger will be the speed of adjustment.

It makes no sense to express P_t and R_t as fractions of the desired investment in the way cash flow is treated in the Coen model because they cannot be related to the investment chore. Furthermore, the case for entering cash flow as a ratio of the difference between the desired and lagged actual capital stocks is not as strong as Coen might claim. His use of this specification rests on the argument that the size of the adjustment coefficient should be influenced by the amount of cash flow in one period relative to the investment chore. The basic theory itself, however, specifies that the investment chore, as defined by $K^*_t - K_{t-1}$, takes place over several periods depending upon adjustment speeds. To relate this multi-period adjustment to cash flow in one period would seem to be too constraining. The alternative specifications would be to enter cash flow as an absolute term, or as a weighted distributed lag. A further objection to inclusion of cash flow in ratio form is the fact that when re-arranged slightly, equations (19) and (20) in Section VI.3 have the form

$$I_t = b_o(K^*_t - K_{t-1}) + b_1(F_{t-1} - \delta K_{t-1}) + \delta K_{t-1} \qquad (23)$$

and

$$I_t = b_o\left[K^*_t - (1-\delta)K_{t-1}\right] + b_1 F_{t-1} \qquad (24)$$

In equilibrium where $K^*_t = K_{t-1}$, equations (23) and (24) would imply a level of actual investment that may be higher or lower than the level of desired replacement investment (δK_{t-1}) depending upon the level of cash flow. This would seem to be incompatible with the notion of an equilibrium state.

The inclusion of P_t, R_t or cash flow (in absolute terms) leads to a more complex investment function than in, for example, (19). With P_t as an example, substituting equation (1) above into equation (6) in the previous section gives

$$I_t = \left[b_o+b_1P_t\right]\left[K^*_t-(1-\delta)K^*_{t-1}\right]+\left[1-b_o-b_1P_t\right]I_{t-1} \qquad (25)$$

Inserting the values for K^*_t given in equation (8) of V1.3

$$I_t = b_o\delta d_o+b_od_1M(s)O_t+b_od_2M(s)(\tfrac{c}{w})_t+(1-b_o)I_{t-1}$$
$$+b_1\delta d_oP_t+b_1d_1P_tM(s)O_t+b_1d_2P_tM(s)(\tfrac{c}{w})_t$$
$$-b_1P_tI_{t-1} \qquad (26)$$

With equation (26) the parameters of the structural equations are over-identified in that there are two estimates for d_o, d_1 and d_2. Even if K^*_t is defined in the less restrictive form

$$K^*_t = d_o + \sum_{i=o}^{n-1}\gamma_i^{\,1}\,0_{t-i} + \sum_{i=o}^{n-1}\gamma_i^{\,2}\,(\tfrac{c}{w})_{t-i} \qquad (27)$$

the two estimates for d_o remain. In addition the fact that P_t is multiplicative with a distributed lag structure creates a serious estimation problem. It would seem then that the Coen model is able to include specific adjustment factors only where they enter the adjustment term in ratio form with $K^*_t - (1-\delta)K^*_{t-1}$ as the denominator.

An alternative method of introducing these incentive policy adjustment effects explicitly into the investment function without the above problems is to include them directly in the lag distribution.

With K_t^* defined as in (27) above, equation 14 may be written as

$$I_t = b\delta d_o + b\sum_{i=o}^{n-1} \gamma_i^1 [0_{t-i} - (1-\delta)0_{t-1-i}] + b\sum_{i=o}^{n-1} \gamma_i^2 [(\frac{c}{w})_{t-i} - (1-\delta)(\frac{c}{w})_{t-1-i}] + (1-b)I_{t-1} \tag{28}$$

It is possible to define γ_i so that

$$\gamma_i = \psi_i + \phi_i P_{t-i} \qquad i=0,1,\ldots,S \tag{29}$$

Then (28) may be written

$$I_t = b\delta d_o + bM(s)\,0_{t-i} + bM(s)(\frac{c}{w})_{t-i} + (1-b)I_{t-1} + bM(s)P_{t-i}\,0_{t-i} + bM(s)\,P_{t-i}(\frac{c}{w})_{t-i} \tag{30}$$

where

$$M(s)0_{t-i} = \sum_{i=o}^{n-1} \psi_i^1 [0_{t-i} - (1-\delta)0_{t-1-i}]$$

$$M(s)(\frac{c}{w})_{t-i} = \sum_{i=o}^{n-1} \psi_i^2 [(\frac{c}{w})_{t-i} - (1-\delta)(\frac{c}{w})_{t-1-i}]$$

$$M(s)P_{t-i}0_{t-i} = \sum_{i=o}^{n-1} \phi_i^1 P_{t-i}[0_{t-i} - (1-\delta)0_{t-1-i}]$$

$$M(s)P_{t-i}(\frac{c}{w})_{t-i} = \sum_{i=o}^{n-1} \phi_i^2 P_{t-i}[(\frac{c}{w})_{t-i} - (1-\delta)(\frac{c}{w})_{t-1-i}]$$

so that the parameters of (30) are exactly identified.

The first four terms of equation (30) are similar to those in equation (14) while the latter two reflect the impact of an incentive policy on the lag structure associated with the determinants of the desired capital stock. Thus equation (30) may be interpreted as saying that investment in any period is determined by distributed lag values of relative factor prices and new orders plus the dependent variable lagged one period. In addition, where $P_t \neq 0$, so that an incentive policy is in operation, then the speed at which investment expenditures respond to changes in relative factor prices and new orders will be different from the speed when no policy is in operation, and the difference will be determined by the size of P_t.

To be consistent with the above interpretation, the $\frac{C}{W}$ variable that enters with a distributed lag should be defined as a set of factor prices that does not reflect in any way the impact of investment incentive policies.

If R_t was in place of P_t in equation (30), the interpretation would be slightly different. In this case the investment incentive policy is made to influence investment expenditures that would otherwise have taken place immediately subsequent to the termination of the policy. Finally, if cash flow is entered into equation (30) the impact of the policy is made to extend long beyond the policy expiry date because the cash benefits, as shown in Chapter V, continue for several periods beyond the one in which acquisition occurs.

Equation 30 then contains two adjustment coefficients. The fixed speed coefficient captures the general adjustment factors involved in the investment process, while the P_t, R_t or F_t terms reflect more specifically the impact of incentive policies.

To summarize, the equations subjected to empirical testing are as follows:

1. The fixed speed of adjustment function (equation 14) where incentive policies enter through the relative price term as a determinant of the desired capital stock;

2. The variable speed of adjustment function (equations (19) and (20)) where incentives enter through both the cash flow term in the adjustment speed, and the relative prices term as a determinant of the desired capital stock;

3. The variable lag function (equation (30)) where incentives influence only the lag structures on the determinants of the desired capital stock. Three separate effects that arise out of incentive policies - the general timing effect, the termination date timing effect, and the cash flow effect - are tested for their influence on lag structures in this function.

FOOTNOTES TO CHAPTER VI

1. In McFetridge and May (1976) the $\hat{\alpha}$ and $\hat{\beta}$ results are printed in the wrong order.

2. This so-called Brechling test is taken from Chapter II of Brechling (1975) where the estimates of the size and sign of the coefficients of the production function are used as a test on the accuracy of the Jorgenson specification of the desired capital stock.

CHAPTER VII

EMPIRICAL ESTIMATES OF THE IMPACT OF INVESTMENT INCENTIVES

VII.1 INTRODUCTION

In this chapter the investment functions developed in the previous chapter are tested empirically, and, where possible, simulations are performed to derive estimates of the quantitative impact of investment incentive policies. A description of the data used in making these empirical estimates is given in Appendix C. Because there are no official estimates of quarterly manufacturing sector investment in machinery and equipment, it was necessary to develop estimates based on imports of machinery and equipment. The procedure used is set out in Appendix C. Two investment series are estimated in this way, one for the manufacturing sector as a whole, and another for the textiles industry.

Section VII.2 reports on those equations where incentive policies are made to influence the desired capital stock. The results are consistent with the McFetridge and May results, indicating an influence for incentive policies far beyond the expiry of the policy -- an outcome which, as discussed earlier, is inappropriate. Section VII.3 describes the results when incentive policies are made to influence the speed of adjustment rather than the desired capital stock.

VII.2 INVESTMENT INCENTIVES IN THE DESIRED CAPITAL STOCK

From Chapter VI, the basic fixed speed of adjustment investment function from the Coen model (equation (14)) is given as

$$I_t = b\delta d_o + bd_1 M(S) O_t + bd_2 M(S) (\frac{c}{w})_t + (1-b) I_{t-1} \quad (1)$$

There are, of course, a number of different ways in which the terms in the lag distribution M(s) may be estimated. In his own work Coen uses rectangular, inverted-V, and arithmatic distributions. Other researchers have used the Pascal and rational lag distributions, and one popular method is the polynomial interpolation process developed by Almon (1965). In the absence of any a priori knowledge on the actual shape of the lag distribution it was decided to use the Almon system.

Use of the Almon procedure precludes the separate identification of the structural parameters b, d_1 and d_2 from the distributed lag weights M(S). Hence, the test is made simply on the overall statistical significance of the Almon terms. In this situation the basic function (equation (1) above) becomes

$$I_t = b\delta d_o + \tilde{M}(S) O_t + \tilde{M}(S) (\frac{c}{w})_t + (1-b) I_{t-1} \quad (2)$$

The Almon lag procedure provides the researcher with a number of options as to the degree of the polynomial, the starting and ending points for the lag distribution, and the constraints which may be imposed on the shape of the polynomial. Again, in the absence of any a priori knowledge as to how appropriate these options may be, only the simplest procedures were used. Thus a second degree polynomial was selected, and the one constraint imposed was that the final value in the lag distribution should be zero. In every case the lag distribution was assumed to start in the current period and regressions were run on equation (2) with a number of lengths for the lag distribution. In the first instance the lags on relative prices and orders were set at equal lengths. It was clear that the fit of the equation in terms of significance of the coefficients could be improved by allowing different lengths of lags for relative prices and orders. Although a number of possibilities around these levels were just as good, the specification chosen for simulation for total manufacturing involved a thirteen period lag on relative prices and a sixteen period lag on orders. With a second degree polynomial the regression involved two variables A_1 and A_2, the Almon variables on orders, and B_1 and B_2, the two Almon variables on relative prices. Thus for estimation purposes equation (2) may be written as

$$I_t = b\delta d_o + a_1A_1 + a_2A_2 + a_3B_1 + a_4B_2 + (1-b)I_{t-1} \tag{3}$$

The results from ordinary least squares (OLS) estimation on total manufacturing data, seasonally adjusted and at 1960 prices, are given in Table 28 with t scores in brackets. Details of data used may be found in appendix B.

With the textiles industry data the specification chosen involved a nine period lag on the relative prices term and a sixteen period lag on orders. The results, again with OLS estimation, are also given in Table 28. The interpolated

TABLE 28

ESTIMATES OF EQUATION (3), TOTAL MANUFACTURING AND TEXTILES INDUSTRIES

	Total Manufacturing	Textiles
	$M(16)O_t, M(13)(\frac{c}{w})_t$	$M(16)O_t, M(9)(\frac{c}{w})_t$
$b\delta d_o$	31659.96 (1.29)	69730.94 (2.88)
a_1	0.34 (2.26)	627.46 (2.56)
a_2	-0.27 (2.27)	-483.62 (2.73)
a_3	-76.98 (2.21)	-94.70 (3.59)
a_4	58.27 (2.09)	70.04 (3.20)
(1-b)	0.53 (3.70)	0.31 (2.46)
$\bar{R}^2$	0.85	0.69
SEE	9385.7	13136.0
h	14.15	2.99

Sample period: Q_1 1960 - Q_4 1975. Because of the use of lags there are only 48 observations on the dependent variable.

lag coefficients on the prices and orders terms for both the total manufacturing and textiles data are given in Table 29[1].

With both the total manufacturing and textiles data the lag distributions on both relative prices and orders have several terms at the beginning that are of the wrong sign and insignificant. Subsequently, however, the parameters become strongly significant in a unimodal distribution with peaks on the relative prices terms at t-7 for total manufacturing and t-5 for textiles. For the orders term the peak occurs in both cases at t-9. These distributions are in accordance with the basic theory which maintains that current values of the determinants of the capital stock do not influence investment decisions. Instead it is the permanent values of the determinants, and these permanent values may be approximated by a lag distribution.

In deriving the rental cost series for use in estimating equation (2), the interest rate used is the McLeod Young and Weir series based on 10 industrial bond yields, and calculated on an after tax basis. In using this rate the assumption is that purchases of machinery and equipment made in response to an investment incentive policy are financed by an issue of debt whose interest payments are tax deductible. If, however, equity financing was used the interest rate term should be higher to reflect the non-deductibility of dividends. Furthermore, if some combination of the two financing methods is used, a weighted

TABLE 29

LAG COEFFICIENTS ON THE
FIXED SPEED OF ADJUSTMENT FUNCTION

(t scores in brackets)

(a) Total Manufacturing

	Relative Prices $(\frac{c}{w})$		Orders (o)	
t	1.03	(0.83)	-0.55	(1.10)
t-1	0.09	(0.10)	-0.24	(0.59)
t-2	-0.70	(0.93)	0.23	(0.06)
t-3	-1.34	(1.74)	0.25	(0.74)
t-4	-1.85	(2.10)	0.45	(1.27)
t-5	-2.21	(2.22)	0.61	(1.63)
t-6	-2.44	(2.26)	0.73	(1.85)
t-7	-2.51	(2.26)	0.82	(1.99)
t-8	-2.45	(2.25)	0.87	(2.08)
t-9	-2.25	(2.25)	0.89	(2.14)
t-10	-1.90	(2.24)	0.87	(2.17)
t-11	-1.41	(2.23)	0.81	(2.00)
t-12	-0.77	(2.22)	0.72	(2.22)
t-13	0.00		0.60	(2.23)
t-14			0.43	(2.24)
t-15			0.23	(2.25)
t-16			0.00	

(b) Textiles

	Relative Prices $(\frac{c}{w})$		Orders (o)	
t	0.95	(0.68)	-8.94	(0.99)
t-1	-1.16	(1.22)	-3.53	(0.44)
t-2	-2.70	(3.36)	1.23	(0.16)
t-3	-3.79	(3.99)	5.34	(0.73)
t-4	-4.38	(3.97)	8.81	(1.20)
t-5	-4.50	(3.87)	11.63	(1.55)
t-6	-4.10	(3.77)	13.81	(1.82)
t-7	-3.23	(3.70)	15.34	(2.01)
t-8	-1.86	(3.64)	16.22	(2.15)
t-9	0.00		16.46	(2.26)
t-10			16.04	(2.34)
t-11			14.99	(2.40)
t-12			13.28	(2.44)
t-13			10.93	(2.48)
t-14			7.93	(2.51)
t-15			4.29	(2.54)
t-16			0.00	

average rate may be appropriate. Other studies have used a variety of measures of the interest rate. In Hall and Jorgenson (1967) an after tax rate is used based on the assumption of a constant 20 per cent pre-tax rate of return. Coen (1968) used Moody's measure of the yield on industrial bonds on a before-tax basis. To test for the sensitivity of the results shown in Table 28 to a different interest rate,equation (3) was re-estimated with the rental cost series calculated with the before tax McLeod Young and Weir series. With the total manufacturing data this led to reduced levels of significance on the Almon variables associated with the orders and prices terms. By contrast the significance on these terms was heightened with the textiles data, but the coefficient of the lagged dependent variable became statistically insignificant. Clearly the results are sensitive to the interest rate specification, but in the absence of any special knowledge on the actual rate of interest, it was decided to continue using the after tax bond rate.

Estimating an equation with a lagged dependent variable using OLS involves some problems. In the absence of auto-correlation the estimate of the coefficient on the lagged dependent variable will be a biased estimate. With auto-correlation in the residuals in conjunction with a lagged dependent variable, then OLS estimates will be both biased and inconsistent. Furthermore, with a lagged dependent variable in the equation the Durbin-Watson test for the presence of auto-correlation is biased. In these circumstances the test devised by Durbin (1970) is more appropriate,[2] and the h values from the test are reported with the equations. Because the values exceed the critical point in the Students t distribution, the hypothesis of zero auto-correlation must be rejected at the 5 per cent level. This gives no indication of the extent of the problem caused by the existence of auto-correlation.

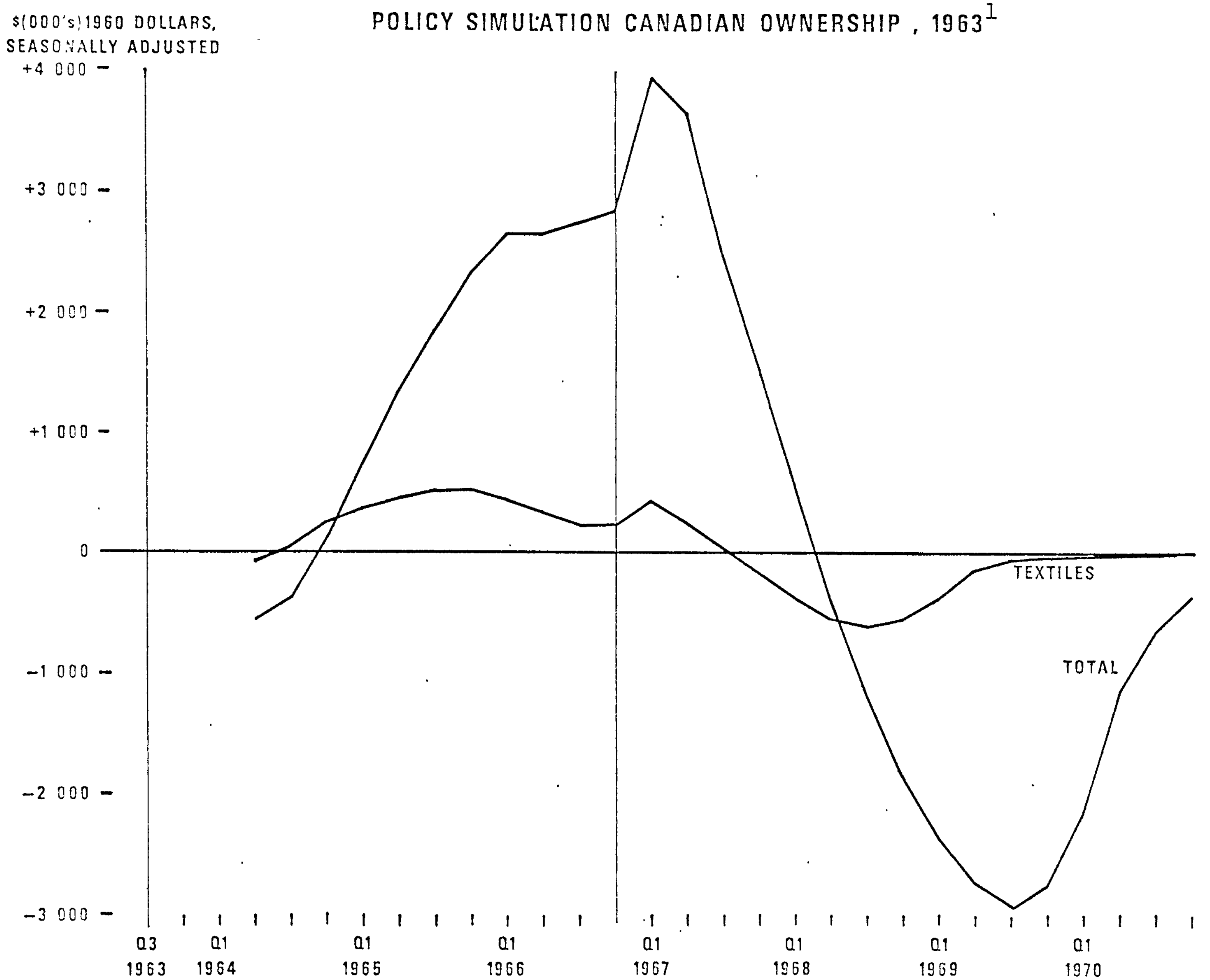
Since all econometric studies of investment are forced to omit variables such as "business confidence", indications of auto-correlation will tend to occur, even though the "true" residuals may be uncorrelated. Under these circumstances the OLS estimates would appear to be reasonable.

In any case, there is a serious problem with the specification of equation (2) with respect to the design of Canadian policies. The lag distribution on the relative prices term will carry forward the influence of an incentive policy far beyond the expiry date of the policy. Similarly, the increase in rental cost that occurs on expiry of the policy will cause an apparent decrease in investment over the

the increase in rental cost that occurs on expiry of the policy will cause an apparent decrease in investment over the subsequent periods in which this effect is felt in the lag distribution. These outcomes are illustrated in Figures 4,5, 6,7 and 8 where the policies under review are simulated using the parameters shown in Table 28. Each of the policies was simulated by substituting in the relative prices series the values that would have been in force if that particular policy had not been introduced. This was done sequentially for each policy so that when one policy is removed from the series all the other policies remain in force. The exception is in Figure 8 where the relative price series in the simulation is based on the assumption that no policies are in operation. With the 1963, 1966 and 1970 policies the inverse response to a change in relative factor prices is shown to begin in the policy period (delineated by the heavy vertical line), reach a peak soon after the expiry of the policy and then decline as the impact of the change in factor prices loses its influence in the lag distribution. Subsequently the post-policy reversal in the factor price values induces an opposite effect on investment that also reaches a peak and then declines as this effect loses its influence. With the 1972 policies shown in Figure 7, this impact reversal effect does not occur because although the policies were initially introduced for a limited period (shown by the dotted line) they were subsequently extended indefinitely. Thus

FIGURE 4

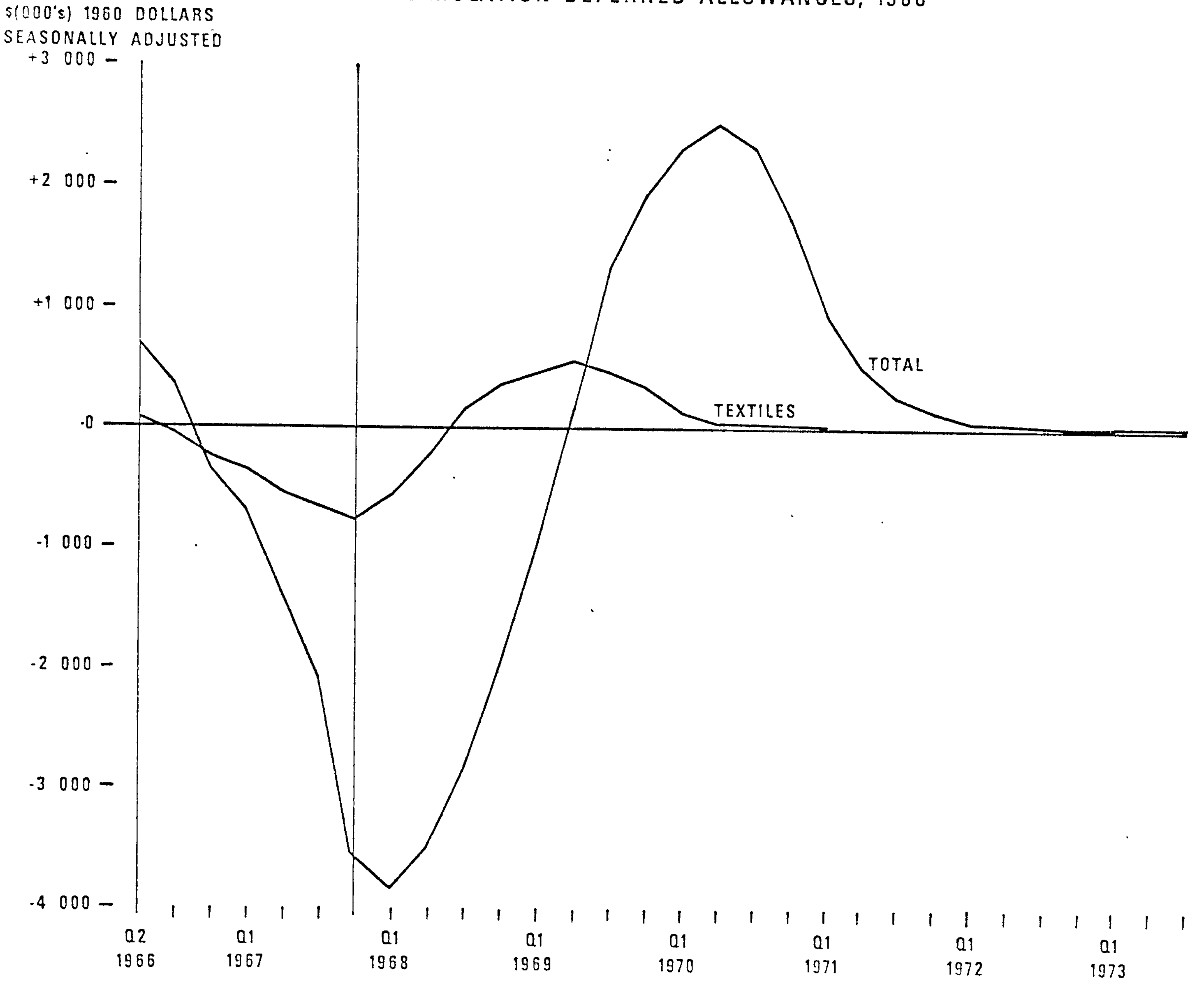
POLICY SIMULATION CANADIAN OWNERSHIP, 1963[1]



[1] Calculated investment policy on less calculated investment policy off.

FIGURE 5

POLICY SIMULATION DEFERRED ALLOWANCES, 1966[1]



[1] Calculated investment policy on less calculated investment policy off.

FIGURE 6

POLICY SIMULATION

INCREASE IN COST BASE, 1970[1]

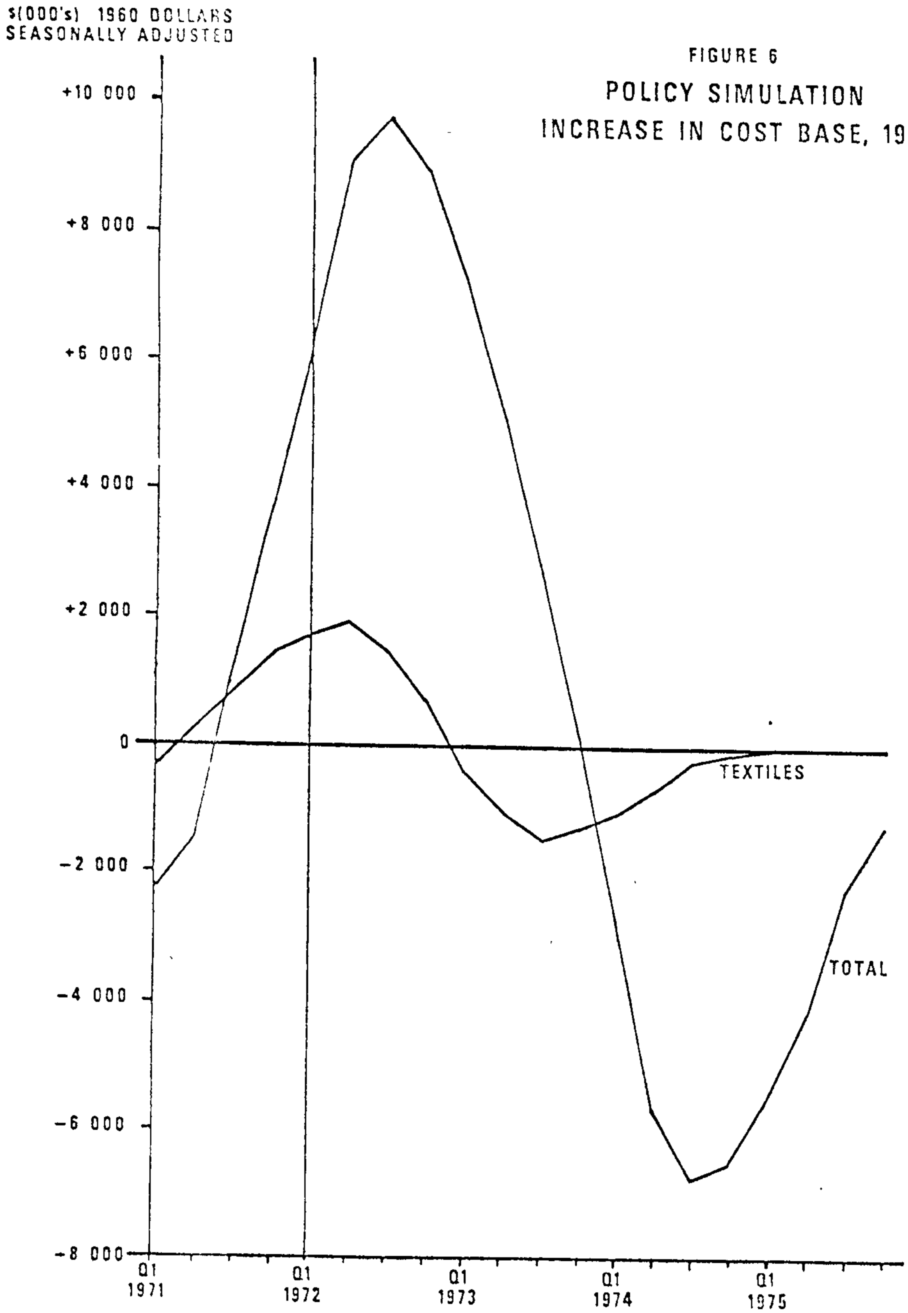
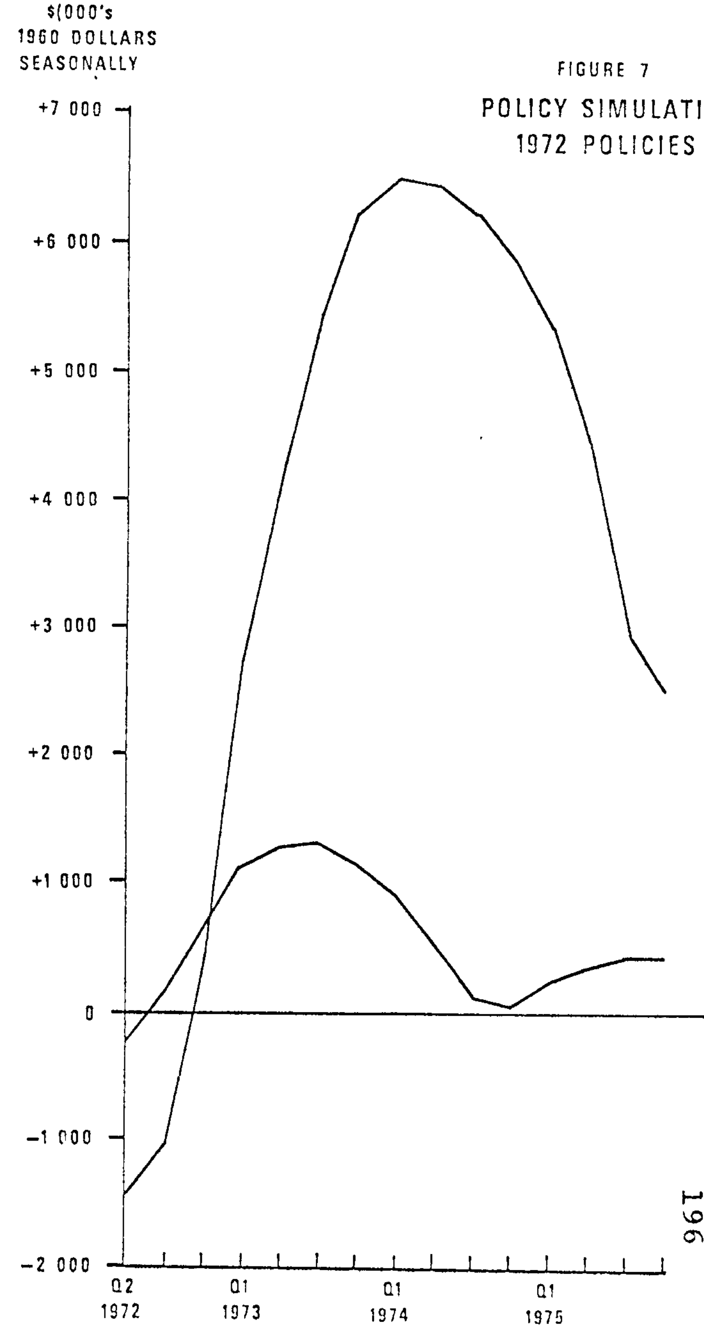


FIGURE 7

POLICY SIMULATION

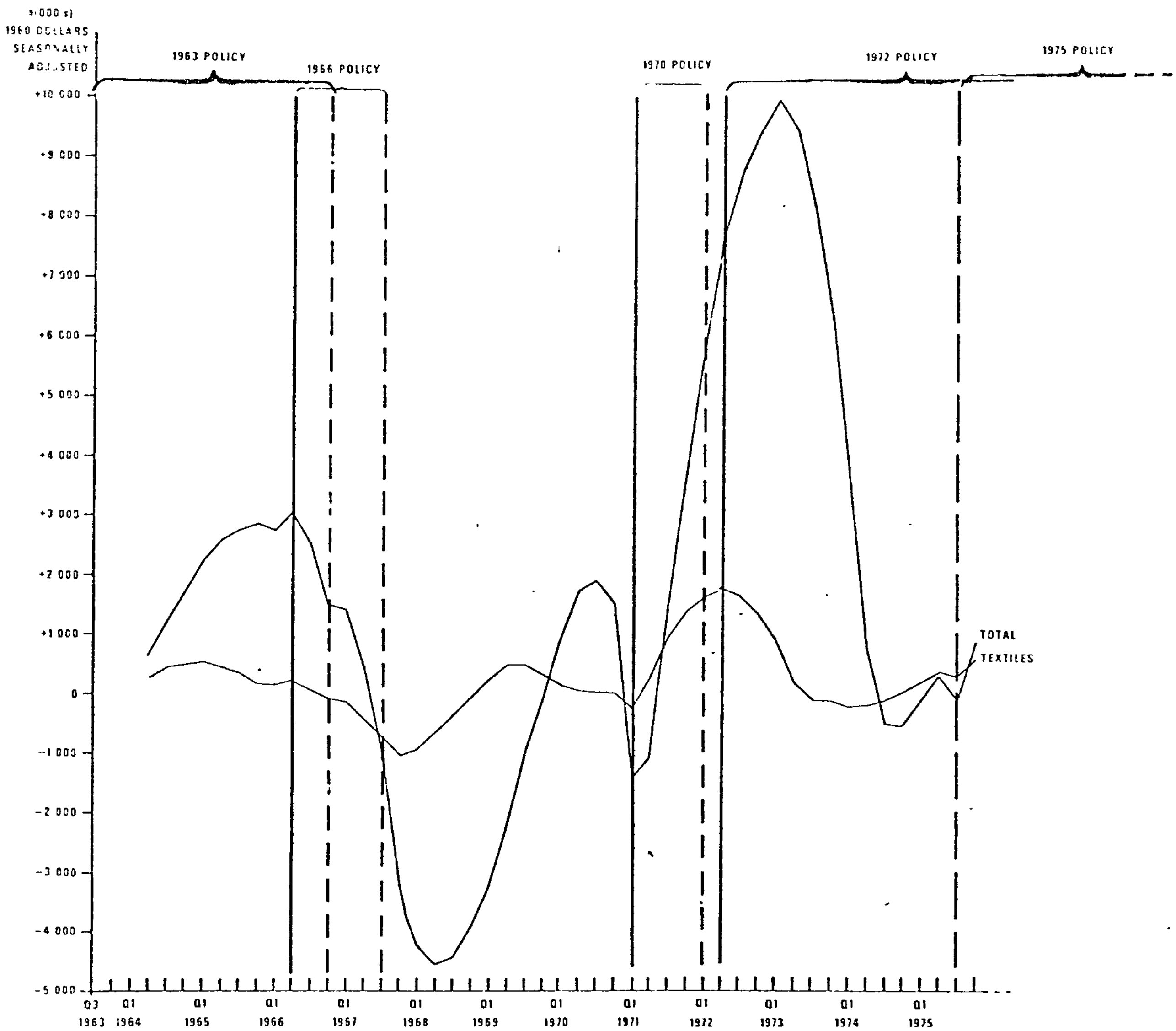
1972 POLICIES[1]



[1] Calculated investment policy on less calculated investment policy off.

FIGURE 8

POLICY SIMULATION ALL POLICIES[1]



[1] Calculated investment policy on less calculated investment policy off.

because the policy is not constrained to operate within a particular period, the impact shown in Figure 7 is a more accurate reflection of the outcome of the policy than is the case with the three earlier policies.

Even though the simulation results discussed above may be inappropriate in terms of the timing of investment expenditures, they do give an indication of the magnitude of the response of investment expenditures to changes in factor prices. With the Canadian Ownership policy the peak impact in the first quarter of 1967 involves an increase of 4 per cent in total imports of machinery and equipment from the level in the absence of policy. Assuming that the policy would have a similar impact on total purchases of machinery and equipment in every period in which the policy was in operation this would lead, on the basis of the investment figures shown in Table 7, to an overall increase in machinery and equipment expenditures of some $175.4 million at 1960 prices. This may be compared with the estimated revenue cost of the policy of $114.5. On the basis of the simulation results the 4 per cent assumption for every period is clearly generous, but it does draw the upper limit on the amount of induced investment. Table 30 sets out the results when this peak increase approach is applied to the simulation results for all the policies under review with the exception of the 1975 tax credit policy. The relatively poor showing

TABLE 30

ESTIMATES OF THE MAXIMUM IMPACT OF INVESTMENT INCENTIVE POLICIES

Policy	Peak Increase (per cent)	Maximum Induced Investment[1] ($M)	Tax Revenue Change[1] ($M)
Canadian Ownership, 1963	4	175.4	-114.5
Deferred Allowances, 1966	-3.6	-74.7	103.6
Increase in Case Base, 1970	8.4	145.3	72.3
Accelerated Allowances and Tax Cut, 1972	4.5	313.3[2]	568.5[2]

[1]At 1960 prices for machinery and equipment.

[2]Based on total machinery and equipment expenditures to the end of 1975.

for the 1972 policies in relation to their revenue cost is heightened when account is taken of the fact that the revenue losses from this policy are based on the assumption that Class 29 assets comprise only 57 per cent of total machinery and equipment expenditures in the manufacturing sector, and they do not include the losses associated with applying a reduced tax rate to taxable income after the deduction of capital cost allowances.

VII.3 INCENTIVE POLICIES IN THE SPEED OF ADJUSTMENT

(a) The Cash Flow Effect

The variable speed of adjustment functions in the Coen model (equations (19) and (20) in Chapter VI) effectively amount to the addition of a first difference cash flow variable to equation (1) above, together with a different interpretation of the coefficient on the lagged dependent variable. To test for the influence of cash flow in this framework (with incentive policies also impacting on the relative price term) the following equation was estimated.

$$I_t = b_o \delta d_o + a_1 A_1 + a_2 A_2 + a_3 B_1 + a_4 B_2 + (1-b_1\delta - b_o) I_{t-1} + b_1 \left[F_{t-1} - (1-\delta) F_{t-2}\right] \quad (4$$

Although regressions were carried out on equation (4) with a number of different lengths of lag on the orders and relative price terms, the coefficient of the cash flow variable was consistently insignificant, and wrongly signed with the total manufacturing data. Table 31 reports the results from regressions carried out on functions with the same lag structures as the functions reported in Table 29. A comparison with the results in Table 29 shows that the addition of the cash flow variable leads to a reduction in the significance on the orders terms for both manufacturing and textiles. In addition, the extra variable did not contribute to any improvement in the $\bar{R}^2$ value. These factors would appear to indicate multicollinearity between the orders and cash flow terms. In his original work Coen found evidence of multicollinearity between the cash flow variable and the relative

TABLE 31

ESTIMATES OF EQUATION (4), CASH FLOW IN THE ADJUSTMENT SPEED, MANUFACTURING AND TEXTILES INDUSTRIES

(Policy on values in the relative prices terms)

	Total Manufacturing	Textiles
	$M(16)O_t, M(13)(\frac{c}{w})_t$	$M(16)O_t, M(9)(\frac{c}{w})_t$
$b_o \delta d_o$	31862.20 (2.53)	91727.79 (4.78)
a_1	0.12 (1.13)	304.06 (1.78)
a_2	-0.08 (0.87)	-314.23 (1.99)
a_3	-67.84 (2.66)	-104.33 (3.92)
a_4	59.79 (2.68)	79.41 (3.58)
$1-b_1\delta-b_o$	0.65 (4.98)	0.35 (2.71)
b_1	-0.04 (1.25)	0.74 (1.52)
$\bar{R}^2$	0.85	0.67
SEE	9531.50	13475.6
h	5.90	4.08

Sample period: Q_1 1960 - Q_4 1975. Because of the use of lags there are only 48 observations on the dependent variable.

prices, but it was not sufficient to prohibit simulation with the estimated functions. With the equations reported in Table 31, however, it is not possible to simulate for cash flow effects. The more promising approach to the assessment of the role of cash flow is in testing for its direct impact on lag structures.

Equation (30) in Chapter VI is an example of the investment function when any of the adjustment factors F_{t-1}, P_t or R_t is entered as a determinant of the lag structure on the orders and relative prices terms. With the Almon procedure, and second degree polynomials the basic equation is

$$I_t = b\delta d_o + a_1A_1 + a_2A_2 + a_3B_1 + a_4B_2 + (1-b)I_{t-1} + a_6C_1 + a_7C_2 + a_8D_1 + a_9D_2 \quad (5)$$

Testing first for the role of cash flow, then in equation (5)

C_1, C_2 = Almon variables on $F_{t-1-i}\ 0_{t-i}$

D_1, D_2 = Almon variables on $F_{t-1-i}(\frac{c}{w})_{t-i}$

Regressions on equation (5) with even lags on the orders and prices terms produced good fits with the total manufacturing data, but not the textiles data. Table 32 reports the estimates with twelve period lags on both orders and prices. The coefficients are highly significant in all cases except the lagged dependent variable and the interactive $F_{t-1-i}\ 0_{t-i}$ terms. Variations in the lag structures between the relative price and orders terms did

TABLE 32

ESTIMATES OF EQUATION (5), CASH FLOW IN THE LAG STRUCTURE TOTAL MANUFACTURING, WITH POLICY OFF AND POLICY ON VALUES IN THE RELATIVE PRICES TERMS

$M(12)0_t$, $M(12)(\frac{c}{w})_t$

	Policy off values	Policy on values
$b\hat{\delta}d_o$	65450.36 (2.62)	64648.97 (2.44)
a_1	0.99 (2.35)	0.94 (1.97)
a_2	-0.87 (2.48)	-0.82 (2.11)
a_3	-491.26 (3.79)	-459.66 (3.82)
a_4	347.08 (3.60)	310.76 (3.89)
(1-b)	0.15 (0.59)	0.11 (0.70)
a_6	-0.0000010 (1.78)	-0.0000009 (1.51)
a_7	0.0000009 (1.98)	0.0000009 (1.70)
a_8	0.0007 (3.70)	0.0007 (3.43)
a_9	-0.005 (3.77)	-0.005 (3.58)
$\bar{R}^2$	.90	.90
SEE	7683.63	7718.19
h	N.A.	2.40

Sample period: Q_1 1960 - Q_4 1975. Because of the use of lags there are only 48 observations on the dependent variable.

not increase the significance on these terms. While not perfect the results were sufficiently good to allow simulation for the impact of incentive policies on cash flow.

Also reported in Table 32 are the results from regression on (5) with the policy on values in the relative price term for total manufacturing. The inclusion of the policy on values makes little difference to the overall fit of the equation and does not change noticeably either the coefficients on the relative price terms, or their significance.

To simulate the cash flow effect of incentive policies in aggregate requires information on the contribution of incentive policies to the profit variable used in the regressions. One element in this profit variable is the amount recorded by firms as deferred taxation. This refers to the difference between the taxes the firms would have paid if tax payments were based on income after deduction of depreciation deductions as determined by firms for their own accounts and taxes actually paid on income after the deduction of capital cost allowances determined by the rates in Part XI of the _Income Tax Regulations_. The deferred taxation amounts arise out of two sources, (a) the difference between the rates of depreciation used by firms and the rates of capital cost allowances normally allowed by Revenue Canada, and (b) the difference between the normal Revenue Canada allowance rates and the particular rates allowed under incentive policies. In a recent survey[3] the Department of Finance found that from a sample of firms approximately 20 per cent of accumulated deferred taxes were due to the existence of special allowance rates resulting from investment incentive policies. This information provided a clue to the magnitude of the impact of incentive of policies on cash flow. In the simulation on equation (5) the cash flow variable was reduced by 20 per cent, and Figure (9) shows the change in investment expenditures if the actual impact of incentive policies was close to the amount estimated for the simulation. This method of simulation though does not allow any precise assessment of the impact of individual policies because, as shown in Chapter V, the change in cash flow as a result of incentive policies extends over several periods subsequent to the one in which the outlay is made.

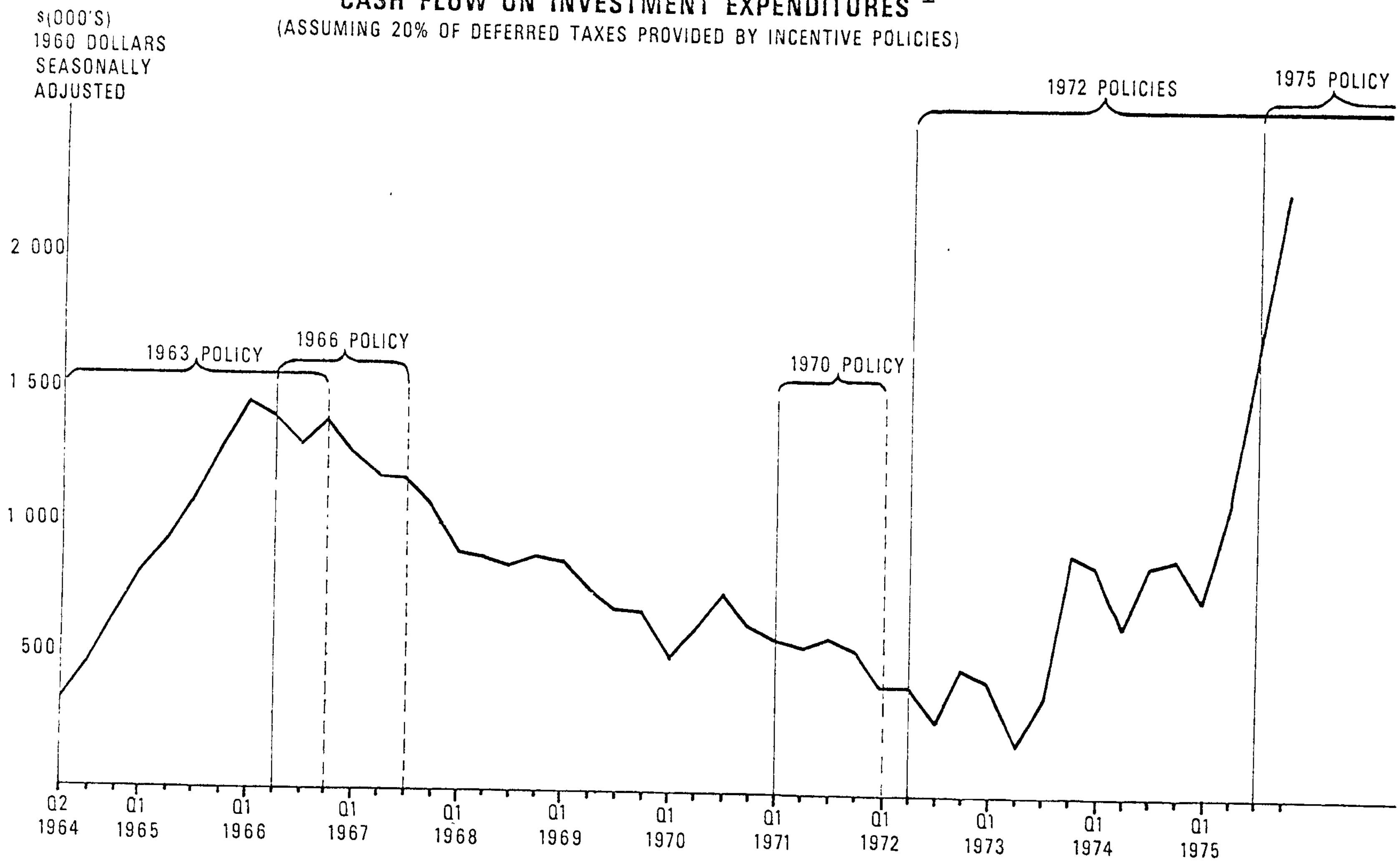
Nevertheless, Figure 9 indicates that the cash flow effect associated with incentive policies appears to have influenced investment expenditures. The scale on which this influence occurs is more open to question. If the impact of investment incentive policies on cash flow was limited to increasing the amount of deferred taxes by 20 per cent, then Figure 9 shows that investment expenditures have been around one per cent higher as a result. If a greater proportion of deferred taxes were actually the consequence of incentive policies, then the increase in investment would be correspondingly higher.

In Chapter III it was suggested that the role for

FIGURE 9

IMPACT OF INCENTIVE INDUCED CHANGES IN CASH FLOW ON INVESTMENT EXPENDITURES [1]

(ASSUMING 20% OF DEFERRED TAXES PROVIDED BY INCENTIVE POLICIES)



[1] Calculated investment policy on less calculated investment policy off.

cash flow in the investment process is in influencing the speed of adjustment by firms to changes in the desired capital stock and not influencing the desired capital stock itself. The results in Figure 9 suggest an overall higher level of investment in the aggregate, but this is not inconsistent with changes in the timing of expenditures in individual firms.

(b) The General Timing Effect

The strength of the general timing effect associated with each policy is shown in Figure 10. For the 1972 policies the differences between policy off and policy on values disappear at the end of 1974, following the announcement in the November 1974 Budget Speech that the policies would be continued indefinitely. To test for this effect the values shown in Figure 10 are used in equation (5) where

C_1, C_2 = Almon variables on $P_{t-i}\ O_{t-i}$

D_1, D_2 = Almon variables on $P_{t-i}\ (\frac{C}{W})_{t-i}$

Ordinary Least Squares regressions on equation (5) with even lags on the orders and prices terms produced good fits with the total manufacturing data, but not the textiles data. Table 33 shows that with a fourteen period lag on the total manufacturing data all of the coefficients appear highly significant. Because of the size of (1-b), the h statistic, with 47 observations, is impossible to calculate[4].

TABLE 33

ESTIMATES OF EQUATION (5), GENERAL TIMING EFFECT IN THE LAG STRUCTURE, TOTAL MANUFACTURING AND TEXTILES

(Policy off values in the relative prices terms)

	Total Manufacturing $M(14)O_t, M(14)(\frac{c}{w})_t$	Textiles $M(11)O_t, M(11)(\frac{c}{w})_t$
$b\delta d_o$	80061.90 (2.61)	108225.40 (3.70)
a_1	0.47 (2.63)	656.53 (1.89)
a_2	-0.36 (2.71)	-600.78 (2.31)
a_3	-273.20 (4.19)	-110.97 (2.99)
a_4	192.41 (3.70)	84.20 (2.50)
(1-b)	0.30 (2.01)	0.03 (0.19)
a_6	-0.0002 (2.87)	-0.15 (1.12)
a_7	0.0002 (2.87)	0.19 (1.67)
a_8	0.20 (3.59)	0.02 (0.70)
a_9	-0.15 (3.22)	-0.01 (0.42)
$\bar{R}^2$	.88	.72
SEE	8576.53	12494.73

Sample period: Q_1 1960 - Q_4 1975. Because of the use of lags there are only 48 observations on the dependent variable.

No indication can be given therefore of the extent of autocorrelation in the estimation. Also shown in Table 33 is the best fit obtainable with the textiles data. The t scores on the interactive terms $P_{t-i}\ 0_{t-i}$ and $P_{t-i}(\frac{c}{w})_{t-i}$ are too low to permit simulations with the textiles data.

To simulate for this effect P_t is assumed to be zero, implying an absence of incentive policies. Changes in calculated values for total imports of machinery and equipment are shown in Figures 11, 12, 13 and 14. For the Canadian Ownership policy (Figure 11) the pattern of investment changes induced by the policy is similar to that shown in Figure 4 (where incentive policies enter the rental cost term directly) but the scale of the impact is considerably larger. At the peak level 40.4 per cent of machinery and equipment imports are shown to be due to the influence of the policy. Although the proportion of Class 19 acquisitions to total machinery and equipment expenditures reached 47.3 per cent in 1965 (Table 7), it would seem very unlikely that such a proportion was the result of the policy.

A similar outcome is observed in Figure 12 with the Deferred Allowances policy. The pattern of changes in imports is very similar to that shown in Figure 5, but the scale is approximately double that in Figure 5.

Simulation of the 1970 and 1972 policies (Figures 13 and 14) produced effects in the early part of the policy

FIGURE 10

STRENGTH OF THE GENERAL TIMING EFFECT
(¢/w POLICY OFF - ¢/w POLICY ON)
(CENTS PER $)

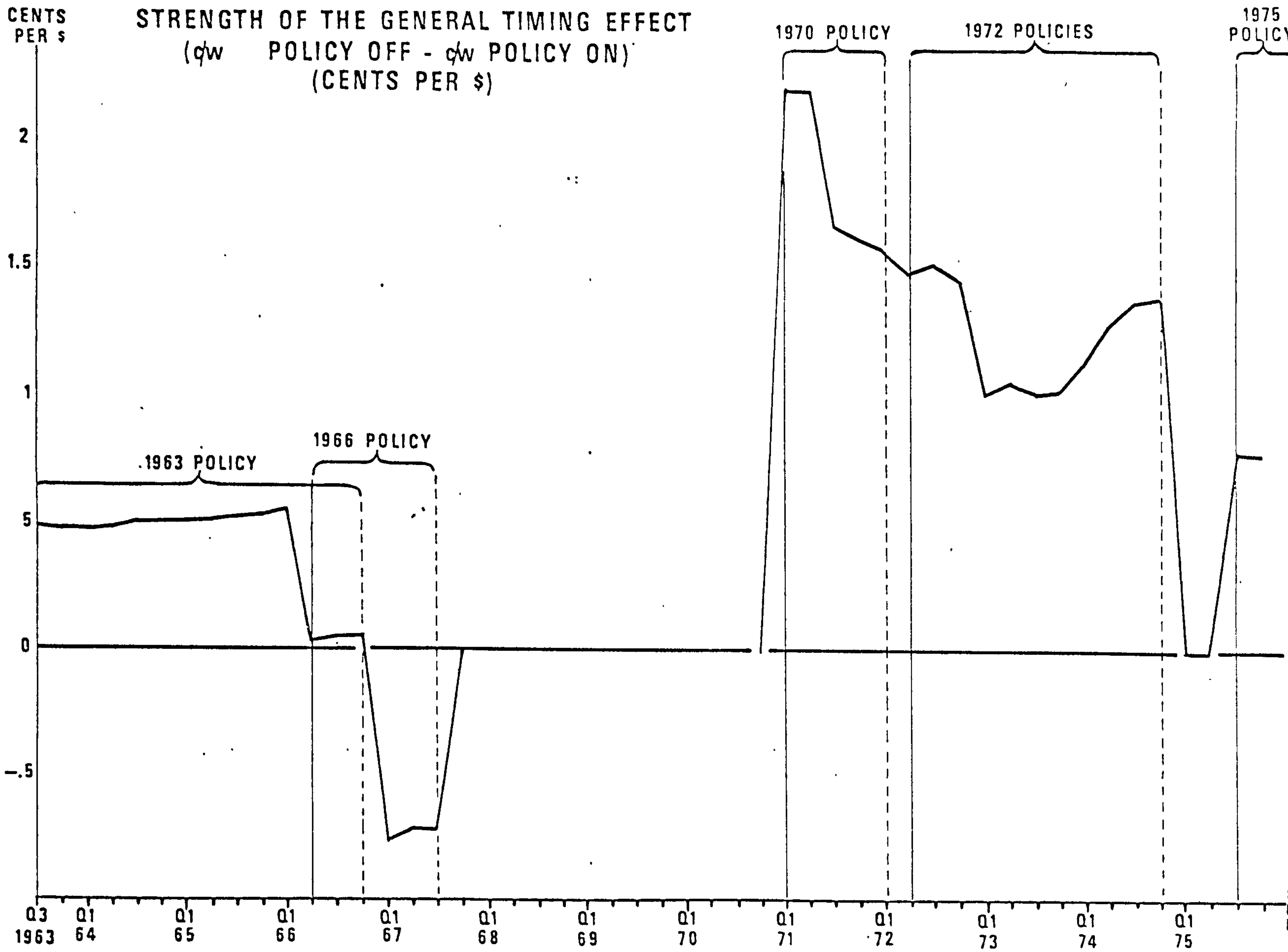
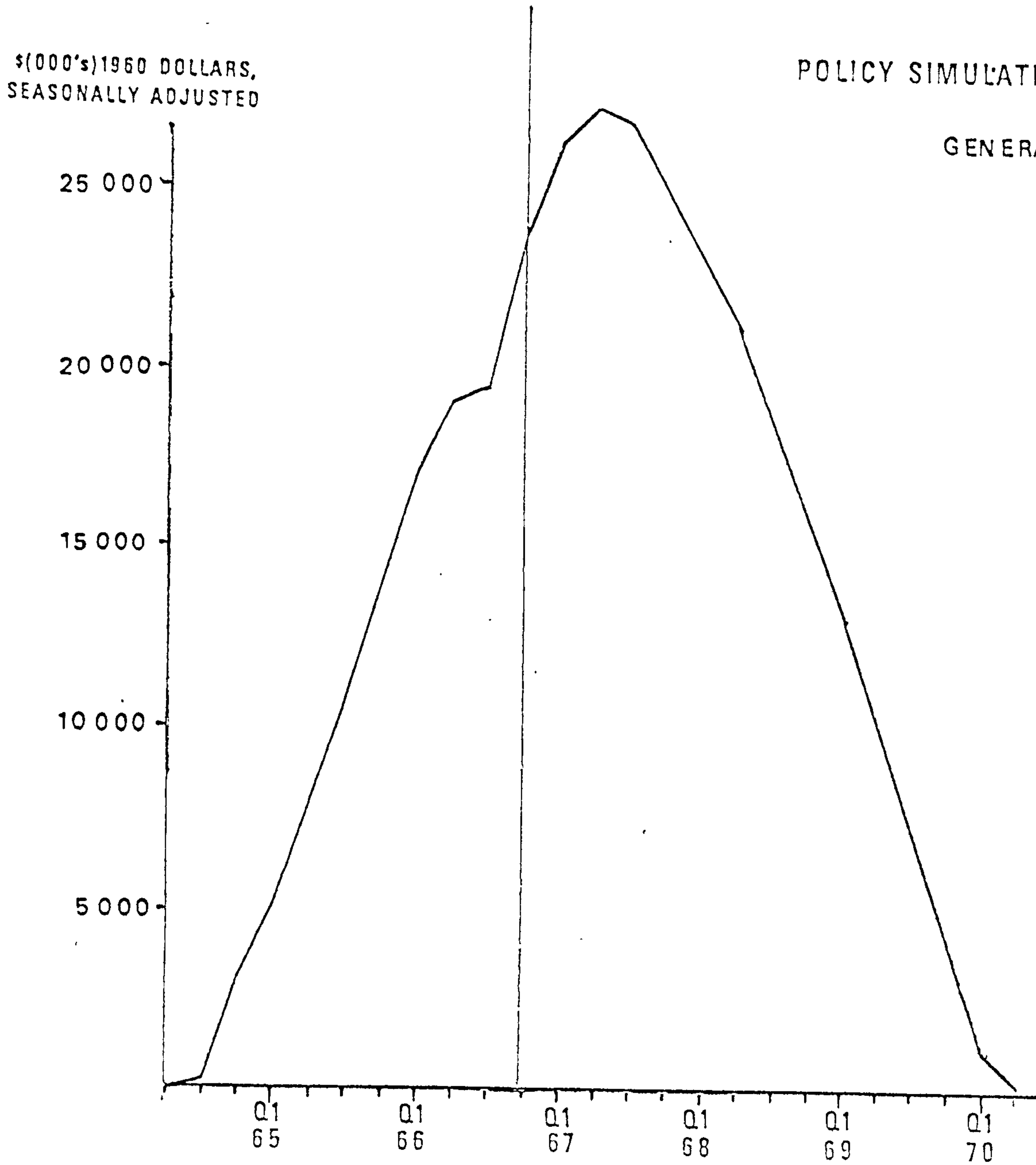


FIGURE 11

POLICY SIMULATION CANADIAN OWNERSHIP, 1963[1]

GENERAL TIMING EFFECT



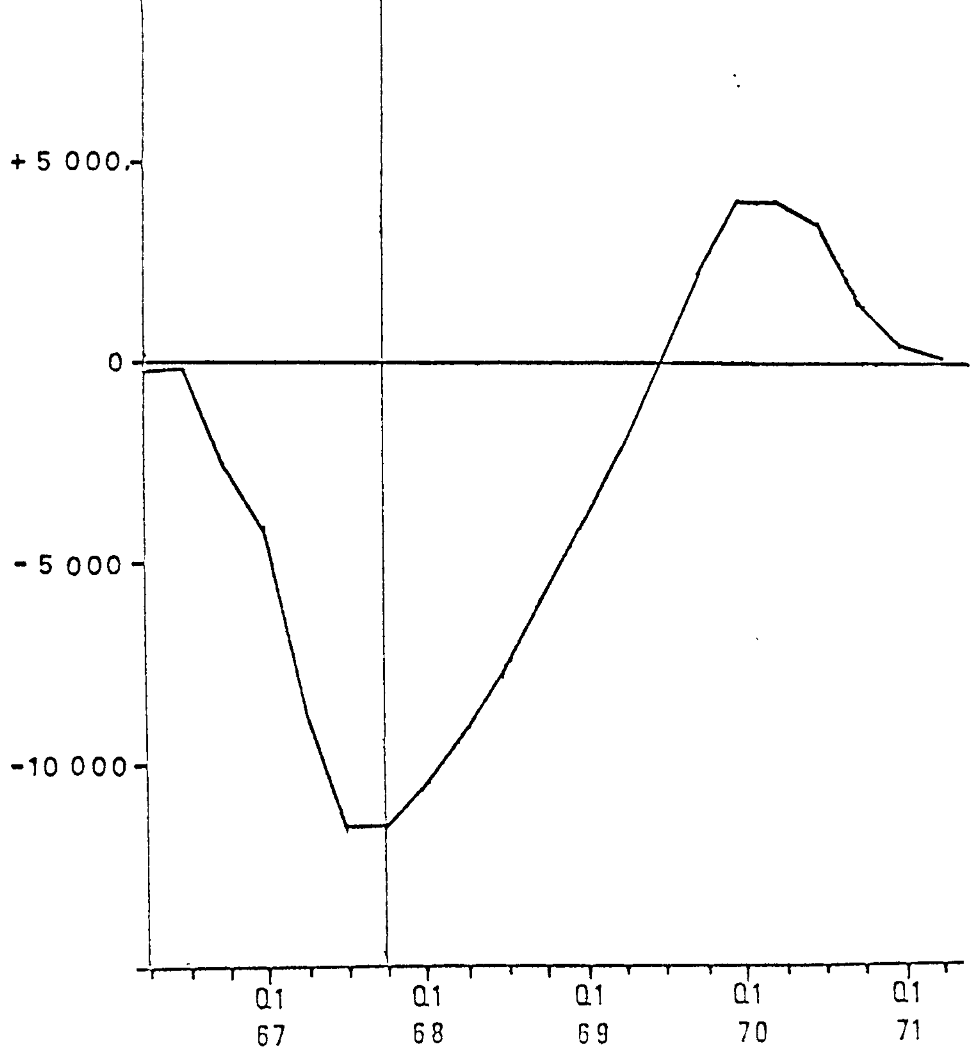
[1] Calculated investment policy on less calculated investment policy off.

FIGURE 12

POLICY SIMULATION DEFERRED ALLOWANCES, 1966 [1]

GENERAL TIMING EFFECT

$(000's) 1960 DOLLARS
SEASONALLY ADJUSTED



[1] Calculated investment policy on less calculated investment policy off.

FIGURE 13

POLICY SIMULATION

INCREASE IN COST BASE, 1970 [1]

GENERAL TIMING EFFECT

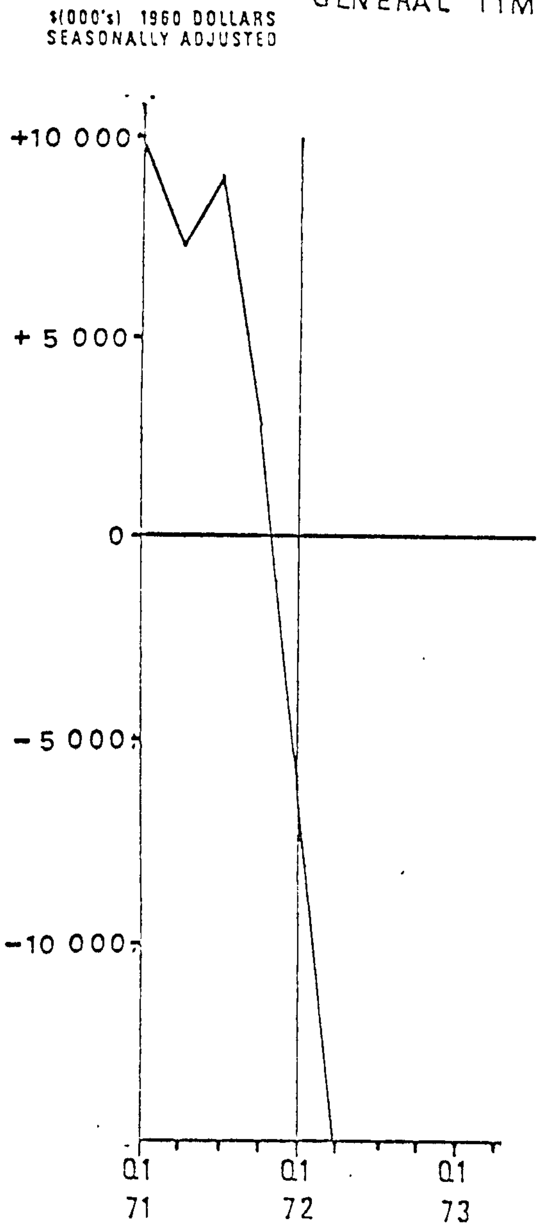
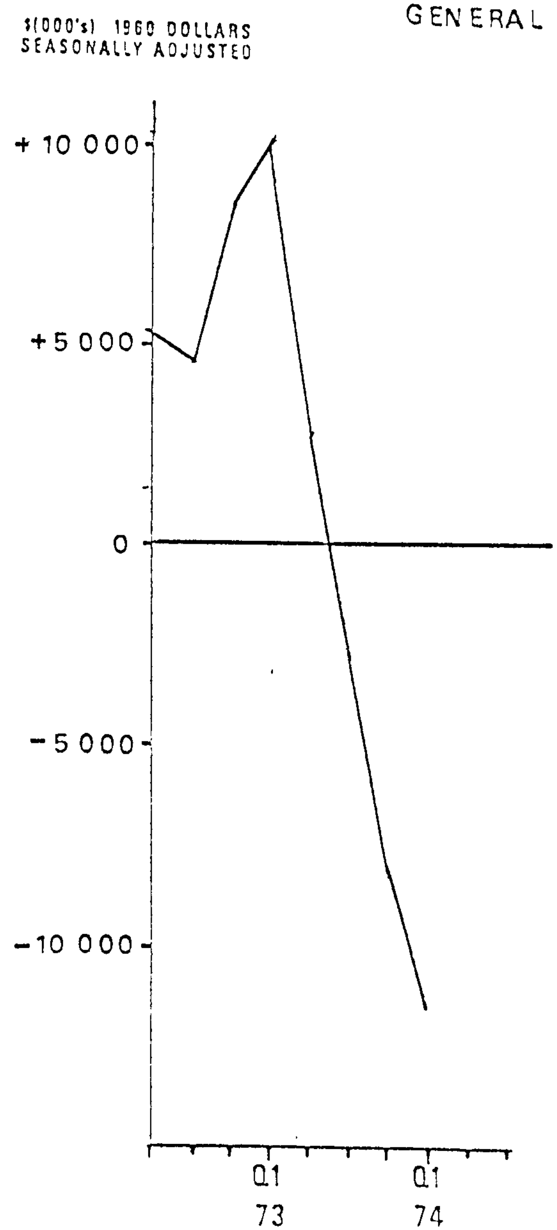


FIGURE 14

POLICY SIMULATION

1972 POLICIES [1]

GENERAL TIMING EFFECT



[1] Calculated investment policy on less calculated investment policy off.

period that are comparable in scale with the amounts shown in Figures 6 and 7. Subsequently, however, very large negative amounts appear, implying reductions in machinery and equipment imports of up to 22 per cent during the policy period. The complete ranges of negative amounts are not shown in Figures 13 and 14 both because of their scale and their implausibility.

Thus despite the good statistical fit for equation (5) when the general timing effect is included in the lag structure, the policy simulations yield results that are generally counter intuitive. The one exception is the result from the deferred allowances policy where the scale of the policy impact is more in accord with a priori expectations. These results may be partly the outcome of the fact that once again the effect of the distributed lag system is to carry over the impact of incentive policies from the incentive period into non-policy periods. Such a procedure may be appropriate in the case of the cash flow simulation reported earlier because the cash flow effect is not constrained by policy termination dates. In situations where an effect is required to be constrained to a policy period, inclusion of this effect in a distributed lag will lead to misleading results.

(c) The Termination Date Timing Effect

The values of the termination date timing effect, calculated according to the formula given in Chapter III, are shown in Figure 15. To test for the impact of this effect on lag structures these values are used in equation (5) so that

C_1, C_2 = Almon variables in $R_{t-i}\ 0_{t-i}$

D_1, D_2 = Almon variables on $R_{t-i}\left(\frac{C}{W}\right)_{t-i}$

Regression on equation (5) with these values, and using both the total manufacturing and textiles industries data, failed to produce estimates with all coefficients significant. The best estimates are shown in Table 34.

There are two reasons why an effect that concentrates on specific points in time may not appear significant in aggregate data. First,the data are quarterly and, although the termination dates for many policies are actually at the end of quarters, the effect may be obscured by movements in other months in the final quarters. Second, the time frame for the data is the period in which machinery and equipment are imported. If, however, the data were collected on the basis of the period of acquisition for tax purposes then this termination date effect may appear significant. Until that time the intuitive appeal of the termination date effect will remain untested.

FIGURE 15

STRENGTH OF THE TERMINATION DATE TIMING EFFECT (CENTS PER $)

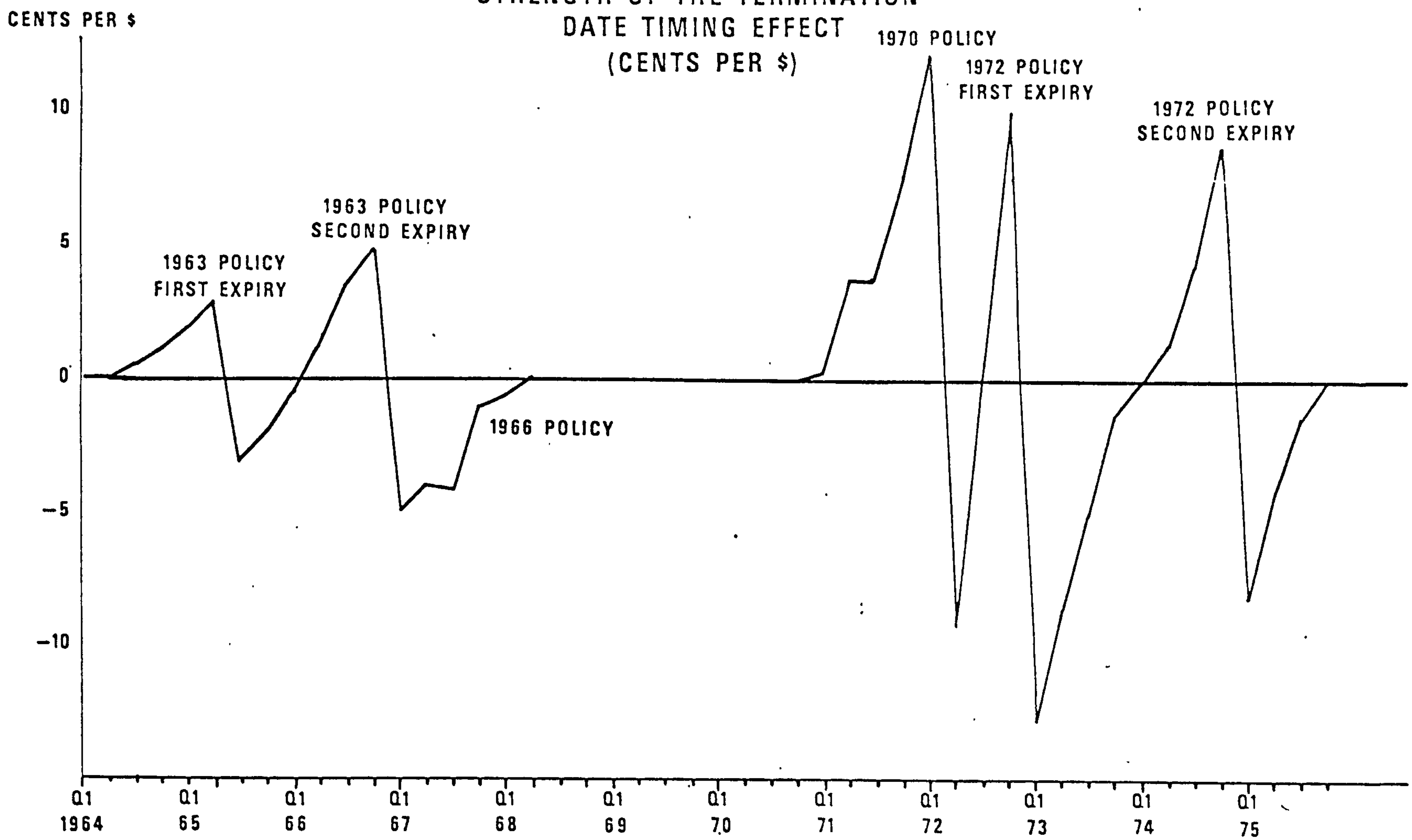


TABLE 34

ESTIMATES OF EQUATION (5), TERMINATION DATE TIMING EFFECT IN THE LAG STRUCTURE, TOTAL MANUFACTURING AND TEXTILES

(Policy off values in the relative prices terms)

	Total Manufacturing	Textiles
	$M(16)0_t, M(16)(\frac{c}{w})_t$	$M(15)0_t, M(15)(\frac{c}{w})_t$
$b\delta d_o$	64626.41 (1.79)	92917.04 (2.21)
a_1	0.24 (1.18)	625.81 (1.93)
a_2	-0.15 (1.02)	-434.17 (2.07)
a_3	-118.97 (2.44)	-131.20 (2.25)
a_4	76.64 (2.03)	102.66 (2.10)
(1-b)	0.32 (1.86)	0.07 (0.45)
a_6	0.0006 (2.9)	0.90 (1.69)
a_7	0.0004 (2.22)	-0.40 (1.04)
a_8	0.11 (0.61)	0.13 (0.85)
a_9	-0.06 (0.43)	-0.09 (0.75)
$\bar{R}^2$	.86	.69
SEE	9107.20	12999.49

Sample period: Q_1 1960 - Q_4 1975. Because of the use of lags there are only 48 observations on the dependent variable.

FOOTNOTES TO CHAPTER VII

1. The t scores on the terms in the interpolated lag distribution are the results from tests on the coefficients

$$b\gamma_0,\ b\gamma_1,\ b\gamma_2,\ \ldots$$

The parameter b has its own significance test as (1-b), the coefficient on the lagged dependent variable, but separate t scores on the γ_i elements of the lag distribution are not easily obtainable. In any event the estimates of b tend to be biased in the absence of autocorrelation in the disturbance terms, and biased and inconsistent with autocorrelation. In this situation the separate estimates of γ_i and tests for their significance were not calculated.

2. The formula used for the calculation of the h statistic is

$$h = r\sqrt{\frac{n}{1-n\hat{v}(b_1)}}$$

where

r = first order autocorrelation coefficient

n = number of observations

$\hat{v}(b_1)$ = estimated variance, on the coefficient of the lagged defendent variable

The h test is a large sample test ($n > 30$) and breaks down if $n\,\hat{v}\,(b_1) \geqslant 1$.

3. The results of this survey were published as Budget Paper C associated with the Budget of May 25, 1976.

4. See Footnote 2.

CHAPTER VIII

SUMMARY AND CONCLUSIONS

VIII.1 RESULTS FROM THIS STUDY

The objective of this study was to make an assessment of the impact of investment incentive tax policies on investment expenditures in the manufacturing sector in Canada. The first step in this assessment required two separate pieces of analysis: a review of the theory on investment behaviour to establish how incentive policies in general may be expected to influence investment expenditures and an analysis of the policies themselves to examine the extent to which their design allows them to play the role predicted by the theory. The following conclusions arose out of this preliminary analysis:

1. Investment theory is a highly controversial area within the body of economic theory and the role of investment incentives is uncertain. Three possibilities exist by which incentive policies may influence investment behaviour: (a) the factor substitution effect (b) the cash flow effect and (c) an accelerator effect.

2. The accelerator effect is not, however, a unique product of investment incentive policies, but is present in any government policy that creates or expands a budget deficit. The justification for investment incentive policies as such must rest on their ability to have a first round direct impact on investment expenditures.

3. Models based on Jorgenson's re-formulation of neo-classical capital theory allow considerable scope for investment incentive policies to influence investment behaviour through the substitution effect, but they also contain special assumptions and theoretical inconsistencies that limit their ability to reflect the influence of investment incentive policies.

4. The use of investment incentive policies as short-term stabilization policies in Canada tends to limit the scope for the operation of any factor substitution effect in incentive policies. Furthermore, failure to recognise the constraints imposed by this short term character will lead to estimation problems and errors in the interpretation of empirical results.

5. This short term character of Canadian policies gives rise to additional effects on investment behaviour not normally considered in the literature. The general timing effect and the termination date timing effect are suggested ways in which investment expenditures are influenced by short-term incentive policies.

As a result of these considerations the model used by Coen to assess the impact of incentive policies in the United States was adopted as the framework within which to test empirically for the impact of Canadian policies. The advantages of the Coen model are that (a) the model has the ability to include effects, other than the substitution effect, that arise out of incentive policies, and (b) capital stock data are not required in empirical work with the model.

The major conclusions from the empirical analysis are as follows:

1. There is evidence that the influence of incentive policies on investment behaviour is derived from several different sources. In addition to the factor substitution effect, both the cash flow and general timing effects also appear to have an impact on investment expenditures.

2. Less clear, however, is the size of the change in investment expenditures as a consequence of these different effects. With the substitution effect rather heroic assumptions are necessary for estimates of the change in investment expenditures to reach a level roughly equal to revenue losses involved in the policy. Simulation for the cash flow effect is hampered by insufficient information on the impact of incentive policies on aggregate cash flow. With the general timing effect the scale and direction of the impact are substantially different from _a priori_ expectations.

3. The basic problem with the models used to assess impact is that two of the policy effects, the change in relative factor prices and the general timing effect, are not constrained to operate only within the policy period. Instead, because these effects work within distributed lag

structures, their influence is carried beyond the policy period. More realistic measures of the impact of incentive policies will require the development of alternative models that enable policy effects to be constrained in time.

4. Problems with data availability, and the assumptions that these problems make necessary, mean that the empirical results must be treated only as indicative rather than definitive.

The above conclusions are based only on an analysis of incentive policies in the manufacturing sector. An important question not considered here is the extent to which the incentive policy only re-allocates investment from non-favoured to favoured sectors and does not lead to any overall increase in aggregate investment expenditures. To the extent that incentive policies simply re-allocate investment expenditures then they must be seen as a costly and distortionary approach to stabilization policy. Thus, despite the fact that it has been possible to demonstrate an impact on investment in a favoured sector as a result of incentive policies, the confirmation of their efficacy as stabilization policies must rest on a demonstration that they induce an increase in aggregate investment. Such a demonstration is yet to be made.

Despite the inevitable problems associated with any empirical work, it is hoped that this study will provide guidance to policy-makers and other researchers on matters of theory and methodology with respect to investment incentive policies. The unique contribution made here has been to highlight the important role of timing in the design of, and reaction to, Canadian investment incentive policies. Many other features remain to be explored.

VIII.2 FURTHER RESEARCH

From the discussion in the previous section there are two problems with high priority in any further research in this area. First, to construct models of investment behaviour in which the various time constrained effects in incentive policies operate only within the policy period and do not enter distributed lag functions. Second, to test the extent to which incentive policies directed at one sector of the economy re-allocate a given amount of investment expenditures between sectors, or actually lead to an increase in overall expenditures.

A further priority in the design of future models of investment behaviour should be to eliminate any lagged dependent variables from the reduced form of the investment function. In this way the problem of identifying the existence of autocorrelation will be simplified. In addition, the role of incentive policies in influencing replacement expenditures should be explicitly included in the formulation of the investment function.

Improvements in the specification of investment models must also be matched by improvements in the quality of data. If imports of machinery and equipment and shipments of machinery and equipment from Canadian machinery industries were classified according to their industry of destination then a very good quarterly or even monthly disaggregated machinery and equipment investment series could be constructed.

A good investment series is not sufficient, however, in situations where incentive policies are applicable only to a special set of machinery and equipment expenditures, for example those that fall within a particular capital cost allowance class. Further work is necessary to relate the tax definition of investment expenditures eligible for the benefits of an incentive policy to actual expenditures.

The above points, however, relate only to investment incentive policies. Further research is required on the whole class of policies that involve the use of financial penalties and rewards to bring private actions into line with social objectives. Governments have other policy instruments such as statutory regulation and direct expenditures to achieve the same objectives and their choice should be guided by a knowledge of the benefits and costs associated with each instrument.

KEY TO SYMBOLS

a	=	Maximum allowable rate for capital cost allowances
b	=	Speed of adjustment coefficient
B_t	=	Positive termination date timing effect in period t
c	=	Rental cost of capital
C_t	=	Negative termination date timing effect in period t
d_i	=	Annual capital cost allowance in period i
$\tilde{d}_i$	=	Annual capital cost allowance in period i after the deduction of the tax credit
D_i	=	Increase in capital cost allowances in period i
e	=	Time period of capital cost deductions
F_i	=	Cash flow in period i
F_i^*	=	Cash flow in period i with an incentive policy
I_t(net)	=	Net investment in period t
I_t(gross)	=	Gross investment in period t
k	=	Rate of investment tax credit
K_t	=	Actual capital stock in period t
K_t^*	=	Desired capital stock in period t
L_t	=	Actual labour in input
$M(s)$	=	Polynomial distributed lag operator
O	=	New orders for industry output
P	=	Price of output
Q	=	Output

q = Market price of capital goods

r = Rate of interest (discount)

R_i = Net receipts in period i

T_i = Increases in taxes in period i

u = Proportional tax rate

w = Wage rate

Z = Present value of capital cost allowances

α = Elasticity of output with respect to capital input

β = Elasticity of output with respect to labour input

δ = Rate of depreciation

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APPENDIX A

CONTENTS AND RATES FOR CERTAIN CAPITAL COST ALLOWANCE CLASSES

Class 3 (5 per cent D.B.)	Brick, stone or cement buildings, including component parts, breakwaters, docks, trestles, windmills and wharves.
Class 6 (10 per cent, D.B.)	Frame, log, stucco on frame, galvanized or corrugated iron buildings including component parts, wooden breakwaters, fences, greenhouses, oil and water storage tanks, railway tank cars, wooden wharves and aeroplane hangers.
Class 8 (20 per cent, D.B.)	Machinery and equipment not specified in other classes. The greater part of machinery and equipment acquisitions are in this class when not included in incentive classes (Classes 19, 21, 29).
Class 9 (25 per cent, D.B.)	Electrical generating and radio equipment.
Class 10 (30 per cent, D.B.)	Automotive equipment and mining and logging structures and machinery and equipment.
Class 11 (35 per cent, D.B.)	Advertising signs used to earn rental income.
Class 16 (40 per cent, D.B.)	Aircraft, including fittings and parts. (Rate reduced to 25 per cent, Budget of May 25, 1976).
Class 19 (50 per cent, S.L.)	Machinery and equipment which would normally be in Class 8, but are eligible for the Canadian ownership allowances.
Class 20 (20 per cent, S.L.)	Buildings that would otherwise be in Class 3 or 6, but were constructed in a designated region under the terms of the Area Development Incentives Act.
Class 21 (50 per cent, S.L.)	Machinery and equipment that would otherwise be in Class 8, but were purchased for use in a designated region under the terms of the Area Development Incentives Act.

Class 29 (50 per cent, S.L.)	Machinery and equipment which would normally be in Class 8 but are eligible for the 1972 accelerated allowances

D.B. - Diminishing balance system
S.L. - Straight line system

APPENDIX B

VALUE OF THE RENTAL COST TERM UNDER DIFFERENT ASSUMPTIONS ON THE TREATMENT OF REPLACEMENT INVESTMENT

In Chapter III the rental cost expression

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

is developed with the assumption that the present value of capital cost allowances on an initial outlay is identical with the present value of capital cost allowances on replacement expenditures. This may be illustrated by rearranging (1) to give

$$\frac{c}{r} = \frac{q(1-uz)}{1-u} + \frac{q\delta}{r}\frac{(1-uz)}{1-u} \tag{2}$$

This expression states that the present value of a stream of annual rental cost amounts is equal to the after-tax cost $\frac{q(1-uz)}{(1-u)}$ on an initial outlay with a market cost of q, plus the present value of the after-tax cost $\frac{q\delta(1-uz)}{(1-u)}$ of a stream of annual replacement expenditures with a market cost of $q\delta$.

In the context of both temporary changes in tax policies, as is the case with Canadian policies, and heterogenous capital goods that are not subject to proportional replacement, some modifications can be made to these rental cost expressions.

First, in situations where replacement is considered in the sense of the replacement of whole assets at future periods, and usually embodying different technology, it may be that the notion of proportional replacement does not enter the rental cost for the firm. Obsolescence at rate δ may still be feasible, but the obsolescence will not be compensated for in the original asset, but rather in the purchase of new assets. In this situation the rental price expression becomes

$$c = \frac{q\{r(1-uz)+\delta\}}{(1-u)} \tag{3}$$

This follows by making $\frac{q\delta z}{r} = o$ in equation (16) in Chapter III.2.

The percentage change in the cost of capital defined in this way as a result of a change in the present value of capital cost allowances is given by

$$\frac{ru(z_1-z_o)}{r(1-uz_o)+\delta} \tag{4}$$

Alternatively, the situation may occur where an investment incentive policy is in force for only a short duration, and replacement is assumed to be proportional in the original asset. Thus while the initial outlay qualifies for the investment incentive, for example an increase in the present value of capital cost allowances from z_o to z_1, the subsequent replacement at rate δ may only attract capital cost allowances with a present value of z_o. In this situation equation (16) has on the right-hand side

$$qz_1 + \frac{q\delta z_o}{r}$$

so that

$$c_1 = \frac{q\{r(1-uz_1)+\delta(1-uz_o)\}}{1-u} \quad (5)$$

and the percentage reduction in the cost of capital as a result of the increase in the present value from z_o to z_1 is given by

$$\frac{ru(z_1-z_o)}{(r+\delta)(1-uz_o)} \quad (6)$$

If, as was the case with the 1972 accelerated capital cost allowances policy, a temporary policy is made permanent, then $z_o = z_1$ and the expression reverts to the original form.

A further possibility is that replacement expenditures could be treated by the tax authorities as current rather than depreciable expenditures. Interpretation Bulletin IT-128 from the Department of National Revenue states that

> "Where an expenditure made in respect of a property serves only to restore it to its original condition, that fact is one indication that the expenditure is of a current nature."

If replacement expenditures are treated as current expenses then the right-hand side of (16) is

$$qz_1 + \frac{q\delta}{r}$$

so that

$$c = \frac{q\{r(1-uz)+\delta(1-u)\}}{1-u} \quad (7)$$

Similar considerations apply in the situation where a tax credit or grant is introduced for only a short period of time so that replacement does not receive the benefits of the tax credit. If the tax credit is the only incentive policy in operation then

$$c = \frac{q\{r(1-k)+\delta\ (1-uz)\}}{(1-u)} \quad (8)$$

assuming, once again, that the amount of the tax credit is deductible from undepreciated capital costs.

These alternative expressions for the rental cost term under different replacement assumptions suggest that the value of the rental cost term should be subject to more careful analysis depending upon the policy design and the institutional background. Nevertheless, for this present study the original formulation is retained, largely because it accurately reflects the percentage change in the cost of a single asset as a result of an incentive policy.

APPENDIX C

DERIVATION OF THE MACHINERY AND EQUIPMENT SERIES AND OTHER DATA SOURCES

Quarterly data on investment expenditures by industry group in Canada are unavailable. The quarterly national accounts provide estimates of gross capital formation, but these data are too aggregative for use in a study confined to the manufacturing sector. To construct these quarterly national accounts data, Statistics Canada makes use of monthly data on imports and exports of machinery and equipment, and shipments from Canadian machinery industries. The domestic machinery industry supplies only around 40 per cent of total machinery and equipment, giving the dominant role in supplying these capital goods to imports. Furthermore there appears to be a degree of product rationalization on a continental basis, with Canadian producers concentrating on supplying machinery to agriculture and other natural resource based primary industries, as well as materials handling equipment and office and store machinery.

In the light of these factors it was decided that a useful proxy for quarterly total machinery and equipment expenditures in the manufacturing sector could be obtained from the monthly imports data. One further problem remained, however, in that the import data are classified in a descriptive way that does not always indicate the particular industry group that will be using the machinery. Thus in the Summary of Imports (SC 65-005) and the Summary of External Trade (SC 65-001), the sources for these data, imports of machinery and equipment are classified as follows:

1. Engines and turbines, diesel, general purpose
2. Engines and turbines, general purpose nes
3. Electric generators and motors
4. Bearings
5. Other mechanical power transmission equipment
6. Compressors, blowers and vacuum pumps
7. Pumps, except oil well pumps
8. Packaging machinery
9. Other general purpose industrial machinery
10. Conveyors and conveying systems
11. Elevators and escalators
12. Industrial trucks, tractors, trailers, stockers
13. Hoisting machinery
14. Other materials handling equipment
15. Drilling machinery and drill bits
16. Power shovels
17. Bulldozing and similar equipment
18. Front end loaders
19. Other excavating machinery
20. Mining, oil and gas machinery
21. Construction and maintenance machinery
22. Machine tools, metalworking
23. Welding apparatus and equipment
24. Rolling mill machinery
25. Other metalworking machinery
26. Pulp and paper industries machinery
27. Printing presses
28. Other printing machinery and equipment
29. Spinning, weaving and knitting machinery
30. Other textile industries machinery
31. Food, beverages and tobacco industries machinery
32. Plastics and chemical industry machinery
33. Other special industry machinery
34. Soil preparation, seeding and fertilizing machinery

35. Combine reaper - threshers
36. Other haying and harvesting machinery
37. Other agricultural machinery and equipment
38. Wheel tractors, nes
39. Track-laying tractors and used tractors
40. Tractor engines and tractor parts.

Each of these categories contains specific contents classified according to the Canadian Import Commodity Classification (SC 12-525). Examination of this commodity classification resulted in the selection of the following categories as those which consisted wholly or predominantly of machinery imported by the manufacturing sector, and which are therefore susceptible to influence by the investment incentive policies under review in this study.

8. Packaging machinery
9. Other general purpose industrial machinery
22. Machine tools, metal working
24. Rolling mill machinery
25. Other metalworking machinery
26. Pulp and paper industries machinery
27. Printing presses
28. Other printing machinery and equipment.
29. Spinning, weaving and knitting machinery
30. Other textile industries machinery
31. Food, beverages and tobacco industries machinery
32. Plastics and chemical industry machinery
33. Other special industry machinery

While categories 34-40 are clearly agricultural machinery, and 15-21 are for the resource or construction industries, categories 1-7, 10-14 and 23 were not sufficiently industry specific in their description to enable them to be allocated to particular industries. From their description they are probably distributed over all industries.

Figure C.1 shows the relationship between the total annual machinery and equipment expenditures in the manufacturing sector as reported by Statistics Canada in Public and Private Investment in Canada (61-206) and the annual total for the proxy import series. On an annual basis the imports series appear to be much smoother than the total series. Figure C.2, however, sets out the quarterly totals for the imports series. These indicate a much larger degree of quarter-to-quarter variation, and reflect quite well the changes indicated in the annual amounts of total machinery and equipment expenditures.

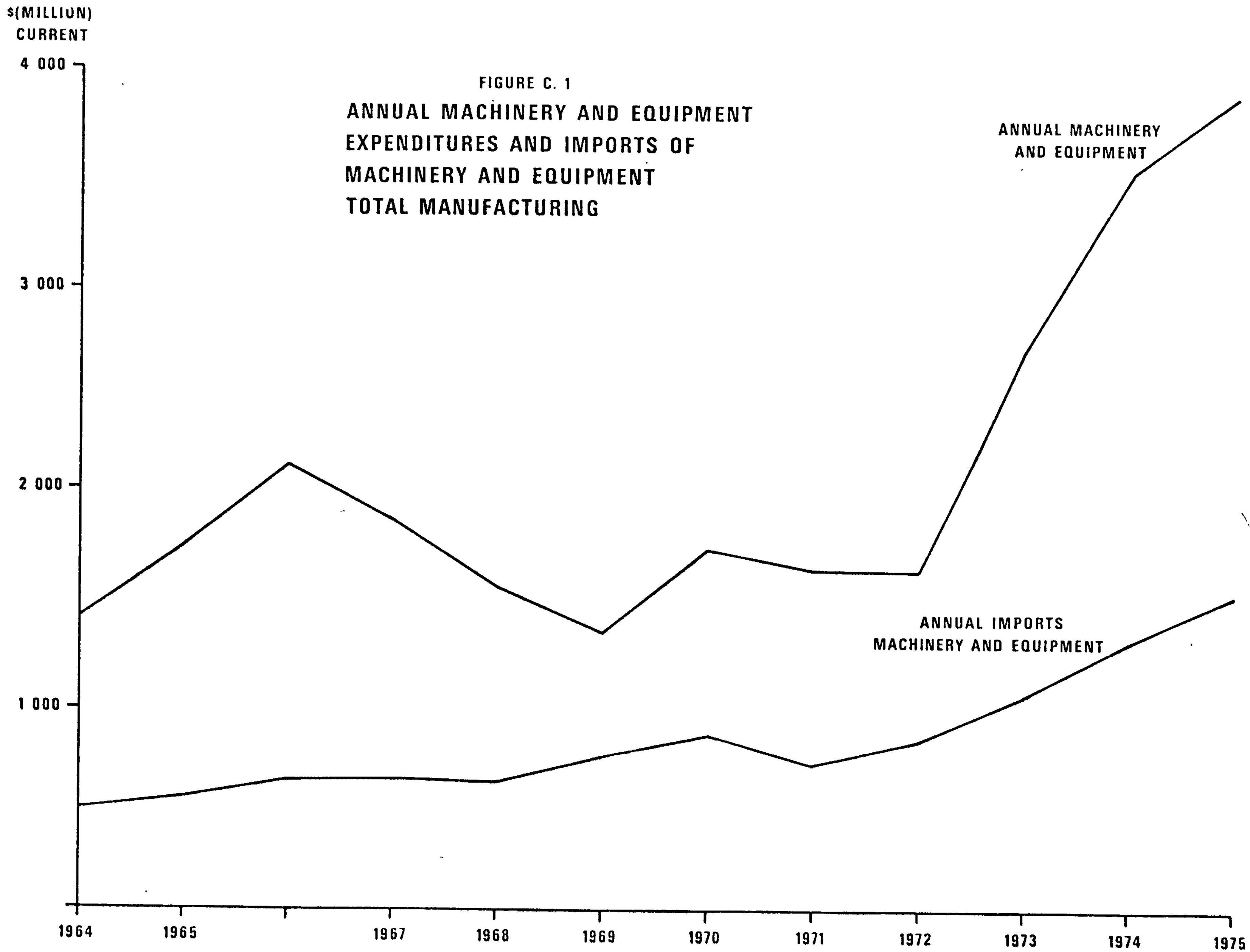
As mentioned in Chapter I both the imports data and the annual survey data can only be considered as approximations to the actual amounts of machinery and equipment expenditures that are subject to the investment incentive policies. This is, of course, because the tax definition of eligible assets does not correspond with normal industrial classifications. On this basis the measurement errors involved in the use of the import series are probably no greater than would be the case if annual data were used.

In the case of items 29 and 30, textile industry machinery and equipment, the annual sum of the amounts was found to be very close to the annual survey amounts shown for the textiles industry (see Figure C.3). This suggests that almost all of this industry's machinery and equipment is imported. In this situation it was decided to use the textile industry imports data along with the total imports series in the estimation of investment functions.

As to other data sources, new orders and shipments from the total manufacturing sector and the textiles industry were obtained from Inventories, Shipments and Orders in Manufacturing Industries (SC 31-001). These data are available on a monthly basis, and were aggregated into quarters. As deflators for the orders and shipments variables industry selling price indexes were taken from Prices and Price Indexes (SC 62-002).

To deflate the imports and cash flow variables unpublished price indexes for machinery and equipment by industry were obtained from Statistics Canada. These indexes are based on manufacturers' selling prices and then corrected for import duties, exchange rate changes, and federal sales tax. All indexes were rebased to 1960 = 100.

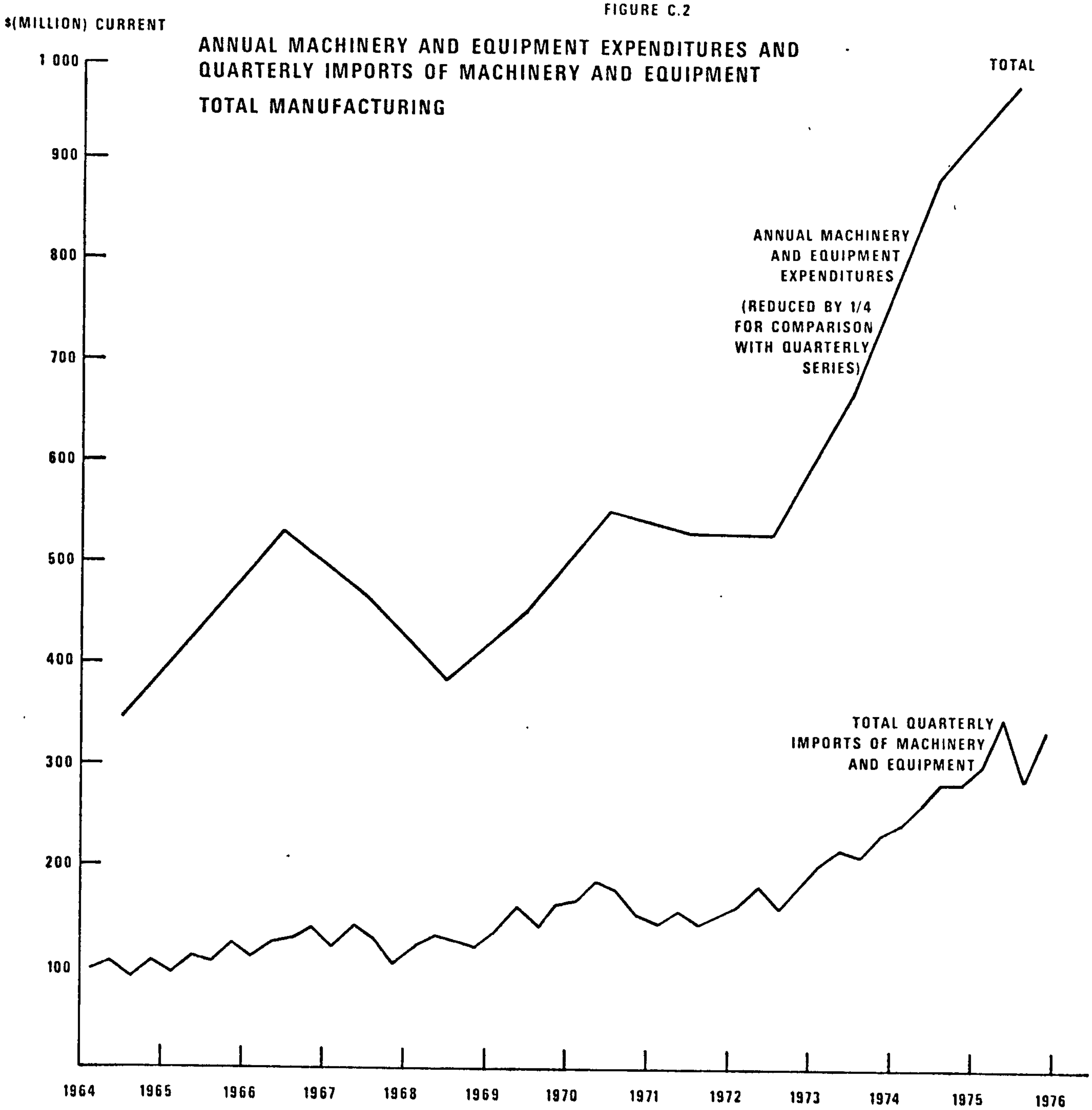
Average hourly earnings of hourly-rated wage earners was used as the wage variable. Hourly-rated employees generally represent the substitutable part of the production process. The data were obtained from Employment Earnings and Hours (SC 72-002).



SOURCE : STATISTICS CANADA 61-206 AND 65-005

FIGURE C.2

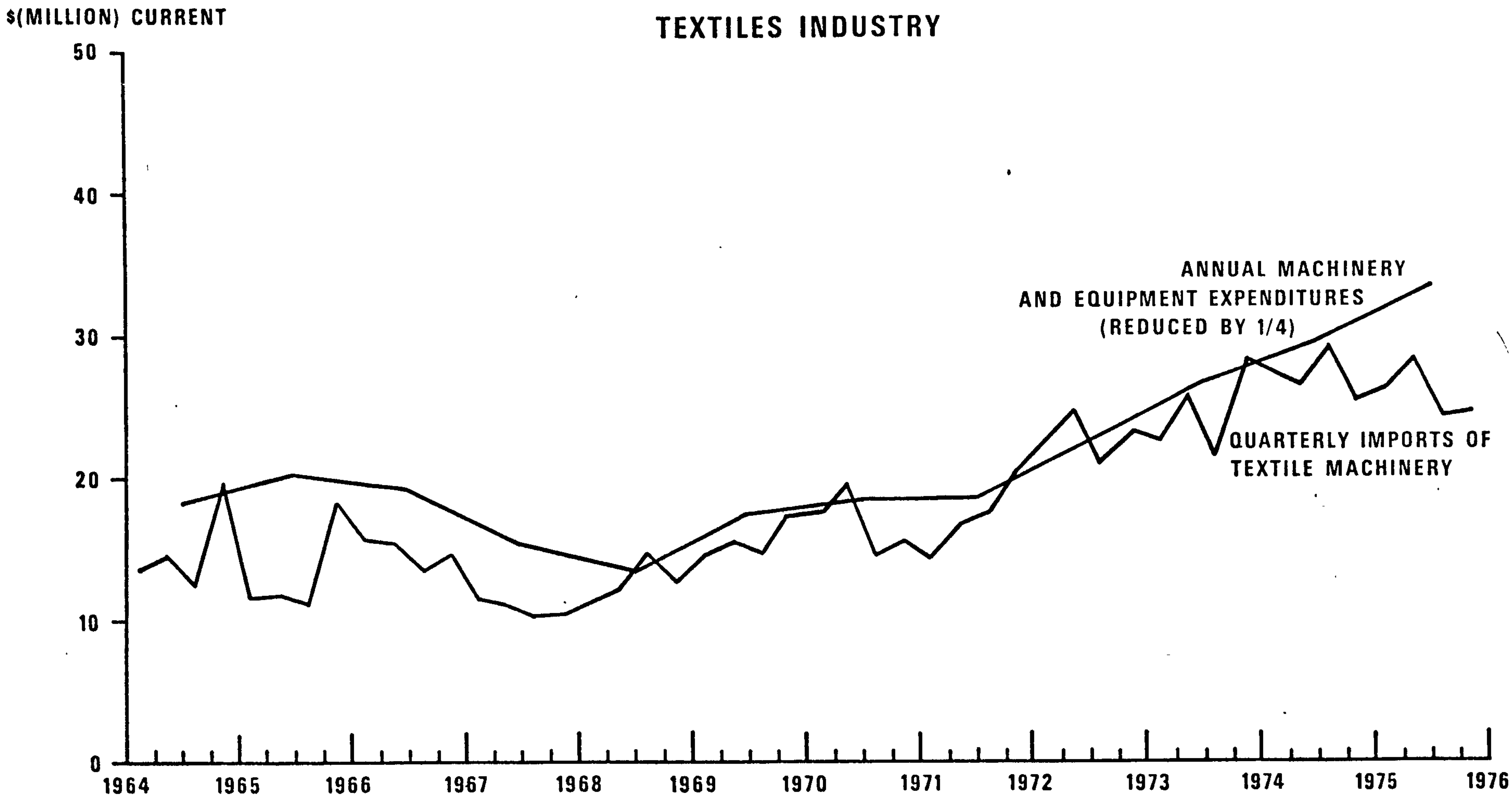
ANNUAL MACHINERY AND EQUIPMENT EXPENDITURES AND QUARTERLY IMPORTS OF MACHINERY AND EQUIPMENT
TOTAL MANUFACTURING



SOURCE STATISTICS CANADA 61-206 AND 65-005

FIGURE C.3

ANNUAL MACHINERY AND EQUIPMENT EXPENDITURES AND QUARTERLY IMPORTS OF MACHINERY AND EQUIPMENT
TEXTILES INDUSTRY



SOURCE: STATISTICS CANADA 61-206 AND 65-005

The cash flow variable is derived from Statistics Canada's concept of base profit. Base profit is defined as the net income of a corporation before income taxes, extraordinary items, and depletion and depreciation deductions. Base profit includes both the provision for current taxes and amounts allocated as deferred taxes based on the difference between book depreciation methods and tax capital cost allowances. The cash flow variable actually used in the empirical work is base profit less current taxes. To simulate the impact of incentives on cash flow a proportion of the deferred taxes amount was subtracted from cash flow variable. The Statistics Canada data are derived from a quarterly survey of financial statements and reported in Industrial Corporations (SC 61-003).

Details of capital cost allowances claimed by asset class are taken from Corporation Taxation Statistics (SC 61-208) as were amounts for corporation taxable incomes and taxes payable. Statutory tax rates are detailed in Principal Taxes in Canada (SC 68-201)

The value for δ, the exponential rate of economic depreciation is assumed to have an annual value of .1471. This is the rate used by Hall and Jorgenson (1967) and is derived from the product of 2.5 times the inverse of the effective lifetime of machinery and equipment. Finally, the interest rate before tax is the 10 industrials bond yield from McLeod, Young and Weir.

The data series used as a basis for the empirical work reported in this study are given in the following tables. These data were seasonally adjusted, where necessary, with the X-11 program, and deflated by the appropriate price index. Table C.1 gives the basic time series data for total manufacturing, C.2 for textiles and Table C.3 gives series common to both industries. The period covered by the data is from the first quarter of 1960 to the fourth quarter of 1975, but the cash flow and imports series begin at later dates. A key to the symbols at the head of each column is given below.

I(t)	=	Imports of machinery and equipment by the industry ($ 000's)
O(t)	=	New orders placed with the industry ($M)
F(t)	=	Cash flow in the industry ($M)
W(t)	=	Wages ($ per hour)
C(t)ON	=	Rental cost series including incentive policy effects ($ per $100 of outlay on machinery and equipment)
C(t)OFF	=	Rental cost series excluding incentive policy effects ($ per $100 of outlay on machinery and equipment)
INDEX 1	=	Machinery and equipment price index
INDEX 2	=	Industry selling price index
TIME	=	Termination date timing effect
TAX RATE	=	Top statutory tax rate

TABLE C.1 TOTAL MANUFACTURING TIME SERIES

	40 I(T)	41 O(T)	42 F(T)	43 W(T)	44 C(T) ON	45 C(T) OFF	46 INDEX 1	47 INDEX 2	
1	0.	5828.70	0.	1.82330	20.2001	20.2001	100.000	100.000	1
2	0.	5688.60	0.	1.83670	20.1171	20.1171	101.400	100.000	2
3	0.	5797.10	0.	1.82000	19.8306	19.8306	101.800	100.000	3
4	0.	5817.00	0.	1.85330	20.2303	20.2303	102.900	100.000	4
5	0.	5705.71	0.	1.82330	20.3876	20.3876	103.700	99.8000	5
6	0.	5780.46	0.	1.83670	20.4859	20.4859	104.200	99.8000	6
7	0.	6077.75	0.	1.82000	20.7072	20.7072	106.300	100.200	7
8	0.	6122.83	0.	1.85330	20.7267	20.7267	106.400	100.300	8
9	0.	6258.61	426.766	1.86670	20.7095	20.7095	107.300	100.500	9
10	0.	6426.17	474.662	1.89000	21.2332	21.2332	109.000	100.900	10
11	0.	6441.97	514.821	1.87330	21.8630	21.8330	110.200	101.500	11
12	0.	6501.28	516.609	1.84330	21.4475	21.4475	110.100	101.500	12
13	0.	6550.88	474.977	1.93000	21.5644	21.5644	110.700	101.800	13
14	0.	6726.98	525.111	1.95000	21.6939	21.6939	112.400	102.300	14
15	0.	7017.22	551.782	1.93670	22.1214	22.5968	116.000	102.800	15
16	0.	7127.67	606.997	1.98330	22.1214	22.5968	116.600	103.000	16
17	891031.	7469.80	586.453	1.99670	22.3884	22.8695	117.400	103.300	17
18	824902.	7461.99	571.480	2.01670	23.3419	23.8435	122.400	103.400	18
19	753244.	7483.35	575.850	2.02000	23.6014	24.1230	122.700	103.300	19
20	820807.	7707.84	592.411	2.05000	23.4666	23.9853	122.700	103.300	20
21	800187.	7895.56	586.252	2.09000	24.4289	24.9539	128.100	103.600	21
22	810684.	8082.76	607.361	2.11330	24.7555	25.3027	128.700	104.400	22
23	836109.	8308.94	633.914	2.10330	25.0251	25.5928	129.000	105.100	23
24	907375.	8550.19	558.349	2.16330	25.3356	25.9251	129.500	105.600	24
25	896405.	8816.71	640.718	2.20330	25.8457	26.4621	131.000	107.100	25
26	902432.	8860.43	616.940	2.23000	26.6114	26.6641	132.000	107.400	26
27	994352.	8774.84	621.252	2.24670	27.4858	27.5445	132.800	108.100	27
28	.101896E+07	9000.74	637.145	2.30330	27.7756	27.8349	134.200	108.300	28
29	940737.	8769.29	588.634	2.35000	29.0791	28.1880	137.100	109.100	29
30	.103937E+07	8741.75	611.465	2.38330	27.5334	26.6734	128.600	109.700	30
31	.105702E+07	8976.57	655.285	2.41000	27.0448	26.1668	124.000	110.100	31
32	823136.	9002.08	674.947	2.47000	26.7681	26.7681	124.700	110.500	32
33	.104118E+07	8878.30	624.552	2.49670	27.4364	27.4364	126.800	111.500	33
34	975477.	9270.84	669.700	2.56670	27.6939	27.6939	126.900	111.800	34
35	.100262E+07	9483.62	663.601	2.59000	27.5446	27.5446	127.300	112.300	35
36	966353.	9778.39	740.390	2.66670	27.8248	27.8248	127.500	112.900	36
37	.111280E+07	10010.4	711.123	2.72330	28.6129	28.6129	130.000	115.000	37
38	.112874E+07	9943.59	721.876	2.76670	29.4788	29.4788	131.700	116.300	38
39	.108643E+07	10082.0	636.421	2.79000	29.9955	29.9955	132.900	116.600	39
40	.127076E+07	10061.6	693.305	2.88000	30.3558	30.3558	133.400	117.400	40
41	.126543E+07	9542.46	631.941	2.93670	31.2951	31.2951	136.400	119.400	41
42	.125049E+07	9692.80	595.413	2.99670	31.5246	31.5246	137.400	119.500	42
43	.135594E+07	9908.44	610.769	3.01330	31.2263	31.2263	136.100	118.500	43
44	.113343E+07	9588.98	562.852	3.10670	31.2433	31.2433	137.300	118.900	44
45	.104781E+07	10173.5	628.906	3.20330	27.0764	30.5058	138.600	119.800	45
46	.104499E+07	10245.6	664.889	3.26330	27.7233	31.2065	140.600	121.400	46
47	.105218E+07	10542.9	742.405	3.29000	28.7834	31.7150	142.200	122.400	47
48	.111727E+07	10560.5	730.796	3.37330	28.5003	31.4247	142.000	122.800	48
49	.115297E+07	10634.3	786.622	3.43670	28.6894	31.6097	143.000	125.200	49
50	.117733E+07	11186.9	803.087	3.50670	28.9084	31.7202	143.500	126.700	50
51	.115924E+07	11029.2	774.065	3.56000	29.1729	32.0568	143.900	127.900	51
52	.126000E+07	11657.1	838.846	3.65000	29.3315	32.1844	145.600	129.900	52
53	.138089E+07	11813.3	967.679	3.73000	30.3984	32.6989	148.200	134.800	53
54	.133973E+07	11605.4	949.855	3.82000	31.4043	33.8535	152.200	139.600	54
55	.144476E+07	11899.7	993.633	3.87000	32.4651	34.8637	155.500	146.200	55
56	.149517E+07	12438.5	1091.95	3.99670	33.3002	35.7605	159.500	150.800	56
57	.146127E+07	12446.7	1155.71	4.10670	35.1904	38.0174	166.600	160.100	57
58	.139020E+07	12189.4	1113.93	4.26000	38.3173	41.6221	174.300	168.100	58
59	.168136E+07	12077.1	1069.40	4.45330	41.8138	45.4891	185.000	175.800	59
60	.147262E+07	11615.3	939.686	4.67000	43.1717	47.0623	194.200	181.900	60
61	.151250E+07	10891.1	901.746	4.83670	43.9451	43.9451	199.900	186.600	61
62	.156167E+07	10897.0	881.543	5.01330	46.6535	46.6535	208.700	190.000	62
63	.144348E+07	11208.0	846.562	5.09670	46.0298	48.4524	213.200	193.300	63
64	.157139E+07	11376.4	822.466	5.28700	46.3968	48.8387	214.900	194.800	64

TABLE C.2 TEXTILES INDUSTRIES TIME SERIES

	40 I(T)	41 O(T)	42 F(T)	43 W(T)	44 C(T) ON	45 C(T) OFF	46 INDEX 1	47 INDEX 2	
1	0.	0.	0.	1.36670	20.2001	20.2001	100.000	100.000	1
2	0.	0.	0.	1.37000	20.5536	20.5536	103.600	100.000	2
3	0.	0.	0.	1.37670	20.5709	20.5709	105.600	100.000	3
4	0.	0.	0.	1.36000	21.4493	21.4493	109.100	100.000	4
5	0.	136.409	0.	1.36670	21.8228	21.8228	111.000	99.7000	5
6	0.	221.063	0.	1.37000	22.1570	22.1571	112.700	99.7000	6
7	0.	236.327	0.	1.37670	22.8111	22.8111	117.100	100.200	7
8	0.	224.652	0.	1.36000	23.0059	23.0059	118.100	100.600	8
9	0.	235.551	18.9439	1.40330	23.1414	23.1415	119.900	100.700	9
10	0.	247.478	19.9387	1.42000	24.2916	24.2916	124.700	101.100	10
11	0.	252.353	19.9198	1.42670	25.2952	25.2953	127.500	102.000	11
12	0.	244.184	20.3961	1.44000	24.6812	24.6812	126.700	102.300	12
13	0.	251.120	22.8524	1.45670	24.6422	24.6423	126.500	102.700	13
14	0.	258.847	28.1262	1.46330	24.9364	24.9364	129.200	102.300	14
15	0.	275.852	31.6365	1.47670	25.5159	26.0643	133.800	102.700	15
16	0.	289.739	31.5215	1.50000	25.4778	26.0253	133.600	103.300	16
17	10482.0	286.789	31.5896	1.51670	25.5540	26.1033	134.000	103.700	17
18	10273.8	290.927	28.1667	1.53670	26.5457	27.1162	139.200	103.600	18
19	9277.37	288.986	28.8887	1.55670	26.7752	27.3670	139.200	103.500	19
20	13259.3	292.864	28.2923	1.58000	26.5266	27.1130	138.700	103.700	20
21	8269.01	302.505	24.7204	1.60000	27.0797	27.6617	142.000	103.800	21
22	8306.95	308.221	31.5630	1.62330	27.3907	27.9962	142.400	103.400	22
23	8322.32	315.713	34.9033	1.63670	27.6440	28.2712	142.500	103.100	23
24	11706.6	323.524	27.6089	1.65670	28.4855	29.1482	145.600	103.300	24
25	10893.4	336.214	34.3446	1.69330	29.0616	29.7548	147.300	103.000	25
26	10394.2	318.411	28.5267	1.71000	29.7363	29.7951	147.500	103.200	26
27	9612.37	323.791	28.1447	1.74670	31.1285	31.1215	150.400	103.400	27
28	8989.97	316.313	21.9664	1.80000	31.5632	31.6306	152.500	103.600	28
29	7417.67	330.732	21.4673	1.83000	32.6424	31.6422	153.900	103.800	29
30	7577.20	332.498	24.5203	1.85670	30.8948	29.9298	144.300	103.700	30
31	7884.13	339.400	28.3731	1.88000	30.0982	29.1211	138.000	103.300	31
32	7114.90	352.372	28.4152	1.94330	29.6446	29.6446	138.100	103.300	32
33	8180.80	353.764	25.7009	1.96670	30.4224	30.4225	140.600	103.600	33
34	8433.05	359.826	24.2099	2.04000	31.0329	31.0329	142.200	103.300	34
35	11013.7	377.756	25.9554	2.05000	30.8768	30.8769	142.700	103.400	35
36	8338.57	393.449	27.5185	2.10670	31.1201	31.1202	142.600	103.800	36
37	10186.6	404.880	29.1530	2.14330	31.9584	31.9585	145.200	104.500	37
38	10441.8	407.252	32.8397	2.17670	32.5900	32.5901	145.600	104.800	38
39	10741.2	403.155	23.8864	2.23330	32.9974	32.9974	146.200	104.600	39
40	11137.6	402.201	24.4587	2.28000	33.8374	33.8374	148.700	104.500	40
41	11701.8	374.905	24.2294	2.33000	35.1956	35.1956	153.400	104.800	41
42	12242.0	380.402	23.6737	2.36670	35.2185	35.2185	153.500	104.600	42
43	10236.8	377.746	19.9937	2.38330	34.0025	34.0025	148.200	103.800	43
44	9841.03	379.903	23.7035	2.39330	33.9967	33.9967	149.400	103.000	44
45	9945.39	399.514	28.4668	2.49330	29.0495	32.7288	148.700	102.800	45
46	10895.6	411.273	25.5760	2.57330	30.2275	34.0253	153.300	102.900	46
47	11893.9	421.002	31.2028	2.58670	32.2649	35.5512	159.400	103.800	47
48	11724.2	427.629	36.4441	2.62670	32.1531	35.4524	160.200	104.600	48
49	14142.8	436.011	33.0381	2.70000	32.6016	35.9202	162.500	105.800	49
50	15095.2	451.265	27.2718	2.76330	32.4943	35.6549	161.300	106.700	50
51	13861.1	453.488	23.5892	2.75670	32.7410	35.9776	161.500	107.500	51
52	13086.8	454.002	29.4051	2.83000	33.4411	36.6938	166.000	108.700	52
53	13859.9	474.754	33.7599	2.89670	34.5008	37.1117	168.200	111.700	53
54	14947.1	467.955	36.9311	2.93000	35.2628	38.0130	170.900	116.400	54
55	13047.2	439.066	39.2612	2.98670	36.5780	39.2806	175.200	122.100	55
56	15057.9	467.854	46.8743	3.05670	36.6615	39.3702	175.600	134.700	56
57	15300.8	444.899	46.9545	3.15330	39.0137	42.1478	184.700	144.100	57
58	14035.6	408.119	45.0985	3.33000	41.0212	44.5594	186.600	151.500	58
59	15341.5	414.602	36.4551	3.47330	45.9274	49.9643	203.200	153.400	59
60	11431.3	392.439	28.0825	3.59670	46.2172	50.3582	207.900	152.100	60
61	13044.8	348.398	18.6525	3.73330	45.0223	45.0223	204.800	149.800	61
62	11494.2	388.814	17.8339	3.88670	53.9410	53.9410	241.300	149.300	62
63	10454.4	445.665	22.8366	4.03000	53.0249	55.8157	245.600	151.100	63
64	9499.75	458.748	27.0991	4.15670	52.6147	55.3839	243.700	156.600	64

TABLE C.3 OTHER TIME SERIES

	48 TIME	49 TAX RATE			48 TIME	49 TAX RATE	
1	0.	-.500000	1	33	-.580000E-02	.514100	33
2	0.	-.500000	2	34	0.	.514100	34
3	0.	-.500000	3	35	0.	.514100	35
4	0.	-.500000	4	36	0.	.514100	36
5	0.	-.500000	5	37	0.	.514100	37
6	0.	-.500000	6	38	0.	.514100	38
7	0.	-.500000	7	39	0.	.514100	39
8	0.	-.500000	8	40	0.	.514100	40
9	0.	-.500000	9	41	0.	.514100	41
10	0.	-.500000	10	42	0.	.514100	42
11	0.	-.500000	11	43	0.	.514100	43
12	0.	-.500000	12	44	0.	.514100	44
13	0.	-.500000	13	45	.430000E-02	.514100	45
14	0.	-.500000	14	46	.383000E-01	.514100	46
15	0.	-.500000	15	47	.365000E-01	.467100	47
16	0.	-.500000	16	48	.757000E-01	.467100	48
17	0.	.500000	17	49	.120800	.465000	49
18	0.	.500000	18	50	-.912000E-01	.465000	50
19	.570000E-02	.500000	19	51	.140000E-02	.465000	51
20	.117000E-01	.500000	20	52	.100900	.465000	52
21	.192000E-01	.500000	21	53	-.132400	.400000	53
22	.297000E-01	.500000	22	54	-.852000E-01	.400000	54
23	-.290000E-01	.500000	23	55	-.498000E-01	.400000	55
24	-.192000E-01	.500000	24	56	-.216000E-01	.400000	56
25	-.540000E-02	.500000	25	57	0.	.400000	57
26	.217000E-01	.500000	26	58	.139000E-01	.400000	58
27	.360000E-01	.500000	27	59	.432000E-01	.400000	59
28	.499000E-01	.500000	28	60	.883000E-01	.400000	60
29	-.491000E-01	.500000	29	61	-.827000E-01	.400000	61
30	-.392000E-01	.500000	30	62	-.428000E-01	.400000	62
31	-.403000E-01	.500000	31	63	-.137000E-01	.400000	63
32	-.950000E-02	.500000	32	64	0.	.400000	64