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A STUDY OF THE STRUCTURAL EFFECTS OF AN EXPORT BOOM IN A RESOURCE-BASED OPEN ECONOMY: THE CANADIAN EXPERIENCE, 1962-1983

by

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M.A., Lakehead University, 1972

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ABSTRACT

One significant development in the world growth pattern has been the declining share of the industrial sector in the industrialized economies. This has come to be known as 'deindustrialization'. The literature on this subject falls into two groups. The first group emphasizes demand as the origin of this problem and includes the secular trend and the Cambridge views. The secular view sees structural change as an outcome of society reallocating available resources in response to changing preferences. The Cambridge view finds growing inability of the export sector to pay for imports as the main cause. The second group emphasizes supply phenomena, and includes the Bacon-Eltis and the Dutch-disease views. The former points to rapid expansion of the public sector as the main cause, while the latter explains the problem in terms of resource movement and spending effects.

The present study argues that in a resource-based economy the structural adjustment process follows a cyclical path. A global recovery leads to a resource boom. This triggers structural adjustment mainly through asymmetric sector wage behaviour. Thus, unlike the secular view of gradual transition and the Dutch-disease view of once-and-for-all adjustment, the cyclical adjustment process is of recurring nature.

The main objective is to test the following two hypotheses. First that the structural adjustment process is cyclical, and second that intersectoral asymmetry in wage behaviour plays a crucial role in this process. A two-sector general equilibrium model based on a tradeable-non-tradeable dichotomy is developed. The model uses three prices, one for the non-tradeable and two for the tradeable product. It is assumed that in the long run purchasing power parity

holds. A distinguishing feature of the model is that it is a synthesis of views emphasizing both demand and supply, as main elements of both are formally incorporated in the model. The reduced-form equations are obtained, and then adapted to test the main hypotheses. In order to trace the time profile of the explanatory variables, Almon distributed lags are applied. The results of the empirical tests support the main hypotheses. The main implication is that the wage structure should be made more flexible by eliminating institutional rigidities.

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Finally, my special thanks go to my wife, Hena, for sustaining through the occasional frustrations which are common in all research works, and for proof reading several drafts of this thesis.

Any errors remaining in the transcript are the sole responsibility of the author.

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CHAPTER I

INTRODUCTION

Background:

One of the most significant developments in the world growth pattern has been the declining share of the goods-producing sector in general, and of the industrial sector in particular, in both national income and employment of western industrialized economies. What is more important, the manufacturing sector, considered as the most vital segment of the economy, has declined in absolute terms in some countries. This declining trend has come to be known as 'deindustrialization'. Unlike 'deruralization' which meant a shift of resources from less dynamic to more dynamic sectors of the economy during early years of development, this recent trend represents a shift of resources from the industrial sector to the service-producing sectors - a phenomenon referred to as 'servicization'.

Sometimes, it is argued that servicization is simply a manifestation of changing comparative advantage and that there is no inherent cause for concern[1]. Ajit Singh in his 1977 paper dealing with the decline of the British manufacturing sector, on the other hand, strongly disagrees with this view. He points out the relative contribution of the manufacturing sector to British exports and the balance of payments. But more importantly, he emphasizes the structural characteristics of the manufacturing sector which foster technological progress and productivity growth[2].

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[1]This line of argument has been strongly supported by A.K. Cairncross in his paper presented at the SSRC conference on industrial economics in Oxford in 1975.

[2]This view is shared by many others. Fuchs (1968) for instance, found that the

A stagnating industrial sector therefore, is bound to have some serious long term growth consequences. But more importantly, since structural adjustment in a resource-based economy is postulated to be of a cyclical nature, it will tend to exacerbate the problem of structural unemployment. Moreover, economic fluctuations are an integral part of all market economies, and they are difficult to predict. A cyclical adjustment process, superimposed upon a normal business cycle, will make it even more difficult.

Current views:

There is a significant body of literature dealing with the issue of structural change which can be studied under four categories. Each category represents a view emphasizing a different explanation of this process, and therefore, each seems to have a different policy implication. One of the prevalent views about the process of structural change is that it is secular in nature. Just like during the early years of development there was a secular trend towards industrialization (deruralization), there is now a trend towards servicization (deindustrialization). It is argued that countries first industrialize and then develop into post-industrial societies characterized by a rapidly growing demand for services. The main implication of this secular view is that a structural adjustment process of this type is gradual and hence predictable. Furthermore, since it is a movement dictated by the postulates of efficiency, it amounts to society simply reallocating its resources according to its changing preferences. And hence, there is very little to worry about, as long as it is consistent with the rising standard

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[2](cont'd) annual average rate of growth of productivity in industries was 2.2% compared with only 1.1% in services. This difference, in his view, is too large to be explained by the usual problem of measurement of output in the service industries. Rather, he attributes it to the faster technological progress and greater economies of scale in industries. See also Kaldor (1966 and 1975).

of living.

Another view is found in what is known as the Bacon-Eltis thesis. It suggests that the rapid expansion of the public sector has retarded growth of the manufacturing sector. This is because an expanding public sector attracts additional labour and capital, creating a resource bottleneck for the manufacturing sector. Thus, this view seems to emphasize supply constraints as the main cause of structural change.

Yet another view is expressed in the so-called Cambridge thesis which claims that expansion of the service sector consequent upon the expansion of the public sector is not a cause, but an effect of deindustrialization. The real cause, according to this view, lies in the growing inability of the export sector to pay for rising imports. This inability stems from a slow growth of demand for manufactured goods both in domestic as well as international markets. A variant of this thesis is the product cycle hypothesis which suggests that the decline of the manufacturing sector is a result of shifting of comparative advantage from mature developed economies to newly industrialized economies.

Finally, the Dutch-disease thesis, which emerged from the pioneering work of Gregory in 1976, attempts to show that a resource boom would generally lead to squeezing of the manufacturing sector due to resource movement and spending effects. The Dutch-disease hypothesis does not contradict the secular trend view. It simply suggests that while there may be a secular trend towards deindustrialization, the process is often accentuated due to the Dutch-disease effect resulting from the economy's efforts to adjust to an exogenous shock. However, unlike the secular trend view, this view may have room for active policy.

The present study:

Broadly speaking, the present study falls in the fourth category of studies, because it treats an exogenous export boom in the resource sector as the catalyst. Canada is a resource-based economy. Domestically, the resource sector accounts for a large share of gross domestic product and national employment. And externally, the bulk of its exports consist of natural resources. The export sector in turn, has feedback effects on national income and employment. The broad thrust of the topic therefore, is to examine how Canada's natural resources, which contribute so much to the national wealth and welfare, can have perverse structural effects.

The principal arguments in this study can be summarized as follows:

1. An export boom is demand-induced in the sense that whenever there is an upturn in major western economies, the demand for exports of Canadian natural resources increases.
2. The impact of an export boom is felt in the resource sector with five possible consequences.
   a. An increased profit potential creates an atmosphere favourable for higher wage demands followed by similar wage demands in the rest of the economy.
   b. The expanding resource sector draws in additional labour and capital from other sectors - a resource movement effect.
   c. An increased profit potential may attract additional foreign capital which puts upward pressure on the value of the Canadian dollar.
   d. Rising exports means an improvement in the trade balance, which *ceteris paribus* would lead to further appreciation of the Canadian

dollar.

e. Since resources constitute basic raw materials for the industrial sector, and since a demand-induced export boom means higher prices of these raw materials, there is a further increase in the cost of production in the industrial sector.

3. As a consequence, the industrial sector is squeezed between the rising cost of labour and raw materials on the one hand, and appreciation of the domestic currency, on the other.

The main focus in this study however, is on the structural effects of a resource boom through the impact on relative wages in the economy. It is proposed that acceleration in wage rates in the resource sector following a resource boom is followed by a similar acceleration in the rest of the economy. However, there is an intersectoral asymmetry in the behaviour of wages. Since the industrial sector is generally more unionized than the non-tradeable sector, the acceleration of wages in the industrial sector far exceeds that in the non-tradeable sector. This creates a factor cost disadvantage for the industrial sector *vis a vis* the non-tradeable sector. Such a relative wage disadvantage, *ceteris paribus,* leads to asymmetric sectoral growth. However, the industrial sector may still outperform the non-tradeable sector during the expansionary phase of the business cycle.

However, the scenario during the contractionary phase is quite different. The industrial sector, because of its high degree of unionization, is likely to experience a smaller deceleration in wage increases than the non-tradeable sector. This creates a significant factor cost disadvantage for the industrial sector. This, coupled with other contractionary forces associated with the cycle, exerts a far stronger squeeze on the industrial sector than on the non-tradeable sector. Thus,

there is likely to be a significant asymmetry in the growth pattern of the industrial sector *vis a vis* the non-tradeable sector.

Since the main argument in this study is that an exogenous resource boom has perverse structural effects, it seems to imply that the Canadian economy would be better off without these resources. This is clearly not the case. It is not the resources which are harmful *per se*, but having an economy so heavily dominated by them. The United States has a resource endowment similar to Canada, but it may not suffer from the same adverse consequences because it is a more balanced economy than Canada. Also, because the Canadian economy is relatively more open, it is more susceptible to foreign influences.

Another point worth emphasizing here is that the origin of structural change is not always external in nature. An accommodating monetary and fiscal policy adopted at home can very much be a source of structural change. In the post-war years, the majority of western industrialized countries followed a policy of 'leaning against the wind' in the wake of Keynesian influence. One outcome of this may have been a rapid expansion of the public sector with a shift of resources away from other sectors of the economy. This appears to be the main argument behind the Bacon-Eltis thesis.

The present study differs from most of the previous work in this area in several respects. Firstly, in this study, it is argued that in a resource-based economy, the structural adjustment process follows a cyclical pattern. While this hypothesis does not refute the current views on this issue, it does have different cost implications in terms of loss of output and employment. Unlike the secular view, where the process is gradual over time and therefore predictable, and unlike the Dutch-disease hypothesis, where the process is more

violent, but of once-and-for-all nature, the cyclical adjustment process is of recurring nature. It is argued that even when the process is secular, it is not without some serious consequences. There is considerable evidence in the literature to suggest that the industrial sector fosters growth by generating dynamic forces in the economy.

Secondly, the emphasis here is on a demand-induced boom in the resource sector as opposed to a supply-induced boom discussed in most studies, except Stoeckle (1979) who has considered both types of export booms. Finally and more importantly, a formal model of structural adjustment has been derived. This model has been tested using several specifications of structural change. This is something which has been missing in all previous studies.

Period under study:

The empirical portion of the study covers a period of 22 years, from 1962 to 1983. There is no particular reason for picking 1962 as the starting period except for the fact that finding necessary data on several key variables for earlier periods is extremely difficult if not impossible. It should be mentioned here that the period under study covers Canada's experience with both fixed and flexible exchange rate systems. Canada went to a flexible system in May of 1970. Prior to this, Canada had a fixed exchange rate regime. Since all data series are quarterly, there are 88 observations on each series.

Methodology:

The methodology adopted in this study is both that of partial and general equilibrium. The entire analysis leading up to the theoretical models of structural

change has been undertaken in a partial equilibrium framework. The theoretical models of structural change in Chapter V, however, have been developed within a general equilibrium framework. It is essentially a two-sector model with two product markets, one each for the tradeable and the non-tradeable sectors. There are three prices, one each for the tradeable and the non-tradeable sector, with the third being the foreign price of tradeables. It is assumed that in the long run, purchasing power parity holds. But in the short run, the two tradeable prices may diverge. A distinguishing feature of the model is that it is a synthesis of both views emphasizing demand and supply aspects of the problem, as main elements of both are formally incorporated in the model.

Outline of the study:

The study is divided into two parts. Part one is mainly descriptive providing a background for part two. Part two consists of development of a theoretical framework for analyzing the structural adjustment process in a resource-based economy, as well as a formal derivation of the theoretical models. This is followed by econometric testing of several models of structural change. There are seven chapters in this study. A brief outline follows.

Chapter II presents some empirical evidence on structural change in western industrialized countries during the past 20 years. It provides a review of the current literature dealing with the issue of structural adjustment. And finally, economic implications of structural change are discussed in detail.

Chapter III discusses the nature and composition of Canadian exports. In particular, it emphasizes their exogenous character and evaluates their effects on the value of the Canadian dollar via an improvement in the trade balance. This

chapter also examines the induced nature of capital inflow and evaluates its impacts on the value of the Canadian dollar.

Chapter IV analyzes in detail the structure of the Canadian economy in terms of output, employment and wages. An attempt is made to quantify changes in sectoral composition, both in terms of major sectors as well as in terms of well defined groups of sectors. The asymmetric nature of the sectoral growth patterns is analyzed and its consequences are examined. And finally, the null hypothesis of no cyclical structural adjustment process is tested.

Chapter V develops a theoretical framework to analyze the structural adjustment process in a resource-based economy. In particular, it examines the taxonomy of structural change and highlights the role of the resource sector in transmitting structural change in the Canadian economy. It also contains formal derivations of theoretical models of structural change.

Chapter VI estimates the basic model developed in the previous chapter. The model is tested using four different definitions of structural change. The Almon method of distributed lags is applied in order to establish the time profile of each explanatory variable. A dummy variable has been used wherever felt appropriate in order to capture the asymmetric impact of a given variable during the two phases of the business cycle. Finally, main results of the empirical investigation are summarized.

Chapter VII presents a summary of main findings followed by a brief discussion of policy implications. In particular, a case for a flexible wage system is examined.

CHAPTER II

STRUCTURAL CHANGE: INTERNATIONAL EVIDENCE AND A SURVEY OF CURRENT THEORIES

This chapter first outlines the scheme of classification of sectors and their groups used in this study. This is followed by an examination of some international evidence on structural change. This includes analysis and presentation of time series data for the period 1962-82. Section II-3 examines the issue of interdependence between structural change and economic growth. In addition, several studies on observed statistical relationships explaining the process of structural change are reviewed. In Section II-4 current views on this issue as they are found in some well-known theoretical studies of structural adjustment are reviewed in detail. And finally, economic implications of structural change are discussed in Section II-5

II-1 Scheme of Classification of Sectors

As the subject matter of this thesis is structural change, the explanation of the changing relative size of various sectors and groups of sectors over time is a central concern. It is therefore, imperative to have a clearly spelled out scheme of classification. This study follows the United Nations's International Standard Industrial Classification (ISIC), a practice followed by Statistics Canada and also by the majority of other authors. Keeping with this tradition, a primary sector is defined to include agriculture; fishing and trapping, and forestry. The industrial sector includes mining and quarrying; manufacturing; construction and utilities. Utilities include water, gas and electricity. The primary and industrial sectors constitute the tradeable or the goods-producing sector. And finally, the

non-tradeable sector or the service-producing sector is defined to include finance, real estate and insurance; trade; transportation and communication[1]; community business and personal services; and public administration and defence. Thus, the tradeable and non-tradeable sectors together exhaust the economy. However, in order to make certain points, a new group has been defined or a modified classification has been used in some sections of this study. For instance, a resource sector has been defined to include the primary sector plus the mining sector. And as a result, mining has been excluded from a new definition of an industrial sector. There are some other modified groups of sectors which have been used in this study. All these changes are made expressly clear at the appropriate time.

II-2 Some International Evidence On Structural Change

One of the most striking features of world growth patterns in recent years has been a relative decline of the goods-producing sector as a whole, in both developed and developing countries[2]. But the similarity ends there. While in the developed countries, both the industrial and primary sectors (the two groups constituting the goods-producing sector) experienced a decline, in the developing countries, only the primary sector experienced a decline. The industrial sector, on the other hand, has shown a steady increase in its share. This has been made possible because of a sharp decline in the relative share of the primary sector which still accounts for about one-third of the total GDP in these countries. The

---

[1]Fuchs (1964) includes this in the goods producing sector. But I have chosen to follow Dowie (1966) and Deakin and George (1965) and have included it in the service-producing sector. Deakin and George use the criterion that a sector producing a service rather than a tangible, material commodity, should be considered as a service sector. Worton (1969) also followed the same practice.

[2]See Shelp (1981) and Kadar (1984) for an excellent review of the subject.

decline of the primary sector in the developed countries, on the other hand, has been only marginal as this sector has already become a very small proportion of the total economy. Another noteworthy point which emerges from this analysis is the increase in the relative size of the service-producing sector in both groups of countries. However, the increase has been more steady and pronounced in the industrialized than in the developing countries. Time series behaviour of major sectors in both the developed and the developing countries is depicted in Figures II-1a and II-1b[3].

A comparison of growth patterns of the two groups of countries is interesting, and merits empirical investigation on its own. However, the present study concentrates on the industrialized countries alone. Table II-1 shows the share of industry as a percentage of total GDP for nineteen industrialized countries. A close examination of the table reveals the following main points.

Period: 1962-72

1. The average decline of the industrial sector for the group as a whole amounted to 1.96 percentage points, from 40.90 in 1962 to 39.03 in 1972.
2. Of the twelve countries experiencing a decline, eight countries recorded a decline equal to or larger than the average decline for the industrialized countries as a whole.
3. The share of industry actually rose in seven of the nineteen countries.
4. West Germany consistently recorded the highest share, 53.48 in 1962 and 49.18 in 1972. New Zealand has the lowest share, while Japan shows the most stable pattern throughout this period.
5. The United States, Australia and Germany experienced a decline of about 4

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[3]Source: International Financial Statistics, IMF.

Figure II–1a
Major sectors as percentage of GDP in industrial countries, 1962–81

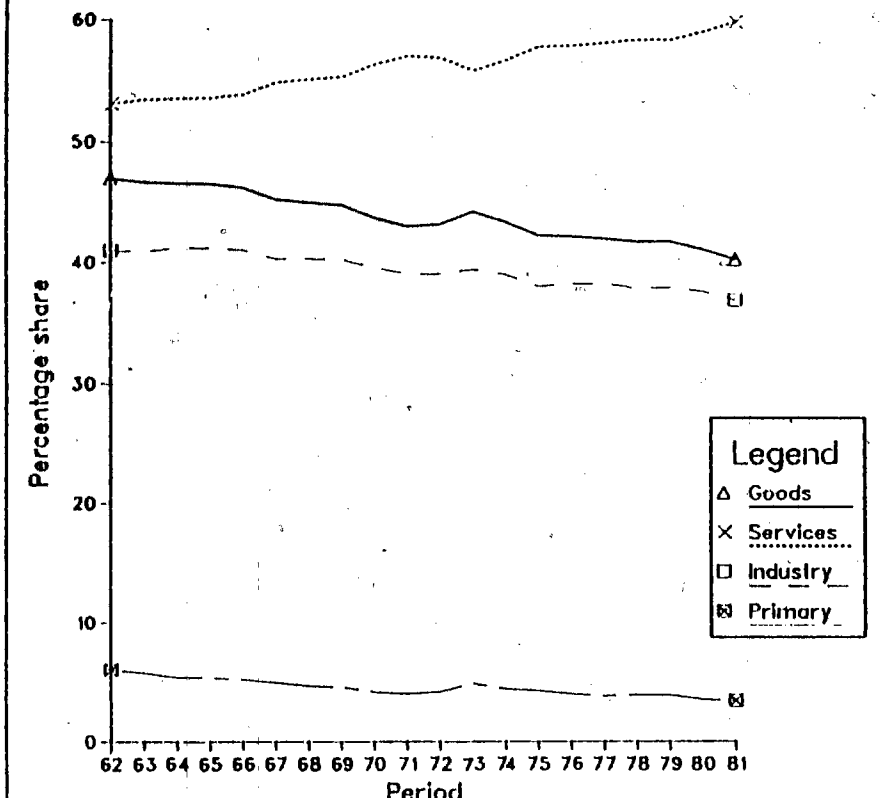

Figure II–1b
Major sectors as percentage of GDP in developing countries, 1962–81

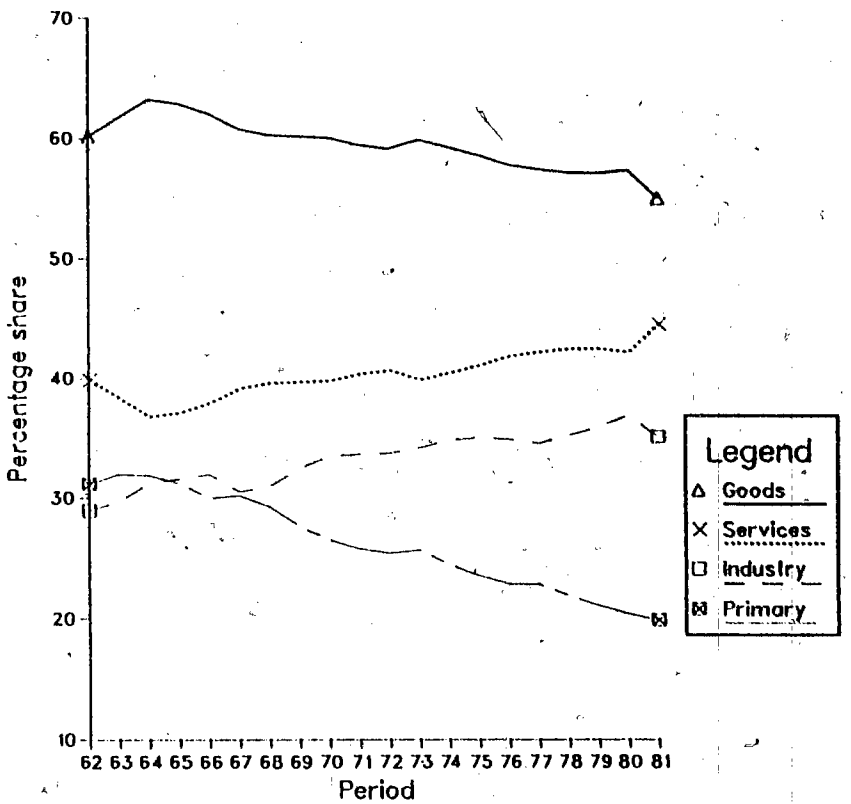

Table II-1

Industry as percentage of GDP[1] in developed countries, 1962-82.

Countries	Actual share				Change in share		
	1962	1972	1973	1982	1962-72	1973-82	1962-82
USA	37.82	33.55	33.45	31.02	-4.27	-2.43	-6.80
Canada	38.56	35.76	36.69	33.02	-2.80	-3.67	-5.54
Australia	40.76	36.58	35.72	34.84	-4.18	-0.88	-5.92
Japan	45.47	45.58	46.03	43.27	+0.11	-2.76	-2.20
New Zealand	31.94	31.07	30.41	32.07	-0.87	+1.66	+0.13
Austria	47.03	45.94	45.79	40.19	-1.09	-5.60	-6.84
Belgium	42.65	41.55	41.71	36.43	-1.103	-5.28	-6.22
Denmark	36.77	49.12	48.81	38.95	+12.35	-9.86	+2.18
Finland	37.61	39.19	39.98	36.84	+1.58	-3.14	-0.77
France	41.90	40.95	40.41	36.46	-0.95	-3.95	-5.44
Germany	53.48	49.18	48.81	43.36	-4.30	-5.45	-10.12
Ireland	35.66	35.68	35.77	35.54	+0.02	-0.23	-0.12
Italy	42.09	42.20	43.22	42.76	+0.11	-0.46	+0.67
Luxembourg	53.75	46.09	46.48	30.14	-7.66	-16.34	-23.61
Netherlands	41.91	38.59	38.09	34.28	-3.32	-3.81	-7.63
Norway	33.45	34.93	34.25	41.13	+1.48	+6.88	+7.68
Spain	38.29	39.70	40.20	38.14	+1.41	-2.06	-0.15
Sweden	44.93	39.41	39.99	34.41	-5.52	-5.58	-10.52
UK	46.32	42.32	42.03	39.19	-4.00	-2.84	-7.13
Ind. countries	40.96	39.03	39.40	36.82	-1.93	-2.58	-4.14

[1]GDP at factor cost.

N.B. Actual periods covered by each country are as follows: Australia (1962-80), Japan (1962-81), New Zealand (1971-82), Austria (1964-82), Belgium (1962-81), France (1962-81), Germany (1962-81), Ireland (1970-79), Italy (1962-81), Luxembourg (1970-81), Netherlands (1962-79), Spain (1964-77), Sweden (1963-82), Industrial countries (1962-81)

Source: International Financial Statistics, IMF, Supplement on output, no. 8

percentage points, while Canada had a smaller decline of about 2.80 percentage points.

Period: 1973-82

1. The average decline for the group of nineteen countries amounted to 2.58 percentage points, from 39.40 in 1973 to 36.82 in 1981. This is a much larger decline than recorded in the first period.
2. Of the seventeen countries experiencing a decline in this period, twelve had a decline equal to or larger than the average decline for the industrialized countries as a whole.
3. Only two countries, New Zealand and Norway, actually experienced a rise in the share of industry as opposed to seven countries in the first period.
4. West Germany managed to show a consistently higher share than any other country once again. Japan was a close second in this respect.
5. Canada had a decline of 3.67 percentage points from 36.69 in 1973 to a low of 33.02 in 1982. This is a much larger decline than the one experienced in the first period.

On the basis of this analysis one can draw two broad conclusions. First, that the industrialized countries have indeed experienced a significant decline in the share of industry over the entire period, 1962-81. And second, that the decline has actually accelerated in the second period. It is also important to mention that in the case of each individual country as well as for the industrialized countries as a whole, the share of industry showed a significant decline following the two OPEC oil shocks. This is in conformity with the expectations of the Dutch-disease hypothesis.

II-3 Interdependence of Structural Change and Economic Growth

Structural change and economic development are sometimes used interchangeably, both dealing with the issue of patterns of growth[4]. Notwithstanding the problem of simultaneity, this interdependence is one of the widely studied topics in economics[5]. Both Chenery (1961) and Fels, Schatz and Wolter (1971) have found some interesting statistical relationships between structural change and level of income. The latter study, however, is more directly related to this study as it deals with structural change in developed countries. Fels, Schatz and Wolter, while working at the Kiel Institute of World Economics, estimated functions relating sectoral shares in GDP to a set of variables. They estimated this function both using international cross section data for high income countries as well as time series data for Germany. Among the explanatory variables, they used per capita income, size of population, the relative degree of industrialization, the shares of imports and exports in total GNP and share of consumption in GNP. They found that per capita income was the single most important determinant of structural change.

Kasper (1978) explains why per capita income is so important in explaining structural change. First, as income rises, capital-intensive activities are favoured because of faster accumulation of capital. This process is further reinforced because capital-intensive activities lend themselves to large economies of scale. Second, rising income is also consistent with accumulation of human capital.

---

[4]The distinction between economic development and growth is sometimes explained by the analogy that a caterpillar can grow and grow but it is yet to develop into a butterfly. However, concealed in this analogy is the problem of simultaneity. All growth has some structural effects and all structural changes have some growth effects.

[5]Clark (1957), Hoffman (1958), Kuznets (1966), Chenery (1961), Chenery and Syrquin (1975), Fels, Schatz and Wolter (1971), are some of the well known studies.

Third, rising income influences the elasticity of demand. As he puts it,

> "Income elasticities are frequently a function of the income level, they may at first rise and fall again at high incomes. This is, e.g. the case with many industrial products whose consumption approaches saturation levels, which may partly explain the reversal in manufacturing shares" (1978, pp. 97).

Fourth, asymmetric sector productivity increases and demand trends lead to changes in relative prices which ultimately influence demand.

The simultaneous occurence of deindustrialization (decline in the relative size of the industrial sector) and servicization (increase in relative size of the service-producing sector) in recent years has narrowed the focus of attention to tradeable vs. non-tradeable sectors[6]. There are three main reasons commonly given for the relative growth of the service producing sector. First, it is sometimes claimed that as income rises, the income elasticity of demand for services rises. Referring to this, Worton writes,

> "The essence of this hypothesis is that as income per capita rises and a certain standard of goods consumption is achieved, further increments in income tend to be channeled in greater proportion towards spending on additional services rather than on additional goods" (1969, pp. 257).

However, the elasticity issue in the service-producing sector is marred by several problems, the accurate measurement of output being the most serious one. Besides, demand is affected by many other factors such as changes in relative prices and changes in tastes, technology, distribution of income and degree of urbanization. Therefore it is more appropriate to see if in fact, services as a whole face a more income elastic demand schedule than goods.

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[6]Despite some imperfections, it is assumed here that the goods-producing sector is tradeable while the service-producing sector is non-tradeable. This is not to deny that a significant portion of the output of the service-producing sector is actually tradeable.

A rapid rise in real output is generally taken to imply a stronger elasticity of response to the combined effect of all factors. Fuchs (1965), working with U.S. data for the period 1929-63, found that the differential growth rate was only marginally in favour of services. Thus, he concluded that the income elasticity of demand for services was only slightly higher than for goods. He also regressed changes in expenditure per capita on changes in income per capita for the period 1939-58 using cross section data for 48 states and found that the income elasticity of demand for services was 1.15 compared with 1.00 for goods. Worton (1969), working with Canadian data for the period 1946-66, also reached a similar conclusion[7].

Second, the differential growth rate is sometimes explained in terms of asymmetric sector growth in productivity. Fuchs (1965) found that output per man grew faster in goods than in service producing sectors. Thus, the productivity differential does not appear to provide a valid explanation of relative growth of the service-producing sector. However, he also notes that during the same period, both the capital/labour ratio and the average quality of labour rose faster in the goods-producing sector. Thus, it is very difficult to draw any conclusion in this respect. Third, he observed that the degree of unionization in the goods producing sector rose faster than in the service-producing sector. Also, a large part of the service-producing sector was exempt from minimum wage legislation. These two factors were responsible for a change in relative input prices in favour of the service-producing sector. The third point is of paramount importance in the present study.

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[7] In my own estimate of the differential growth rate using quarterly data on GDP in constant dollars for the period 1962-83, I found an annual average growth differential of .82 percentage points in favour of service-producing sector.

II-4 A Survey of Main Theoretical Developments

A great deal of theoretical development in the area of structural adjustment processes has taken place in the past twenty five years. The following is a brief survey of these developments, grouped under four headings.

The secular trend view:

The entire discussion in the preceding section is in the spirit of the secular trend view of structural change. As income rises above subsistence levels, the proportion of income spent on goods with high primary commodity content falls. This process is reinforced by rise in the tertiary and the government sectors on the one hand, and by technological innovations in the secondary sector, on the other. At this stage of development, both the secondary and the tertiary sectors grow at the cost of the primary sector. As a higher level of economic development is reached, the tertiary sector grows at the cost of the secondary sector, as the size of the primary sector is stabilized. To quote Kadar,

> "The predominance and continued expansion of the sector of services cannot be abstracted from changes in proportions of the two other sectors, i.e., agriculture and industry. In the quarter-century following World War II, the spread of the industrial and service sectors was attained, at least in part, at the cost of human and material resources pumped away from agriculture; as a result, the share of the latter declined rapidly. In the last decade, however, this decline has considerably slowed down; the share of agriculture in GDP never did fall below 3 per cent, and seems to get stabilised somewhere between 3 and 4 per cent.... As a result of agriculture's declining role in feeding the growth of the other two sectors, further expansion of the service sector relies now upon the growth energies pumped away from industry rather than from agriculture" (1984, pp. 31).

In the neoclassical world, growth comes from an increased volume of resource inputs and from growth of knowledge. In this framework, the ability of the market economies to efficiently allocate these resources is mostly taken for

granted. As Cripps and Tarling put it,

> "The mainstream of economic theory has tended to assume that capitalist economies are, to a sufficient degree of approximation efficient in their use of resources at each point of time and that this efficiency is the result of market competition. This implies that growth depends on the provision of more resource inputs and on advances in knowledge" (1973, pp. 1).

. In this world of balanced growth, there is no room for structural change. However, the neoclassical model is not so rigid as to deny any change in tastes and preferences of the society. But even this does not pose any problem, because in this case a society will be simply reallocating its resources according to the changed preferences and there is no efficiency implication.

This view has an important policy implication. Since structural change is a process from one equilibrium to another, and since the process is in conformity with the postulates of efficiency, there is little room for active policy. The process of deindustrialization as defined in this study is, therefore, simply a manifestation of society's changing preferences for more services. Although this secular view of structural change has no direct bearing upon the present study, it is important to note that there are those in the profession who take issue with this view. See Cornwall (1980), Thirlwall (1982), Kaldor (1966, 1975), Singh (1977), Cripps and Tarling (1973). To quote Singh

> ". . . there is a great deal more solidly based relevant evidence concerning the dynamic role of the manufacturing sector in economic growth. For instance, Cripps and Tarling (1973), in their analysis of growth process in advanced industrial countries during 1950-70, have confirmed Kaldor's hypothesis that there is a close relationship between the rate of growth of a country's GDP and the growth of its manufacturing sector. This relationship is much closer than would be expected (since manufacturing is quite a large component of GDP) on purely statistical grounds; it is also closer than that observed between the growth of GDP and of other sectors of the economy. Therefore, from the point of view of the future growth potential of the economy, a shrinkage in its manufacturing sector is clearly a cause for legitimate concern" (1977, pp. 123).

Similarly, Thirlwall says,

> "Manufacturing growth has often been described as 'engine of growth', and with good reason. There is a strong association across countries between the importance of manufacturing in the total economy and the level of per capita income, and between the growth of manufacturing output and the growth of gross domestic product" (1982, pp. 27).

The present study is important because it is expected to add to our understanding of the nature and causes of the process of structural change.

The Bacon-Eltis (1978) view:

This view of structural change suggests that a rapid expansion of government expenditure on non-marketable output and particularly on public services has retarded the growth of the manufacturing sector. This is because an expanding public sector means a shift of both capital and labour away from the industrial sector creating a resource bottleneck for these sectors. The public has not been willing to pay for increased non-marketable output by higher taxation and a reduction in the consumption of marketable output (downward rigidity of private consumption). Therefore, the increased government spending is matched by a reduction in savings, investment, and net exports. The net result is an acceleration of wage claims by trade unions which are either passed through to prices, or there is a fall in the profit margins. Although the main focus of the Bacon-Eltis study was the decline of British manufacturing, they have analyzed both U.S. and Canadian data and arrived at the same conclusion.

This view of structural change has been criticised both on theoretical and empirical grounds[1] In a recent paper Adachi (1984) developed a rigorous model and tested the Bacon-Eltis thesis. His findings are different under different assumptions. One of his main findings is that the cumulative expansion of the non-market sector has taken place as a result of full employment policy

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[1]See Thirlwall (1982). Adachi (1984) has an excellent review.

implemented by the government. But this has happened only in a situation where entrepreneurs' desires for investment have been too low or unions' demands for wages have been too high. Thus, according to him, the real cause of deindustrialization lies in the low propensity to invest and high demand for wages rather than in non-market sector growth.

Furthermore, implicit in the Bacon-Eltis thesis has been the assumption that the allocation of resources by the government is inefficient, or at least not as efficient as allocation by the market. Since the validity of their thesis is so heavily dependent on the validity of this assumption, it should have been made explicit. To sum up, it may be said that if rapid expansion of the public sector has indeed led to a shift of resources away from the manufacturing sector, and if it is true that government is less efficient an allocator of resources than the market, then such structural change appears to be unattractive.

The Cambridge view:

A number of studies suggest that the expansion of the service sector is not a cause as advocated by the Bacon-Eltis thesis, but an effect of deindustrialization. See Singh (1977), Cornwall(1977), Thirlwall (1978) and Cairncross (1979). According to this thesis, the real cause lies in the growing inability of the export sector to pay for imports. Such an inability stems from a slow growth of demand for manufactured goods both in the domestic as well as in the international markets[9] Deindustrialization, therefore, becomes a demand problem

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[9]Singh (1977) for instance, emphasizes the higher income elasticity of demand for imports and low income elasticity of world demand for British exports as the main cause of deindustrialization. This divergence, according to him, is due to deficiency on the supply side. It indicates that the manufacturing sector responds ineffectively to changes in domestic and foreign demands. Thirlwall (1978) found that of 113 manufacturing industries studied, in 30 cases UK income elasticity of demand for imports was greater than two. Only in a few cases, was the income elasticity of exports greater than that for the imports. And when it occured, the

in which the service sector behaves like an employer of the last resort.

The line of argument put forward by Thirlwall can be illustrated by a simple example. Suppose a country's income elasticity of demand for its imports is greater than the world income elasticity of demand for its exports, and that trade is limited to the visible trade account in manufactured goods. Suppose further that the rate of growth of productivity in manufacturing is exactly equal to the rate of growth of output in manufacturing and the rate of growth of world output. In this situation, the current level of employment is not sustainable, assuming there is no currency depreciation. This will be the case despite the fact that growth of productivity is enough to allow the current growth of output. This is because the rate of growth of imports will far exceed the rate of growth of exports, creating a deficit on the current account. Therefore, the rate of growth of output must be reduced to match the rate of growth of exports. This would mean a reduction in the level of employment in the manufacturing sector. Thirlwall says,

> "In the long run, no country can grow faster than at that rate consistent with balance of payments equilibirum on current account, and if the real terms of trade do not change much this rate is determined by the rate of growth of export volume divided by the income elasticity of demand for imports. Attempts to grow faster than this rate mean that exports cannot pay for imports, and the economy comes up against a balance of payments constraint on demand, which affects the industrial sector's ability to grow as fast as labour productivity" (1982, pp. 33).

The Cambridge view is often criticised on the ground that it ignores what seems to be an obvious and simple solution to the problem, namely depreciation of the currency. However, Posner and Steer (1979) argue that the benefits of depreciation would be short-lived. They maintain that wage and price levels would adjust so quickly to depreciating currency that any profit incentive to the

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'(cont'd) income elasticity of demand for imports was low in absolute terms.

exporters would vanish even before any significant response in quantity exported is felt. They further argue that the non-price aspects of foreign competition such as delivery dates, quality of products, design, performance and long-run servicing etc, would act against any lasting benefits from depreciation.

A variant of the Cambridge thesis is found in the view that the decline of the manufacturing sector is a result of shifting of comparative advantage from mature developed countries to the newly industrialized economies. This line of argument is central to the so-called product cycle hypothesis. With the passage of time, technology becomes an internationally mobile factor. This, combined with the benefit of lower labour cost, gives the newly industrialized countries a clear competitive edge. It is therefore, believed that recent trade liberalization and the resultant increase in international competition would mean a continuation of the present declining trend in the manufacturing sector in the developed countries.

The Dutch-disease view:

A great deal of interest has been shown in the analysis of the phenomenon involving structural change which takes place as a result of a sudden boom in one of the resource sectors of a small open economy. In the literature, this is widely referred to as the 'Dutch-disease', after Holland's experience following a massive natural gas discovery in the 60's. Since then, Norway and the UK have gone through a similar experience following North Sea oil discoveries. The Australian mineral development in the late 60's and early 70's is regarded by some economists to have created a comparable situation.

The Dutch-disease hypothesis and its impact on the process of structural adjustment is usually explained in a model consisting of three sectors. The three sectors are the booming sector, the lagging sector and the non-tradeable sector.

The first two are generally identified as the resource sector and the manufacturing sector respectively and they together comprise the tradeable sector. The process of deindustrialization in the Dutch-disease framework involves two major effects. First, there is a resource movement effect following the boom in one of the resource sectors. The boom causes a rise in the marginal product of the mobile factor, labour. This, at a constant wage, leads to a movement of labour away from both the lagging and the non-tradeable sector and into the booming sector. The movement of labour from the lagging sector is commonly known as direct deindustrialization. It does not involve the non-tradeable market and hence there is no change in real exchange rate.

There is a second round of deindustrialization which is caused by the movement of labour away from the non-tradeable sector. The supply curve in the non-tradeable sector shifts inward creating an excess demand for non-tradeable output. This leads to real appreciation (rise in non-tradeable price as a ratio to tradeable price). As a result, there is additional movement of labour away from the lagging sector and into the non-tradeable sector.

The second major mechanism through which structural adjustment takes place is known as the spending effect. The booming sector causes income to rise. This additional income creates an excess demand for non-tradeable output. This can happen either directly because of additional spending by factor owners or because of additional spending by the government following an increase in tax revenue. As a result, there is further real appreciation which draws resources out of both the booming and the lagging sectors and into the non-tradeable sector. The structural change following the two rounds of real appreciation (one from the resource movement effect and the other from the spending effect) is generally known as indirect deindustrialization. It is obvious from the above that

the lagging sector is unambiguously squeezed. However, the effect on the non-tradeable sector is not so clear, as it depends on the relative magnitude of the spending effect and the resource movement effect. If the spending effect dominates the resource movement effect, then the net effect on the non-tradeable sector will be expansionary, and contractionary if the latter dominates the former.

A whole spectrum of studies emerged following the pioneering work of Gregory in 1976[10]. Gregory has shown that the rapid growth of the mineral industry in Australia has put an squeeze on the traditional export sector as well as on the import-competing manufacturing sector. In fact, he has established that the effect on the exporting sector is equivalent to a doubling of tariffs, and on the import-competing manufacturing sector, to bringing the tariff rate down to zero and offering import subsidies. His entire analysis works through the mechanism of exchange rate appreciation. The rapid growth of the mineral sector causes the relative price of tradeables to non-tradeables to fall. In the traditional export sector, the price received declines leading to a reduction in the quantity exported and therefore, a decline of this sector. In the import-competing manufacturing sector, the price of imports falls which means a rise in quantity imported, and a consequent contraction of this sector.

Corden, in his 1981 paper, examined the impact of the North Sea oil discoveries on the UK manufacturing sector. He came to the conclusion that the

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[10]Corden, in his 1984 paper, divides existing studies in this field into two groups. The first group consists of models which have considered only the spending effect. These include Gregory (1976), Forsyth and Kay (1980), Buiter and Purvis (1982), Bruno and Sachs (1982), Corden (1981), Van Wijnbergen (1984), Eastwood and Venables (1982), and Enders and Herberg (1983). The second group of studies has considered both the spending and the resource movement effects. They include Snape (1977), Stoeckel (1979), Long (1983), Corden and Neary (1982), and Neary and Purvis (1982).

massive flow of revenues together with the tight monetary policies pursued by the authorities during the late 70's and early 80's led to a decline of the manufacturing sector. The restrictive monetary policy meant additional appreciation of the pound sterling due to high rates of interest and the subsequent increase in capital inflows. He examined the impact of the oil discoveries under the assumption that the oil projects were financed by capital inflows. However, he could not separate the impact of the oil discoveries from that of restrictive monetary policy because the latter becomes endogenous in a truely dynamic setting[11].

Stoeckel (1979) also considered both the spending and the resource movement effects in a general equilibrium setting. But more importantly, he considered both demand and supply-induced booms. He shows that in a general equilibrium setting, a supply-induced export boom will have some expansionary effect on the import-competing manufacturing sector. However, if the export boom is of demand-induced nature, which he claims to be the case following the Australian mineral boom, then the exchange rate effect will be smaller, but the over all effect on the manufacturing sector will be contractionary.

In an unpublished doctoral dissertation (1985), entitled "Dutch Disease: The Perverse Effects of a Resource Boom in a Small Open Economy", H. Salehi-Esfahani analyzes the adverse welfare effects of a resource boom under three assumptions. These assumptions are, (1) existence of economies of scale in the tradeable sector, (2) existence of imperfect competition in the market for tradeable output, and (3) imperfections in the labour market. He reaches the

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[11]Corden, in his 1984 paper, has tried to widen the scope of the Dutch-disease hypothesis by addressing the issues of immigration, domestic absorption and endogenous terms of trade. Moreover, he has examined both the spending and the resource movement effects in a dynamic setting.

conclusion that under these assumptions, the tradeable sector will experience a relative decline and that this decline will have a negative welfare effect. The whole process takes place through appreciation of the real exchange rate which in turn, affects relative profitability in the two sectors. As he puts it,

> "It is shown that a resource boom, usually thought of as synonymous with prosperity, may in fact exacerbate externalities and imperfections inherent in the economic system, causing a decline in consumption and a subsequent loss of welfare" (1985).

His analysis of deindustrialization under the third assumption is of some relevance to the present study. He has considered two types of imperfections in the labour market. The first, which he calls a distortionary wage tax system, assumes that labour is homogeneous in the two sectors in the sense that there is no difference in productivity. But the distortionary wage tax system creates a wedge between the gross returns to labour in the two sectors. However, under a perfect mobility assumption, all labour is paid a wage equal to the value of its marginal product. He argues that following deindustrialization, some labour moves from the tradeable sector (high gross returns) to the non-tradeable sector (low gross returns). The consequent loss of income and consumption means a loss of welfare.

The second kind of imperfection arises due to imperfect knowledge. Unlike the first case, here labour has different productivities in the two sectors. This difference is unobserveable by employers and following Stiglitz (1975), a no-screening equilibrium exists where the wage is equalized between sectors. He makes the crucial assumption that the high productivity (skilled) worker performs more productively in the tradeable sector than in the non-tradeable sector. In this characterization of the labour market, he has drawn upon Van Wijnbergen (1984) in that the process of learning-by-doing takes place mainly in the

manufacturing sector.

Thus, to the extent that deindustrialization leads to a movement of skilled labour from the tradeable to the non-tradeable sector, there is a loss of production of tradeable goods. This is primarily because of loss of some highly productive workers who perform better in the tradeable sector than in the non-tradeable sector. This loss is not compensated by a rise in the production of non-tradeable goods, since same labour performs less productivley in this sector. There is, therefore, a net loss of income which may not be offset by the resource boom.

There are two main points which seem to emerge from the Dutch-disease analysis. First, there is nothing in the Dutch-disease hypothesis which contradicts the secular trend view on this issue. Since the Dutch-disease effect is an outcome of some exogenous shocks, it only accentuates the process of structural adjustment. Second, since the effect is once-and-for-all with the possibility of reversal after the boom is over, there is room for active policy[12].

II-5 Economic Implications of Structural Change

This recent trend towards servicization has some important economic implications. The following is a brief account of the main implications.

1. Implications for Growth and Stability

A structural change which is characterized by growing importance of the service-producing sector would mean a slower rate of overall economic growth

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[12]An analysis of cross section international data in the preceding section showed that the two oil shocks were indeed followed by a sharp decline in industry as a percent of total GDP in most of the industrialized countries.

in future. As Maddison aptly puts it,

> "In the past there was always some structural drag from movement into the slow-growing service sector, but this was compensated for by its being a relatively high productivity sector. Now, however, this drag is much bigger than it was. The service sector is bigger than it was in the past, the level of service productivity is lower than that in industry, and deindustrialisation of employment in favour of services is increasingly prevalent" (1987, pp. 667).

There is however, some evidence to suggest that the service producing sector is less sensitive to business fluctuations than the goods-producing sector. There is a greater flexibility in the compensation system due to prevalence of commission, tips and self-employed incomes. This together with limited presence of unions allows this sector to adjust to changing business conditions. Moreover, the non-profit and public sectors are the two growing segments in this group. And these sectors are relatively insensitive to changing market conditions.

2. Implications for Labour Force and Business Profile

There is evidence to suggest that the service-producing sector has a greater portportion of female and part-time workers than the goods-producing sector. In addition, a significant portion of the labour force is unskilled or semi-skilled. This may have implications for the changing profile of labour force in this sector. Moreover, this sector is characterized by small size of operations. All this, *ceteris paribus*, means a lower degree of unionization.

3. Implications for Changing Social Structure

The service-producing sector is characterized by the coexistence of good and bad jobs. This good job-bad job scenario is claimed to manifest itself in the gradual disappearance of the middle class. See Petit (1986). However, the Petit thesis on income distribution has been attacked widely. There seems to be

little empirical support for this thesis in Canada.

4. Efficiency Implication in Resource Allocation

The growing importance of the service-producing sector could mean a less efficient allocation of resources provided the public sector plays a greater role in the provision of services than goods, and if allocation of resources by non-market forces is less efficient than allocation by market forces.

5. Implications for Trade and Balance of Payments

The growing size of the service-producing sector is creating a concern among the industrialized countries. A gradual loss of export markets for goods would mean serious balance of payments problems in the future unless trade in services grows fast enough to pick up the slack. The industrialized countries first lost their competitive advantage in labour intensive industries with standardized technologies and short production runs, and then in capital intensive industries with long production runs. On the other hand, the export of services has been growing at a much slower rate than either the rate of decline in merchandise exports or the rate of growth of the service-producing sector. This has led in recent years to a call for efforts to liberalize trade in services.

Grubel (1986a 1986b) does not share this concern. He divides services into two broad categories, namely, consumer services (both marketed and non-marketed) and intermediate producer services. His empirical findings suggest that it is the second category which has been growing rapidly in recent years while the first has shown no significant growth. There is no direct trade in the first category primarily due to the local character of this group, while there is some direct trade in the second category. But the bulk of trade in the second

category is embodied either in people, capital or goods. It is the slow rate of growth in the direct trade of the second category which is a cause for the recent concern. There have been in the past some restrictions on trade of services embodied in people and capital. These restrictions are likely to continue in the future. However, trade in services embodied in goods has been growing rapidly. And therefore, there is no need for a separate international arrangement for trade in services similar to one for goods. What is needed is a liberalization of trade in goods generally[13].

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[13]While this argument shows the futility of having a separate GATT for trade in services, it is not immediately clear how it will mitigate the balance of payments problem associated with the process of servicization. If the problem is due to a falling demand for a country's merchandise exports, the fact that trade in services is of an embodied nature has little bearing on the problem.

CHAPTER III

STRUCTURAL EFFECTS OF DEMAND-INDUCED EXPORT BOOMS

In this chapter, an argument is made that a high degree of openness combined with a strong resource orientation makes the Canadian economy quite susceptible to external shocks. Consequently, there is an increased propensity towards structural change. Section III-1 of this chapter examines in detail the structure and composition of Canadian exports over time. The following section shows that export booms in Canada are by and large of a demand-induced nature[1]. It is argued that a demand-induced export boom will have a different structural implication than an export boom of a supply-induced nature. In Section III-3, an argument is made that an export boom in a resource-based economy would, *ceteris paribus,* encourage capital inflow. In other words, capital inflow is of an induced and not autonomous nature. This is verified empirically using a regression analysis. The final section argues that the balance of payments effect of an export boom would tend to put upward pressure on the value of the Canadian dollar. That is, in a world in which the Marshall-Lerner condition holds, an export boom would be a mixed blessing as it would tend to squeeze the non-resource tradeable sector.

III-1 Structural Composition of Canadian Exports

This section briefly examines the time series behaviour of various categories of exports over the period 1973-83[2]. The main features are summarized in Table

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[1]It should be pointed out that the terms 'export boom' and 'resource boom' have been used interchangeably in this study. Since Canadian exports are dominated by exports of natural resources, an export boom would also mean a resource boom, because the bulk of the resource output is exported.

[2] Data for earlier periods are not available at this level of disaggregation.

III-1[3]. An examination of the table reveals the following points. Firstly, two categories which between them account for about three-quarters of total domestic exports are fabricated inedibles and end products, the latter being the largest component of domestic exports. The categories representing crude inedibles and food and beverages account for 13.43 and 10.00 percent of total domestic exports respectively, while the category representing live animals is quite insignificant in this respect. Secondly, about one-fifth of domestic exports consists of autos and auto parts, accounting for about 46 percent of the end products category. This segment of the export sector is governed by bilateral agreements with the United States rather than by forces of demand and supply in international markets.

Thirdly, exports of natural resources in the narrow and broad senses account for 23.84 and 55.14 percent of total domestic exports respectively[4]. This high percentage clearly indicates the resource-based nature of the Canadian economy. Fourthly, total domestic exports grew at an annual average rate of 3.40 percent over the entire period under study. This rate was exceeded by live animals (9.40 percent), end products (5.93 percent), food and beverages (5.25 percent) and fabricated inedibles (4.22 percent). It is worth mentioning that the high rate of growth of the end products category was mainly due to exports of autos and auto parts, which grew at an annual average rate of 6.23 percent. Fifthly, the

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[3]All figures are in real terms. All values have been deflated by their respective export price indexes. Since there is no appropriate price index available for autos and auto parts, the value for this category of exports has been adjusted by using the price index for total domestic exports.

[4]Two versions of exports of natural resources have been used in this study. The narrow definition (NRN) includes live animals; food and beverages and crude inedibles. The broad definition (NRB) includes all those in the narrow definition plus exports of fabricated inedibles. The rationale for including fabricated inedibles is that this category basically consists of items characterized by their heavy resource content. At best, these can be classified as intermediate goods.

Table III-1

Structural and time series behaviour of Canadian domestic exports, 1973-83.

Categories	% Share		Mean % share	Change in % share	Mean annual growth rates
	1973	1983	1973-83	1973-83	1973-83
Live animals	0.44	0.49	0.41	+0.05	22.88
Food & bever.	9.82	11.43	10.00	+1.61	5.44
Crude inedibles	19.63	8.93	13.43	-10.70	-1.73
Fab. inedibles	31.99	29.90	31.30	-2.09	4.46
End products	37.95	48.30	44.51	+10.38	6.24
Autos & parts	21.76	24.20	20.30	+2.44	7.25
N. res. narrow	29.89	20.85	23.84	-9.04	-0.23
N. res. broad	61.88	50.75	55.14	-11.13	1.53
Total exports	---	---	---	---	3.45

N.B. The first five rows may not sum to 100 because special transactions have been excluded.

Source: Summary of External Trade, Stat. Can., cat. no. 65-001.

percentage share of export of natural resources declined, both in the narrow and broad senses, over this period. This may appear to suggest that the importance of the resource sector declined in this period. However, a comparison based on two specific points in time can be misleading. A more accurate picture would emerge from examination of Figure III-1 where the share of exports of natural resources in total exports has been traced over time. It seems that the share in both the narrow and broad senses has declined in a cyclical fashion.

A related aspect of the structural behaviour of Canadian domestic exports is the relative performance of the various categories of exports in international trade. Traditionally, relative trade performance of a sector is measured in terms of what is commonly known as trade ratios. See Balassa (1967). A trade ratio is defined as (export-import)/(export+import). Its value lies between +1 and -1. A value of +1 indicates a complete trade advantage while that of -1 indicates a complete trade disadvantage. However, it is the change in this value over time which is more important for comparing trade performance. For instance, a reduction in the positive value of this ratio would mean a loss of competitive advantage. Using annual data, trade ratios for major categories of exports were computed, and are presented in Table III-2.

Looking at the table, it is found that of the five major categories, all with the exception of end products enjoyed a consistent trade advantage over the period, 1973-83. And within end products, autos and auto parts recorded a consistent trade disadvantage. Since the remaining four categories are included in the natural resource group defined in the broad sense, this group shows a consistent trade advantage.

Figure III–1
Exports of natural resources as percentage of total domestic exports, 1973–83

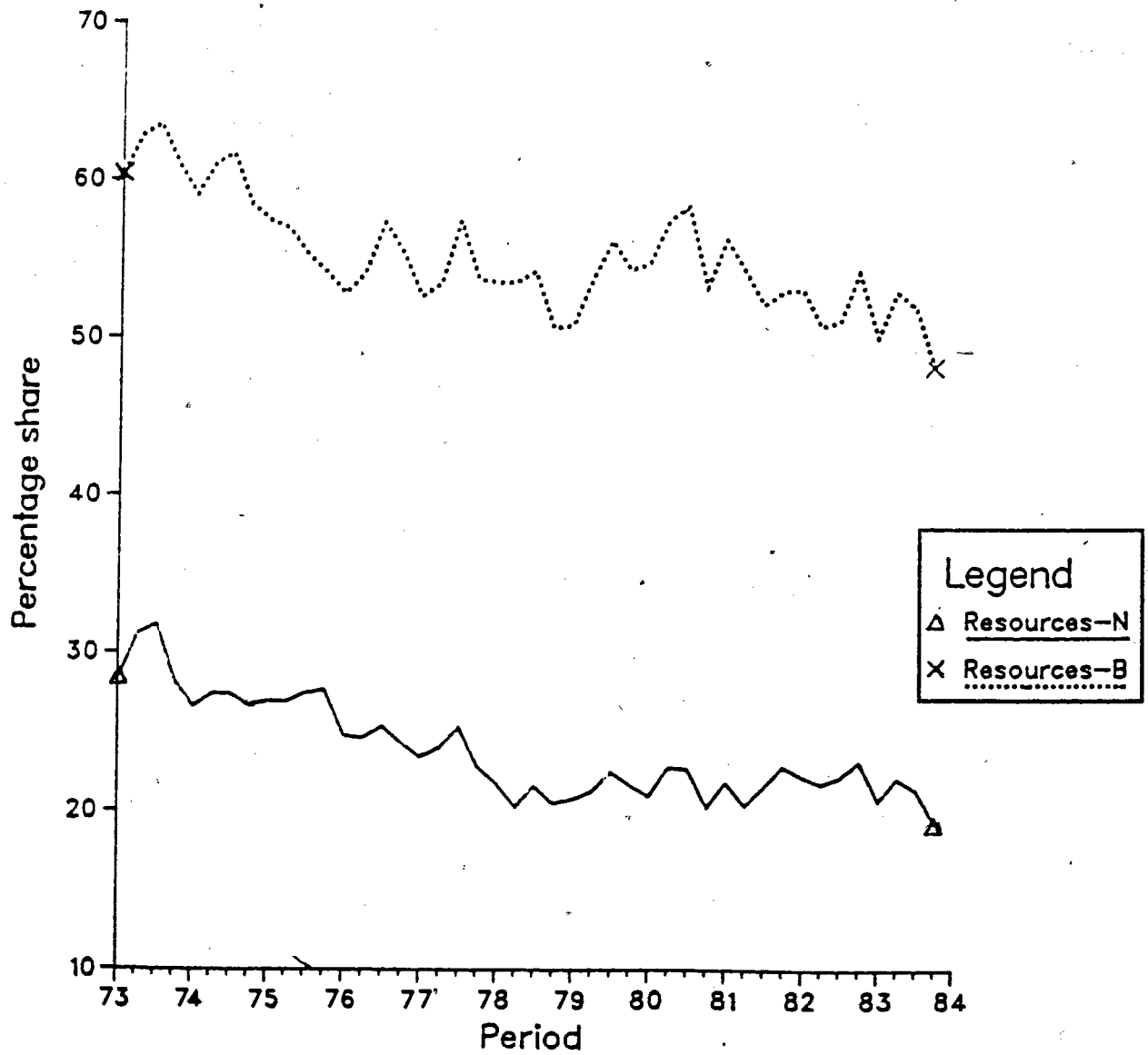

Table III-2

Trade ratios for major categories of exports, 1973-83.

Categories	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
Live animals	0.03	-0.18	-0.08	0.06	0.48	0.49	0.48	0.38	0.03	0.38	0.39
Food & beverages	0.18	0.07	0.09	0.06	0.15	0.16	0.15	0.21	0.22	0.29	0.29
Crude inedibles	0.45	0.44	0.38	0.39	0.40	0.35	0.35	0.21	0.25	0.29	0.19
Fab. inedibles	0.27	0.21	0.19	0.25	0.30	0.33	0.29	0.37	0.31	0.38	0.34
End products	-0.27	-0.32	-0.30	-0.28	-0.23	-0.19	-0.23	-0.23	-0.21	-0.10	-0.12
Autos & parts	-0.08	-0.18	-0.17	-0.12	-0.09	-0.05	-0.16	-0.15	-0.12	-0.03	0.02
N. res. narrow	0.34	0.29	0.26	0.24	0.29	0.26	0.26	0.21	0.23	0.29	0.25
N. res. broad	0.30	0.24	0.22	0.25	0.29	0.30	0.28	0.30	0.28	0.34	0.30
Total exports	0.00	-0.07	-0.08	-0.06	-0.02	0.01	-0.03	-0.01	-0.01	0.08	0.05

Source: Summary of External Trade, Stat. Can., cat. no. 65-001.

III-2 The Demand-Induced Nature of Export Booms

Most of the studies dealing with structural effects of a sudden boom in one of the basic sectors assume that such a boom is autonomous and supply-induced. Two obvious examples of such booms are the oil and gas discoveries in the case of Norway, the Netherlands and the UK, and a vast mineral discovery in the case of Australia. Besides being supply-induced, these booms are of a once-and-for-all nature. That is, once the affected economies complete the adjustment process brought about by the sector experiencing the boom, there is very little further structural ramification.

However, Stoeckel (1979) considered two types of export booms-one which is autonomous and supply-induced and the other which is exogenous and demand-induced. Using the Australian experience of massive mineral discoveries, he shows that in a general equilibrium setting, the effects of a supply-induced export boom will include a small expansion of the import-competing manufacturing sector. This result is in conflict with the conclusion drawn by Gregory (1976) who depended mainly on the partial equilibrium analysis[5].

Stoeckel points out that during the late sixties and early seventies, a rapid rise in the value of Australian mineral exports coincided with rising prices and rising volume. This clearly implies a demand-induced export boom which entails an outward shift of the demand curve rather than an outward shift of the supply curve. For one thing, the exchange rate effect of a demand-induced export boom is likely to be smaller than that of a supply-induced export boom. This is because, under the demand shift, the cost of mineral products rises. And since

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[5]Snape (1977) extended Gregory's theme and used general equilibrium techniques and came up with a set of findings very similar to Gregory's. However, like Gregory, he also chose to disregard the terms of trade effects of the mineral exports boom.

mining is an important source of industrial input, the cost of production in the industrial sector rises relative to imported manufactured goods. This tends to have an offsetting influence on the value of the domestic currency. That is, the magnitude of currency appreciation due to increased earnings from rising mineral exports is somewhat moderated[6]. Nevertheless, the overall impact of a demand-induced export boom, according to Stoeckel, is a contraction of the domestic manufacturing sector.

In this section, it is postulated that, (1) resource boom in Canada is of a demand-induced nature, and that (2) the main impetus for this boom comes from external sources. The first postulate means an outward shift of the demand curve, in price theoretic terms. This is the opposite of a supply-induced boom which will entail an outward shift of the supply curve. Under a demand shift, one would expect to find both prices and quantities moving in the same direction. The second postulate is closely linked with the degree of openness of the Canadian economy. Since exports and imports together constitute more than a quarter of the total GNP, Canada is one of the most open economies in the industrialized world. This makes the Canadian economy quite susceptible to external shocks. Therefore, it is postulated that the major impetus for resource booms in Canada comes from a rise in foreign demand for Canadian resources. Hence, one would expect to find a direct relationship between changes in level of economic activity in major industrialized economies and Canadian exports of natural resources. Both these postulates are subjected to empirical testing in this section.

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[6]If however, mineral prices are determined in world markets, one would expect the cost of production to rise not only in the domestic manufacturing sector but also in the foreign manufacturing sector. However, in practice, exporters tend to resist any immediate price increases for fear of losing their share of the market. This may explain the relative cost disadvantage of the domestic manufacturing sector.

The Demand-Induced Character of Export Booms:

An acceptable method of testing whether a resource boom in Canada is demand-induced is to see whether prices and volumes of export of natural resources are positively correlated. It is important to note that in such a test, the direction of causation has little relevance. In other words, it does not matter whether price and volume move simultaneously or one leads the other. This is because both prices and quantities respond to same exogenous factors. What is important is that both should move in the same direction.

For this, correlation coefficients between price and volume indexes of major categories of exports were computed and are presented in Table III-3. Each price index series has been deflated by the consumer price index.

A close examination of the table reveals the following points. The negative coefficients in the case of live animals are indicative of a supply-induced export boom. However, this perverse relationship is not very important for two reasons. First, the mean share of this category of exports is less than one percent. And second, since this group does not constitute a source of industrial raw materials, it has even less relevance in the present study. Food and beverages also bear negative coefficients. However, these coefficients are not statistically significant. Besides, like live animals, this group is also not an important source of industrial raw materials. The group representing crude inedibles has significant negative coefficients indicating an outward shift of the supply curve. But this apparently perverse nature of the relationship between price and volume indexes can be explained as follows. This category is heavily weighted by exports of oil and gas. As a matter of fact, the ratio of exports of oil and gas to total exports in this group never fell below 35 percent and has been as high as 61

Table III-3

Correlation coefficients between price and volume indexes of various categories of exports, 1968-83

Live animals	Food and beverages	Crude inedibles
$r(P_{t-0},V_{t-0})=-.450^{*}$	$r(P_{t-0},V_{t-0})=-.124$	$r(P_{t-0},V_{t-0})=-.479^{*}$
$r(P_{t-0},V_{t-1})=-.339^{*}$	$r(P_{t-0},V_{t-1})=-.101$	$r(P_{t-0},V_{t-1})=-.337^{*}$
$r(P_{t-0},V_{t-2})=-.208$	$r(P_{t-0},V_{t-2})=-.061$	$r(P_{t-0},V_{t-2})=-.218$
$r(P_{t-0},V_{t-3})=-.121$	$r(P_{t-0},V_{t-3})=-.003$	$r(P_{t-0},V_{t-3})=-.156$
$r(P_{t-0},V_{t-4})=-.047$	$r(P_{t-0},V_{t-4})=-.059$	$r(P_{t-0},V_{t-4})=-.070$
Fab. inedibles	**End products**	**Total dom. exports**
$r(P_{t-0},V_{t-0})=.702^{*}$	$r(P_{t-0},V_{t-0})=-.860^{*}$	$r(P_{t-0},V_{t-0})=.547^{*}$
$r(P_{t-0},V_{t-1})=.747^{*}$	$r(P_{t-0},V_{t-1})=-.845^{*}$	$r(P_{t-0},V_{t-1})=.618^{*}$
$r(P_{t-0},V_{t-2})=.777^{*}$	$r(P_{t-0},V_{t-2})=-.828^{*}$	$r(P_{t-0},V_{t-2})=.654^{*}$
$r(P_{t-0},V_{t-3})=.788^{*}$	$r(P_{t-0},V_{t-3})=-.817^{*}$	$r(P_{t-0},V_{t-3})=.691^{*}$
$r(P_{t-0},V_{t-4})=.783^{*}$	$r(P_{t-0},V_{t-4})=-.802^{*}$	$r(P_{t-0},V_{t-4})=.720^{*}$

* significant at the 5 percent level using a two-tailed test.
P=export price index adjusted for inflation. V=export volume index.

Source: Summary of External Trade, Stat. Can., cat. no. 65-001.

percent between 1973-83, and hovered around 50 percent in most quarters. It can be argued that behaviour of oil and gas in this period has been dictated by international oil cartels rather than by the market forces of demand and supply. Domestically too, the role of the National Energy Program (NEP), with far-reaching regulatory powers, may have played an important role in this regard.

All the coefficients of the fabricated inedibles group on the other hand, are positive and significant. Also, the value of the coefficients increased with the length of lag reaching a maximum value at a lag of three quarters. Since reversing the lags caused the magnitude of the coefficients to decline, it may be argued that the volume index reacted before any price movement was warranted. Perhaps, this is an indication of the speed with which supply can be augmented in response to rising world demand. There are two possible reasons for what seems to be the leading role of the volume index. First, in some cases like mining, there is usually a considerable build up of inventories and therefore, any rise in world demand can be met rather quickly before any price rise is warranted. Second, there is usually vast idle capacity in this sector which makes it possible to augment supplies at short notice. These two points also may explain the increasing size of the coefficients with time.

The other major category, end products, shows significant negative correlation coefficients. However, there is no *a priori* reason to expect a demand shift for this category. Finally, the coefficients of total exports are strongly in support of a demand shift. In view of the dominance of Canadian exports by exports of natural resources, this is not surprising. It seems to lend support to the hypothesis that an export boom in Canada is primarily of a demand-induced nature.

The above correlation analysis seems to provide some support for the postulate that export booms are demand-induced, on the basis of individual categories. However, it remains to be seen whether this result holds for exports of natural resources in its entirety. In order to examine this issue a bit further, a weighted price index for the exports of natural resources in the broad sense was computed[7].

In the following regression analysis, this weighted price index (WPI) has been used as the independent variable while exports of natural resources in the broad sense (NRB) has been used as the dependent variable. Further, in order to account for a potentially spurious relationship due to the presence of a time trend in the data, a trend variable has been incorporated. The estimating equation can be written as follows.

$$NRB_t = \delta_0 + \delta_1 T + \Sigma \delta_{2i} WPI_{t-i} \quad \ldots \quad (3.1)$$

Equation (3.1) was estimated in various functional forms. The linear equation seems to fit the data best. Initially the parameters of the regression model were estimated using ordinary least squares techniques. But since a significant degree of first order autocorrelation was detected by the very low value of the Durbin-Watson statistic, the equation was re-estimated using generalized least squares techniques to achieve increased efficiency. Also, in order to establish the lag structure of the independent variable, the Almon method of distributed lags without any endpoint restrictions was applied. A four period lag with a second degree polynomial seems to fit the data quite well. The results are summarized

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[7]The weights are the shares of each category in total export of natural resources in the broad sense. Thus, the computing formula is the following,

$$WPI = \Sigma\left(\frac{X_i}{X}\right)(P_i) \qquad i=1,2,3,4$$

in Table III-4. An adjusted R^2 of .89 and a F-value of 79.52 indicated a strong fit of the equation. All four coefficients had the correct signs and the first two short run coefficients as well as the long run coefficient were statistically significant. Thus, this regression analysis also seems to provide support for the hypothesis that a resource boom is demand-induced.

Global Expansion and Resource Boom in Canada:

This section intends to show that a resource boom in Canada is mainly due to external demand factors. The demand for resources is a derived demand. And therefore, foreign demand for Canadian exports of natural resources is expected to rise with a rise in the level of economic activity in major industrialized economies. In other words, exports of Canadian natural resources are expected to behave in a procyclical fashion. Also, because Canadian exports are heavily resource oriented, there is expected to be a similar relationship between exports as a whole and the level of economic activity in these countries. Accordingly, three equations are estimated, using exports of natural resources in the narrow sense (NRN); in the broad sense (NRB) and total domestic export (XTL) as the dependent variables. The OECD index of industrial production (IPROQ) was chosen as the independent variable representing the level of economic activity in major industrialized economies.

Since disaggregated data on exports were available only for the period 1973-83, there are 44 quarterly observations on each series. There are two ways of devising an empirical test of the hypothesis. One can run a regression of exports on the OECD index of industrial production, using time as another independent variable. Alternatively, one can regress both the dependent and the independent variables separately on time and obtain the residuals as measures of

Table III-4

Regression results of equation (3.1), estimated over the period 1973-83.

T	Coefficients	T-values
0	26.495	(3.44)*
1	9.772	(1.84)*
2	1.685	(0.32)
3	2.233	(0.22)
$\Sigma\beta_{2i}$	40.185	(4.46)*

Const.=282.17 R^2=.89 F=79.52 SE=399.69 DW=2.30

Rho1=.70

* significant at the 5 percent level using a one-tailed test.

deviations from the trend. In a second stage, one can regress the residuals of the dependent variable on the residuals of the independent variable. These methods are equivalent. However, the latter procedure was selected here. The time series of the two sets of residuals are plotted in Figures III-2a, III-2b and III-2c.

Although the graphs indicate a procyclical movement of exports in general and exports of natural resources in particular, the exact degree of relationship cannot be ascertained from the graphs. Therefore, the following three equations were estimated, where both the dependent and the independent variables are deviations from trend. The equations took the following forms.

$$NRN_t = \alpha_0 + \Sigma \alpha_{1i} IPROQ_{t-i} \quad \ldots \quad (3.2)$$

$$NRB_t = \beta_0 + \Sigma \beta_{1i} IPROQ_{t-i} \quad \ldots \quad (3.3)$$

$$XTL_t = \gamma_0 + \Sigma \gamma_{1i} IPROQ_{t-i} \quad \ldots \quad (3.4)$$

All three equations were estimated by ordinary least squares regression techniques (OLS). However, first order autocorrelation was detected in the error terms. Therefore, all equations were re-estimated using generalized least squares techniques in order to achieve increased efficiency. Also, in order to determine the lag structure, the Almon method of distributed lags was applied. Various lag structures with different degrees of polynomial were tried. A quadratic specification with a five period lag produced the best results. No endpoint restrictions were imposed on the parameters.

The results are summarized in Table III-5. All three equations seem to support the hypothesis that the main cause of resource booms in Canada lies in external sources. Equation (3.2), representing exports of natural resources in the

Figure III-2a
Procyclical behaviour of export of natural resources-narrow,
1973-83

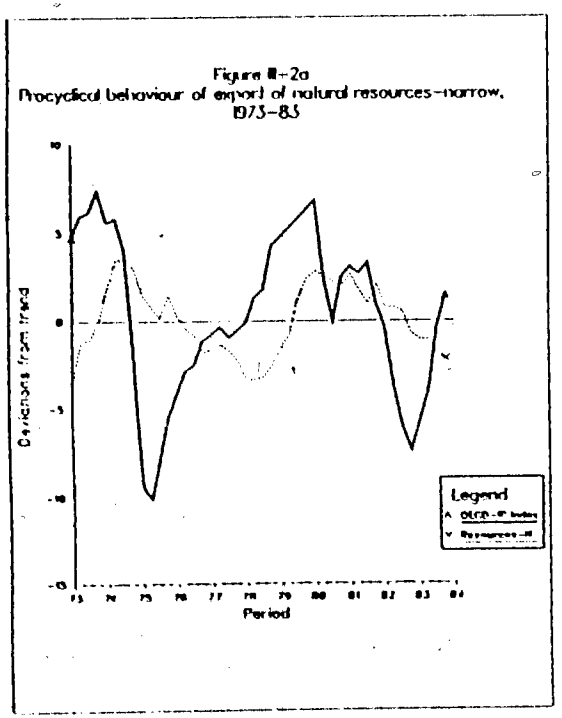

Figure III-2b
Procyclical behaviour of export of natural resources-broad,
1973-83

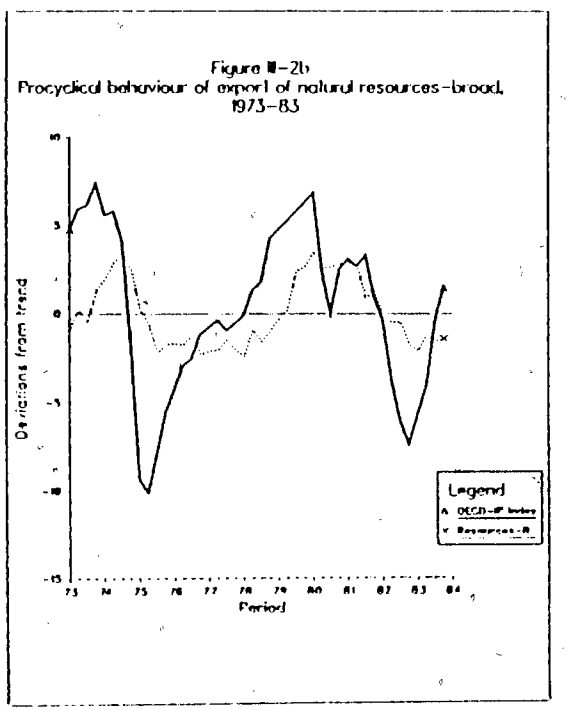

Figure III-2c
Procyclical behaviour of domestic exports-total,
1973-83

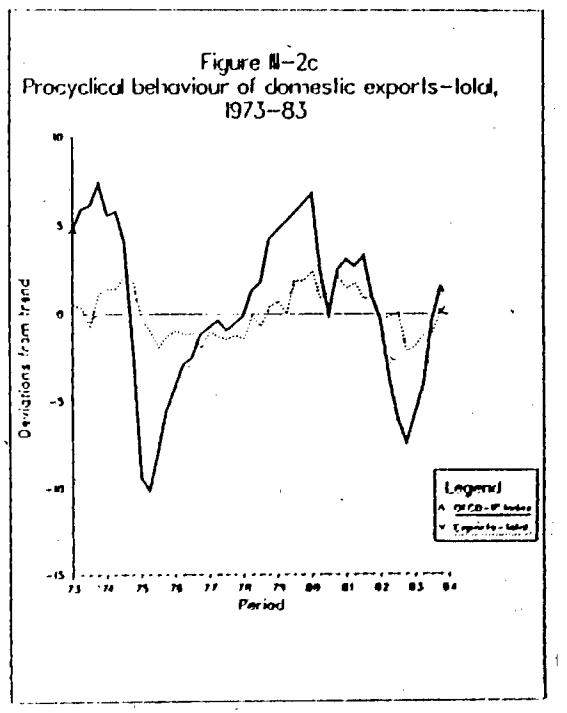

Table III-5

Regression results of equations (3.2), (3.3) and (3.4), estimated over the period 1973-83.

T	Equation (3.2)	Equation (3.3)	Equation (3.4)
0	0.005*	0.007*	0.006*
	(1.81)	(2.59)	(2.91)
1	0.002**	0.003*	0.002*
	(1.31)	(2.85)	(2.57)
2	0.001	0.002**	0.001
	(0.51)	(1.29)	(0.49)
3	0.002*	0.003*	0.001**
	(1.71)	(2.39)	(1.50)
4	0.006*	0.005*	0.004*
	(2.21)	(2.13)	(1.91)
$\Sigma\beta_{1i}$	0.016*	0.020*	0.015*
	(3.08)	(5.00)	(6.52)
Constant	-0.047	-0.013	-0.006
R^2	.14	.35	.50
F	3.36	8.75	15.55
SE	0.04	0.04	0.04
DW	1.62	2.19	2.05
Rho1	0.92	0.75	0.38

* significant at the 5 percent and ** 10 percent levels using a one-tailed test. T-values are in parentheses.

narrow sense, had an adjusted R^2 of .14 and a F-value of 3.36. All coefficients had the correct signs, and all with the exception of the second period lag were significant. And so was the long run coefficient. Equation (3.3), representing export of natural resources in the broad sense, yielded an adjusted R^2 of .35 and a F-value of 8.75. All coefficients had the expected signs, and were significant. The long run coefficient was also significant at the five percent level. Similarly, equation (3.4), representing total domestic exports, had an adjusted R^2 of .50 and a F-value of 15.55. All signs were positive as expected, and all coefficients with the exception of the second period were significant. The long run coefficient was also significant.

Although the above tests seem to confirm the procyclical behaviour of the export of natural resources, a stronger version of this hypothesis, namely, that the dominance of the resource sector (export of natural resources as percent of total exports) increases with an increase in the level of economic activity in the western economies, can be tested. In order to test this, a set of correlation coefficients were computed between percentage shares of exports of natural resources in the broad sense (PNRB) and the annualized growth rates of the OECD countries (G)[1]. The results are summarized in Table III-6.

It is clear from the table that the response of the resource sector increased with length of lag and the coefficient value reached its maximum at a lag of six quarters. The value started declining after that. Thus, expansion in major western industrialized economies does seem to cause an increase in dominance of the export of natural resources in Canada.

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[1]The annualized growth rates were computed for the OECD countries as a whole using quarterly data on GDP in constant 1980 prices and exchange rates.

Table III-6

Correlation coefficients between percentage shares of exports of natural resources and OECD growth rates, 1973-83

$r(PNRB_{t-0}, G_{t-0}) = -.203$

$r(PNRB_{t-0}, G_{t-1}) = .050$

$r(PNRB_{t-0}, G_{t-2}) = .288^{**}$

$r(PNRB_{t-0}, G_{t-3}) = .426^{*}$

$r(PNRB_{t-0}, G_{t-4}) = .524^{*}$

$r(PNRB_{t-0}, G_{t-5}) = .554^{*}$

$r(PNRB_{t-0}, G_{t-6}) = .560^{*}$

$r(PNRB_{t-0}, G_{t-7}) = .501^{*}$

Note: * significant at the 5 percent and ** 10 percent levels using a one-tailed test.

III-3 Export Boom and Induced Capital Inflow

Corden (1982) has examined the impact of an investment boom on the structural adjustment process which mainly works through appreciation of the domestic currency. However, his main focus has been on an exogenous capital inflow as an investment boom precedes an export boom. Turnovsky (1983), in the tradition of Corden, analyzed the structural impact of a capital inflow which takes place in anticipation of an export boom in the resource sector. He showed

that there are two rounds of appreciation of the domestic currency, one before the export boom, and the other after. But unlike Gorden, he also devoted attention to the dynamic time path of the economy following the expectation of an export boom. Furthermore, he examined a case of an unanticipated export boom.

In this study, it is argued that a capital inflow in a resource-based economy like Canada is, by and large, of an induced nature. That is, an export boom precedes an investment boom. A rise in exports of natural resources will lead to increased exploration and development expenditure because of high expected returns on investment. This expenditure, for the most part, is financed by foreign capital. This has special significance in the structural adjustment process, because it will tend to accentuate it by combining the exchange rate effects of an export boom (trade account) with that of an investment boom (capital account).

One can regress capital inflow and export of natural resources against time and compare the two sets of residuals as a measure of deviations from the trend. If there is a significant positive relationship between these residuals, one can maintain that capital inflow is of an induced nature. Alternatively, one can regress capital inflow against export of natural resources using time as another independent variable and reach the same conclusion. For the reasons explained earlier, the first approach has been adopted.

In this study, total direct foreign investment (TDI) has been used as the dependent variable and export of natural resources in the narrow sense (NRN), in the broad sense (NRB) and total domestic exports (XTL) as the independent variables. Since disaggregated export data is not available for the earlier years,

the estimation covers the period 1973-83, thus allowing 44 quarterly observations. An examination of Figures III-3a, III-3b and III-3c indicates that in each case, there is a positive relationship between the two sets of deviations, as expected. However, the exact degree of the relationship is not obvious from visual inspection alone. Therefore, the deviations from the dependent variable (TDI) were regressed separately on the deviations from each of the three independent variables. The Almon method of distributed lag with a lag structure of five periods and a second degree polynomial seems to have produced a good fit of the following equations.

$$TDI_t = \alpha_0 + \Sigma \alpha_{1i} NRN_{t-i} \quad \ldots \quad (3.5)$$

$$TDI_t = \beta_0 + \Sigma \beta_{1i} NRB_{t-i} \quad \ldots \quad (3.6)$$

$$TDI_t = \gamma_0 + \Sigma \gamma_{1i} XTL_{t-i} \quad \ldots \quad (3.7)$$

The results of the estimation are presented in Table III-7. All three equations produced expected signs and all coefficients with the exception of the first period lag in the first two equations were significant. The long run coefficient in each case was highly significant. More importantly, the adjusted R^2 was the highest for the exports of natural resources in the narrow sense and lowest for the total domestic exports. This seems to suggest that there is a strong positive relationship between direct foreign investment and export of natural resources. However, the estimation suffers from a serious autocorrelation problem as indicated by a low Durbin-watson statistic. This seriously undermines the results.

It is however important to bear in mind that in the case of Canada, the crucial underlying assumption of free mobility of international capital seems to be violated. Historically, the role of the Foreign Investment Review Agency (FIRA)

Figure II-3a
Procyclical behaviour of direct foreign investment and export of natural resources in the narrow sense, 1973-83

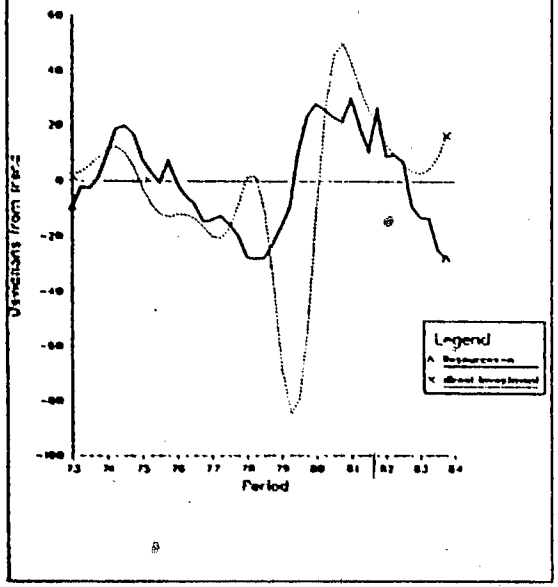

Figure II-3b
Procyclical behaviour of direct foreign investment and export of natural resources in the broad sense, 1973-83

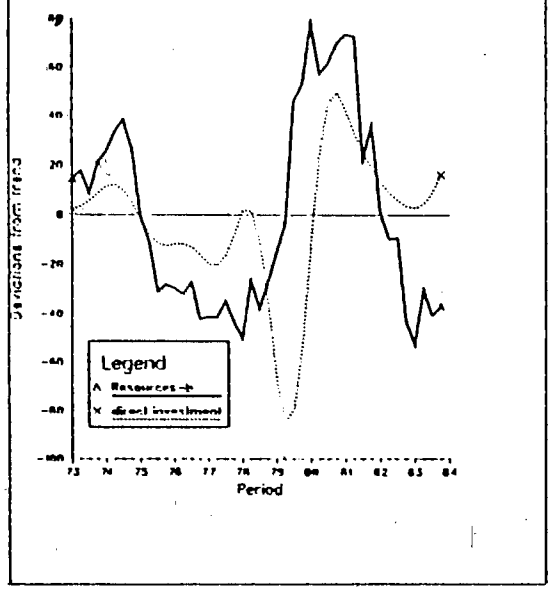

Figure II-3c
Procyclical behaviour of direct foreign investment and total domestic exports, 1973-83

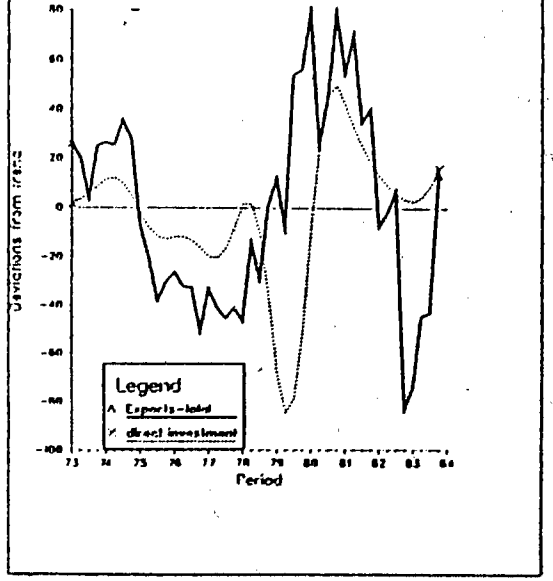

Table III-7

Regression results of equations (3.5), (3.6) and (3.7), estimated over the period 1973-83.

T	Equation (3.5)	Equation (3.6)	Equation (3.7)
0	0.034	0.027	0.055**
	(0.32)	(0.57)	(1.63)
T	0.297*	0.107*	0.102*
	(5.15)	(3.50)	(3.03)
2	0.427*	0.145*	0.119*
	(6.13)	(4.04)	(3.03)
3	0.419*	0.139*	0.108*
	(5.54)	(3.76)	(2.89)
4	0.277*	0.091*	0.068*
	(5.15)	(3.54)	(2.78)
$\Sigma\beta_{1i}$	1.453*	0.509*	0.452*
	(6.08)	(3.95)	(3.07)
Constant	-165.35	-135.95	-127.14
R^2	.49	.27	.16
F	19.62	8.31	4.77
SE	135.74	151.22	159.04
DW	0.85	0.72	0.65
Rho1	1.69	1.69	1.70
RHO2	-0.99	-0.95	-0.95

* significant at the 5 percent and ** 10 percent levels using a one-tailed test. T-values are in parentheses.

has varied significantly from period to period. In more recent years, the National Energy Program (NEP) seems to have played a significant role in regulating foreign ownership and control in the energy sector.

III-4 Resource Boom, Balance of Payments and the Value of the Domestic Currency

The major theme, in this chapter, has been that an export boom, *ceteris paribus*, would lead to an appreciation of the domestic currency both through an improvement in the trade balance and the capital account balance. Since this issue is vital in this study, it needs further examination. However, the objective here is not to build a full-fledged model of exchange rate determination. This subject has been explored quite extensively and there is very little to gain from such an exercise. What is intended here is merely to show that any improvement in the balance of payments would, *ceteris paribus,* have a positive influence on the value of the domestic currency. This argument is captured by the following relationship,

$$X - M + C = R \quad \ldots \quad \ldots \quad (3.8)$$

The above equation is simply a balance of payments equation using exports (X) less imports (M) plus net capital inflow (C) equal to a change in international reserves (R)[9]. In order to test if in fact, an export boom leads to an improvement in the balance of payments and hence in the reserve position, the following two equations were estimated. Equation (3.9) uses BP_1 (X-M+C) as the independent variable, while equation (3.10) uses BP_2 (trade balance in the broadly defined resource sector plus net capital inflow) as the independent variable. The dependent variable (ORS) is the total reserves including gold. Both

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[9]This approach has been adopted from Laney (1982)

equations were estimated using time as another independent variable to account for the trend movement in the time series data.

$$ORS_t = a_0 + a_1 T + a_2 T^2 + a_3 BP_{1t} \quad \ldots \quad (3.9)$$

$$ORS_t = a_0 + a_1 T + a_2 T^2 + a_3 BP_{2t} \quad \ldots \quad (3.10)$$

Equation (3.9) was estimated over the period 1962-83 as well as over 1973-83, while equation (3.10) was estimated only over 1973-83. This is because data on export of natural resources were not available for 1962-72. Various alternative specifications were tried. But the specification in the fourth difference form seems to fit the data best. The estimation results are summarized in Table III-8. The coefficient of the balance of payments variable was positive and significant in each case. The reason for estimating equation (3.9) over 1973-83 was to facilitate a comparison with equation (3.10). It turned out that BP_2 had a slightly higher R^2 than BP_1. This suggests that improvement in the trade balance in the resource sector is at least as important as the overall trade balance in explaining the change in the international reserve position[10].

There are however, two important points worth mentioning here. First, the analysis of capital inflow in the context of a resource boom is much more complicated than this. The final outcome would depend not only on financial capital inflow but also on physical capital inflow. For instance, if a resource boom means increased imports of capital goods, the influence of net capital inflow could be offset. Second, a demand-induced boom would mean rising resource prices, and therefore a rising cost of production in the domestic

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[10]The exchange rate was regressed on exports of natural resources defined in the narrow and the broad sense respectively, as a more direct test of the hypothesis. The regression coefficients in both cases were found significant at the ten percent level.

Table III-8

Regression results of equation (3.9) and (3.10), estimated over the periods 1962-83 and 1973-83.

Variable	Equation (3.9), 1962-83	Equation (3.9), 1973-83	Equation (3.10), 1973-83
BP_1	.243* (7.21)	.230* (5.11)	--
BP_2	---	---	.227* (5.33)
Constant	1543.90	36357.40	37910.60
R^2	.37	.44	.46
F	17.51	11.12	12.08
SE	994.26	1160.00	1140.00
DW	2.15	2.29	2.29
Rho1	1.11	0.85	0.85
Rho2	-.35	-.31	-.31

* significant at the 5 percent level using a two-tailed test. T-values are in parentheses.

manufacturing sector. This may have a dampening effect on the exchange rate. Thus, what happens to the value of the domestic currency following an export boom is a complicated matter. Movement in the exchange rate is also influenced by many other factors, such as monetary and fiscal policies and speculation in the exchange market.

CHAPTER IV

STRUCTURAL ANALYSIS OF THE CANADIAN ECONOMY, 1962-83

This chapter is devoted to examination of the structural adjustment process in the Canadian economy over the period 1962-83. In Section IV-1, the structural behaviour of the economy is examined in terms of output. In particular, the magnitude of intersectoral shifts is determined from the available data. This is done for the two subperiods 1962-1 to 1970-2 and 1970-3 to 1983-4 as well as for the entire period 1962-83. In the following section, the same structural issue is examined in terms of aggregate employment. The existence of intersectoral wage differences is central to this study. Accordingly, the structural behaviour of wages is examined in Section IV-3. Section IV-4 is devoted to an in-depth examination of asymmetric sector growth in the Canadian economy by highlighting the nature of this asymmetry during two phases of the business cycles. Section IV-5 examines the causes and consequences of this asymmetry along with a brief review of the prevalent views on this subject. And finally, Section IV-6 tests the null hypothesis that structural change in the Canadian economy is not cyclical against the alternative hypothesis that it is.

IV-1 Structural Behaviour of Gross Domestic Product

Sectoral shares of gross domestic product and changes in these shares over the two subperiods and the entire period under study are presented in Table IV-1. A close examination of the table reveals the following main points.

Table IV-1

Major sectors as percentage of gross domestic product[1], 1962-83

Major sectors	Percentage share				Change in share	
	1962-1	1970-2	1970-3	1983-4	1962-1 to 1970-2	1970-3 to 1983-4
GOODS SECTOR	40.76	40.48	40.09	35.81	-0.28	-4.28
RESOURCE[2]:	9.32	8.23	8.00	6.02	-1.09	-1.98
Agriculture	4.49	3.26	2.93	2.53	-1.23	-0.40
Fishing	0.28	0.20	0.21	0.12	-0.08	-0.09
Forestry	0.92	0.89	0.83	0.68	-0.03	-0.15
Mining	3.63	3.87	4.02	2.69	+0.24	-1.33
INDUSTRIAL[3]:	31.44	32.25	32.09	29.79	+0.81	-2.30
Manufacturing	21.76	22.99	22.76	21.22	+1.23	-1.54
Construction	7.49	6.67	6.71	5.06	-0.82	-1.65
Utilities	2.19	2.59	2.62	3.51	+0.40	+0.89
SERVICE SECTOR	59.84	59.43	59.90	64.19	-0.41	+4.29
Transportation	8.76	9.48	9.56	10.89	+0.72	+1.33
Trade	11.78	11.45	11.64	13.04	-0.33	+1.40
Finance	12.17	11.52	11.62	13.54	-0.65	+1.92
Services[4]	17.78	19.56	19.59	19.70	+1.78	+0.11
Public admn.	9.36	7.43	7.49	7.02	-1.93	-0.47

[1]GDP at factor cost. [2]Resource includes primary plus mining and quarrying. [3]The definition of industrial includes manufacturing; construction, and utilities. Mining has been excluded because of its dominant resource character. [4]Services refer to community business and personal services.

Source: Real domestic product by industry, 1961-71, and Gross domestic product by industry, Stat. Can. cat. nos. 61-516 and 61-213.

The Period 1962-1 to 1970-2

First, the share of the goods-producing sector seems to have remained stable at about 40 percent. Therefore, the share of service-producing sector also remained stable at about 60 percent over this period. Second, in the goods-producing sector, the resource sector experienced a small decline of about one percentage point. Further, each of its components with the exception of mining, registered a decline. The industrial sector, on the other hand, gained a little (+.81 percentage points), with the largest gain recorded by the manufacturing sector (+1.23 percentage points). Construction is the only component in this group to have declined (-.82 percentage points). Third, in the service-producing sector, services and transportation recorded gains in their shares. All other components showed a decline, with the largest decline experienced by public administration (-1.93 percentage points).

The Period 1970-3 to 1983-4

First, the share of the goods-producing sector recorded a substantial decline (-4.28 percentage points) over this period, whereas the share of the service-producing sector rose by the same amount. Second, in the goods-producing sector, both the resource and the industrial groups lost ground. The industrial sector declined by over two percentage points, while the resource sector declined by slightly under two percentage points. Moreover, all components of the resource sector recorded a decline, with the largest decline registered by mining (-1.33 percentage points). In the industrial sector, all components with the exception of utilities experienced a decline. The manufacturing sector recorded a decline of over one and a half percentage points, compared with a gain of about one and a quarter percentage points during the first subperiod. Third, in the

service-producing sector, all components gained with the exception of public administration. Finance recorded the largest gain (+1.92 percentage points), followed by trade (+1.40 percentage points), transportation (+1.33 percentage points) and services (+.11 percentage points). Public administration recorded a marginal decline (-.47 percentage points).

On the basis of above comparison of the two subperiods, one thing that stands out the most is the fact that relative decline of the goods-producing sector became very pronounced during the second subperiod. And perhaps more importantly, more than half of this decline is accounted for by the decline of the industrial sector, in which manufacturing played an important role. Thus, one can argue that the process of structural adjustment in the Canadian economy accentuated in the second subperiod. This issue becomes a focal point of the empirical investigation in this study. Figures IV-1a and IV-1b show the time series behaviour of the major sectors over the entire 1962-83 period.

IV-2 Structural Behaviour of Aggregate Employment, 1966-83

Looking at Table IV-2, the following points can be made. Over the period 1966-1 to 1970-2, all components of the goods-producing sector with the exception of utilities recorded a decline, with the industrial sector experiencing a larger decline (-2.46 percentage points) than the resource sector (-1.98 percentage points). Furthermore, the manufacturing sector accounted for more than half of the decline in the industrial sector. In the service-producing sector on the other hand, all sectors recorded a rise in their shares with services recording the largest increase (+3.40 percentage points).

Figure IV–1a
Goods and service producing sectors as percentage of GDP in Canada, 1962–83

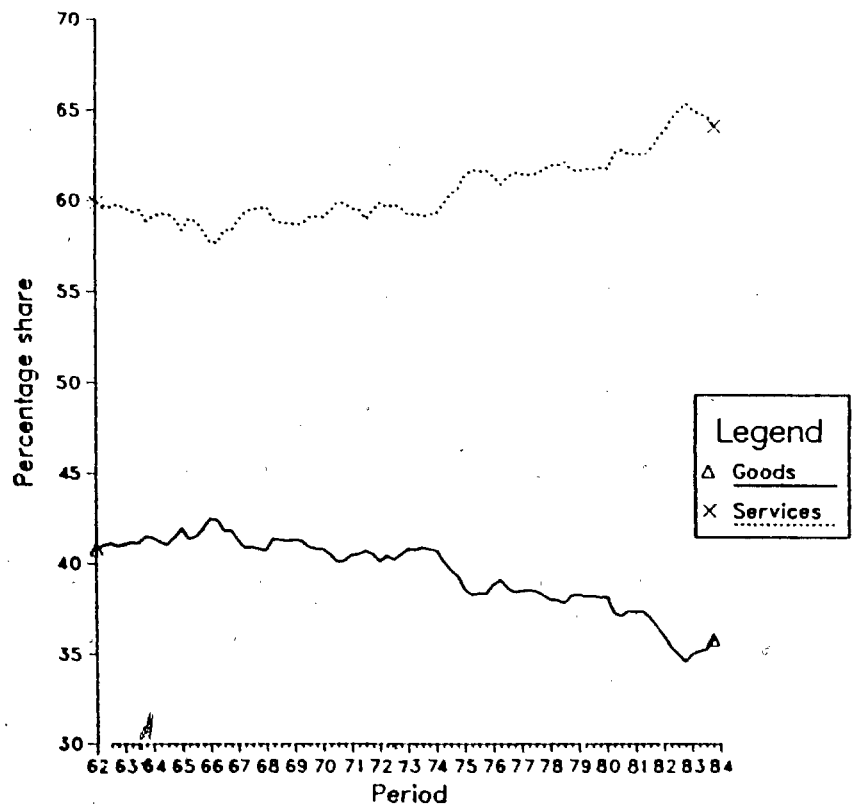

Figure IV–1b
Major goods producing sectors as percentage of GDP in Canada, 1962–83

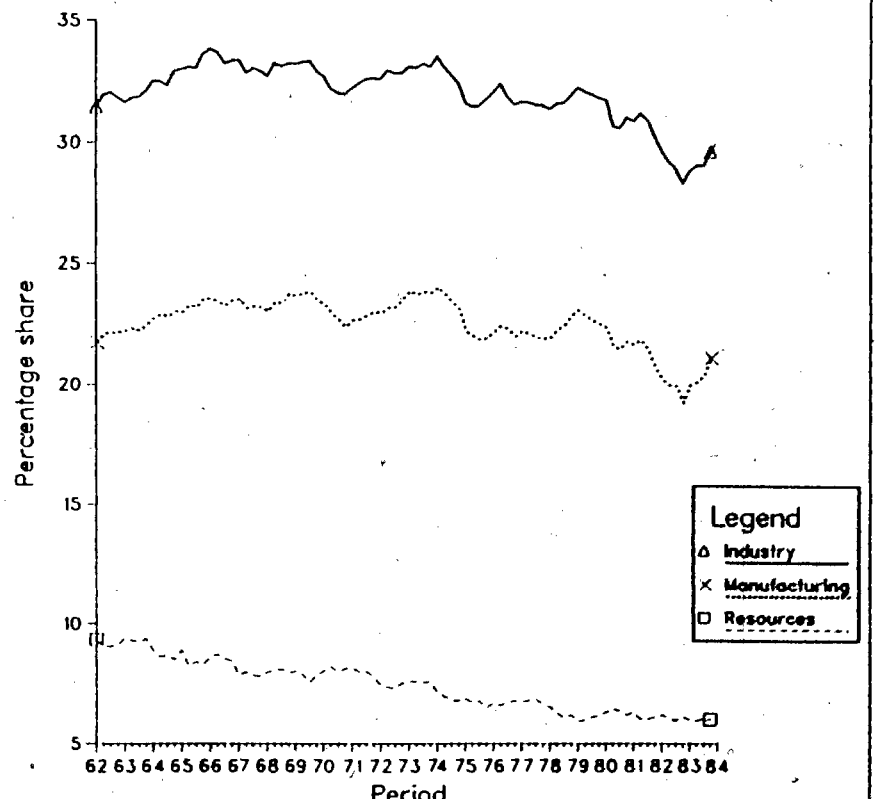

Table IV-2

Major sectors as percentage of total employment, 1966-83[1].

Major sectors	Percentage share				Change in share	
	1966-1	1970-2	1970-3	1983-4	1966-1 to 1970-2	1970-3 to 1983-4
GOODS SECTOR	43.62	39.17	38.71	31.16	-4.45	-7.55
RESOURCE:	11.03	9.05	9.08	7.06	-1.98	-2.02
Agriculture	7.82	6.27	6.29	4.51	-1.55	-1.78
Fishing	0.38	0.25	0.27	0.32	-0.13	+0.05
Forestry	1.14	0.88	0.91	0.71	-0.26	-0.20
Mining	1.68	1.65	1.61	1.51	-0.03	+0.10
INDUSTRIAL:	32.58	30.12	29.63	24.11	-2.46	-5.52
Manufacturing	24.20	22.85	22.57	17.86	-1.35	-4.71
Construction	7.32	6.08	6.00	5.18	-1.24	-0.82
Utilities	1.06	1.20	1.06	1.06	+0.14	+0.00
SERVICE SECTOR	56.60	60.92	61.27	68.85	+4.32	+7.58
Transportation	7.47	7.57	7.79	6.86	+0.10	-0.93
Trade	16.47	16.66	16.88	17.25	+0.19	+0.37
Finance	4.27	4.61	4.56	5.68	+0.34	+1.12
Services	22.56	26.02	25.80	31.85	+3.40	+6.05
Public admn.	5.82	6.06	6.24	7.21	+0.24	+0.97

[1]Data for the earlier years are not available at this level of disaggregation.

Source: Obtained from Statistics Canada, Ottawa.

Over the period 1970-3 to 1983-4, the goods-producing sector recorded a much larger decline (-7.55 percentage points) than it did in the first subperiod, while the service-producing sector showed an increase of the same magnitude. Services seem to have maintained their rising trend with a larger gain (+6.05 percentage points) than in the first subperiod (+3.40 percentage points). This accounts for most of the gains recorded by the service-producing sector as a whole.

However, while making this comparison between the two subperiods, it should be borne in mind that the first subperiod is of much shorter duration than the second. Thus, the absolute differences in the magnitude of sectoral shifts should be interpreted with this in mind. What is important however, is the fact that during the second subperiod, the industrial sector accounted for about three quarters of the total decline in the goods-producing sector. And perhaps even more important, the manufacturing sector experienced a decline of 4.71 percentage points, thus accounting for over 85 percent of the total decline in the industrial sector.

Thus, both on the basis of share of employment as well as gross domestic product, the goods-producing sector has experienced a significant decline over the period 1962-83. Furthermore, the decline of the goods-producing sector seems to have accentuated in the second subperiod. And more importantly, most of the decline in the goods-producing sector can be accounted for by the decline of the industrial sector in which the manufacturing sector consistently played a dominant role[1]. This finding provides a basis for the next and the most crucial chapter in which an attempt is made to build an econometric model to explain

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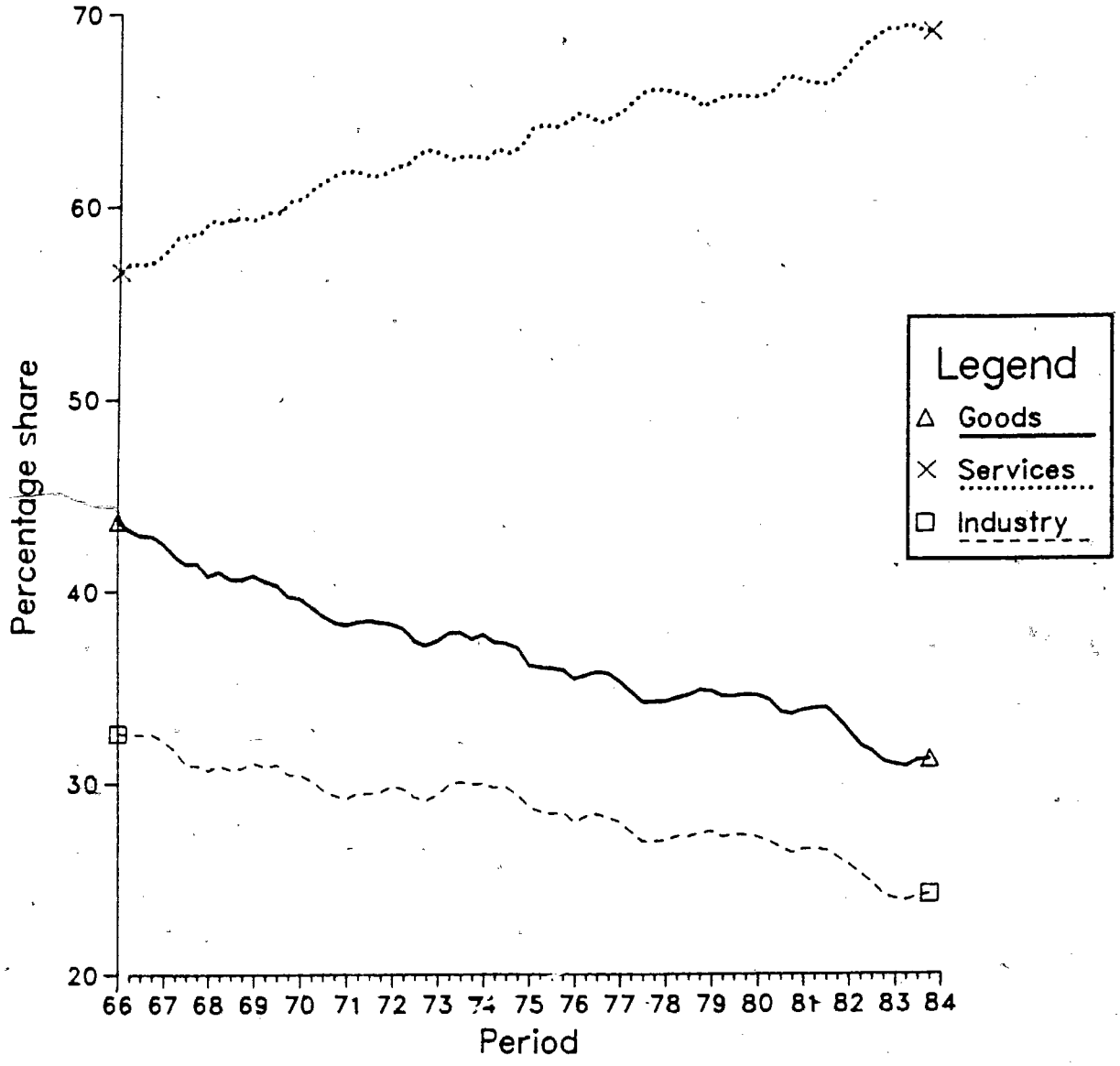
[1]It is important to note that sectoral shifts over the period under study were larger in magnitude in terms of employment than in terms of output. Thus, deindustrialization appears to be more acute in terms of employment.

Figure IV–2
Major sectors as percentage of total employment in Canada, 1966–83



the declining share of the goods-producing sector in general and of the industrial sector in particular.

IV-3 Structural Behaviour of Wages, 1962-83

Since wages are postulated to play a crucial role in explaining the process of structural adjustment in the Canadian economy, it is necessary to analyze the structural behaviour of wages in a disaggregated fashion. In this section therefore, two important features of wage behaviour are examined, namely, the intersectoral differences in the rates of growth of wages and changes in the ratio of each sector's wage level to the general wage level for the economy as represented by industrial composite wage.

Average quarterly growth rates of real wages by sector were computed and are presented in Table IV-3. As the table indicates, in the first subperiod, all sectors recorded a rise in wages with construction leading the way (+1.262 percentage points) followed by utilities (+.879 percentage points), mining (+.764 percentage points), forestry (+.755 percentage points), transportation (+.684 percentage points), manufacturing (+.643 percentage points), services (+.635 percentage points) and finance (+.599 percentage points). Trade recorded the smallest increase (+.387 percentage points). During the second subperiod, all sectors recorded a rise in wages, but the rate of increase was smaller than in the first subperiod with the sole exception of forestry, which experienced a mild acceleration. Thus, it seems that rate of wage increase in most of the sectors decelerated in the second subperiod.

The other relevant point which warrants examination here is question of how the wage level for each sector compares with the general wage level in the

Table IV-3

Average quarterly growth rates of real wages in major sectors, 1962-83.

Major sectors	Mean growth rate			
	1962-1 to 1970-2	1970-3 to 1983-4	Change	1962-83
GOODS SECTOR	0.861	0.551	-0.310	0.671
RESOURCE:	0.755	0.703	-0.052	0.723
Forestry	0.755	0.809	+0.054	0.788
Mining	0.764	0.630	-0.134	0.682
INDUSTRIAL:	0.935	0.451	-0.484	0.637
Manufacturing	0.643	0.398	-0.245	0.493
Construction	1.262	0.426	-0.836	0.749
Utilities	0.879	0.525	-0.354	0.662
SERVICE SECTOR:	0.581	0.327	-0.254	0.425
Transportation	0.684	0504	-0.180	0.573
Trade	0.387	0.085	-0.302	0.202
Finance	0.599	0.437	-0.162	0.500
Services	0.635	0.142	-0.493	0.332
Ind. comp.	0.608	-0.299	-0.309	0.418

Source: Employment and Average Weekly Wages and Salaries, Stat. Can., cat. no. 72-002.

economy and whether or not there has been any change in this relative position. For this purpose, the ratio of each sector's wage level to the industrial composite wage level was computed and is presented in Table IV-4.

The following significant points emerge from the table. First, over the first subperiod, ratios of sectoral wage levels to the composite wage level for the economy as a whole were consistently higher than 100 in all sectors except trade, finance and services. Second, all sectors with the exception of trade and finance, recorded a rise in their ratios during the first subperiod, with construction leading the way (+24.79 percentage points) followed by utilities (+10.82 percentage points), mining (+6.96 percentage points) and forestry (+3.21 percentage points), and smaller increases recorded by transportation and services. Trade and finance are two sectors which recorded declines of (-6.64 percentage points) and(-0.15 percentage points) respectively. Over the second subperiod, forestry and mining led the way with increases of (+30.57 percentage points) and (+24.34 percentage points) respectively. Other sectors to have shown significant increases were utilities (+16.45 percentage points), transportation (+13.77 percentage points), construction (+7.29 percentage points), finance (+6.02 percentage points) and manufacturing (+5.72 percentage points) respectively. Trade and services are the only two sectors showing wages lower than the national average. Moreover, wages in these two sectors as percentage of industrial composite wage slipped further by significant margins.

IV-4 Asymmetric Sectoral Growth-Empirical Evidence

The above analysis gave an overview of the magnitude of sectoral shifts that have taken place in the Canadian economy over the period under study. If a

Table IV-4

Real wages in major sectors as percentage of industrial composite wage, 1962-83.

Major sectors	1962-1 to 1970-2			1970-3 to 1983-4		
	1962-1	1970-2	Change	1970-3	1983-4	Change
Forestry	102.78	105.99	+3.21	106.00	136.57	+30.57
Mining	122.42	129.38	+6.96	130.14	154.48	+24.34
Manufacturing	103.13	104.66	+1.53	104.62	110.34	+5.72
Construction	106.56	131.35	+24.79	132.54	139.83	+7.29
Utilities	120.18	130.99	+10.82	131.22	147.67	+16.45
Transportation	110.33	112.91	+2.58	112.11	125.88	+13.77
Trade	86.02	79.38	-6.64	79.20	70.70	-8.50
Finance	94.44	94.29	-0.15	95.38	101.40	+6.02
Services	70.98	71.42	+0.44	71.67	65.50	-6.17

Source: Employment and Average Weekly Wages and Salaries, Stat. Can., cat. no. 72-002.

particular sector is declining as a percentage of total GDP, it must be the result of asymmetric sectoral growth. In other words, there should be a significant intersectoral growth differential.

This issue is examined next by comparing the growth patterns of each sector over the two subperiods as well as by analyzing the implications of differential rates of growth over the entire period under study. Table IV-5 presents the annualized average growth rates by sector and changes in these rates between the two subperiods.

The first subperiod may be characterized as a period of high growth, as gross domestic product registered a growth rate of 5.89 percent. Secondly, in this period, the goods-producing sector outperformed the service-producing sector by about half a percentage points. And within the goods-producing sector, the industrial sector grew at a faster rate (6.41 percent) than the economy as a whole. It also outperformed the resource sector by almost one and a half percentage points. Thirdly, within the service-producing sector, both services and transportation outperformed the overall economy with growth rates of 6.84 and 6.44 percent respectively. Public administration recorded the smallest growth rate (2.69 percent) in this group.

In the second subperiod, the economy experienced a growth rate of only 3.24 percent. Moreover, in this period, the service-producing sector outperformed the goods-producing sector by more than one and a half percentage points. Secondly, within the goods-producing sector, the industrial sector once again grew at a faster rate (2.48 percent) than the resource sector (1.25 percent). Thirdly, all components of the service-producing sector experienced a fairly even growth.

Table IV-5

Growth rates[1] of gross domestic product by sector, 1962-83.

Major sectors	Mean growth rate				Variance
	1962-1 to 1970-2	1970-3 to 1983-4	Change	1962-83	1962-83
GOODS SECTOR	6.10	2.23	-3.87	3.72	22.63
RESOURCE:	4.98	1.25	-3.73	2.69	33.57
Agriculture	4.35	2.25	-2.10	3.06	108.71
Fishing	2.14	2.84	+0.70	2.57	242.65
Forestry	6.31	1.73	-4.58	3.50	148.54
Mining	5.97	0.92	-5.05	2.87	71.03
INDUSTRIAL:	6.41	2.48	-3.93	4.00	26.53
Manufacturing	6.97	2.40	-4.57	4.15	35.84
Construction	4.49	1.49	-3.00	2.65	35.39
Utilities	7.62	5.65	-1.97	6.41	13.12
SERVICE SECTOR:	5.54	3.90	-1.64	4.54	4.12
Transportation	6.44	4.31	-2.13	5.13	13.01
Trade	5.60	4.20	-1.40	4.74	18.32
Finance	4.86	4.61	-0.25	4.71	3.32
Services	6.84	3.48	-3.36	4.78	5.46
Public admn.	2.69	3.00	+0.31	2.88	3.54
Total	5.89	3.24	-2.65	4.27	8.93

[1]Annualized average growth rates calculated from quarterly data on GDP in constant 1971 dollars.

Looking at the table, it becomes clear that over the entire period 1962-83, the service-producing sector grew at a much faster rate (4.54 percent) compared with the goods-producing sector (3.72 percent). But within the goods-producing sector, the industrial sector grew at faster pace (4.00 percent) than the resource sector (2.69 percent). However, since the industrial sector's growth fell short of the national average, it did lose ground in a relative sense. All components of the service-producing sector grew at much faster rates than the overall economy, with the exception of public administration.

An examination of the last two columns of the table reveals another interesting point. There appears to be a definite pattern between the mean and variance of the sectoral growth rates. To be more specific, there seems to be a negative relationship between the two sets of numbers. While it is extremely difficult to draw any substantive conclusion of a causal nature from this observation, it is intutively appealing to think that relative stability of a sector will have a positive influence on its rate of growth, as a high variance would imply high cost of adjustment[2].

There is another aspect of this asymmetry and this is to do with the differential performance of various sectors during the two phases of a business cycle. Since performance of the manufacturing sector *vis a vis* the service-producing sector is of special interest in this study, the issue of asymmetric period growth is examined in more detail. For the purpose of this study, the following criterion was used for judging whether a phase is expansionary or contractionary. Using the OECD index of industrial production as a reference point, for a phase to change from expansionary to contractionary,

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[2]A Spearman's correlation coefficient of -.55 between the means and variances of the growth rates in the 12 sectors was significant at the five percent level.

there must be at least two consecutive quarters of deterioration. Similarly, for a period to change from contractionary to expansionary, there must be at least two consecutive quarters of improvement[3].

Using this definition, the annualized growth rates of major sectors of the Canadian economy were computed for the two phases of the business cycle. The results show that the industrial sector grew at 4.56 percent during the expansionary periods, while the economy as a whole grew at a rate of 4.44 percent. Thus, the industrial sector outperformed the economy by a small margin of .12 percentage points. During the contractionary periods on the other hand, the economy grew at 4.17 percent as compared to the industrial sector which grew at a rate of 3.68 percent. Thus, the economy outperformed the industrial sector by a margin of .49 percentage points. Thus, over the entire cycle, the industrial sector on average grew at a rate .19 percentage points below the economy, causing a deterioration in the relative size of this sector.

A similar comparison of the service-producing sector showed that the service-producing sector gained ground during the expansionary periods as it grew at 4.59 percent. Thus, it outperformed the economy by a margin of .15 percentage points. However, during the contractionary periods, it grew at 4.50 percent, thus outperforming the economy by .33 percentage points. Thus, over the cycle, the service-producing sector improved its relative position by .24 percentage points. It is obvious from the above analysis that the industrial sector lost ground (-.19 percentage points), while the service-producing sector gained (+.24 percentage points). Looking from another angle, while the industrial sector barely matched the service-producing sector during the upturn, the

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[3]A similar practice is followed by the US Commerce Department and other agencies, such as Conference Board of Canada and Data Resources Inc. However, these agencies use the index of leading indicators as the reference point.

service-producing sector outgrew the industrial sector by a margin of .82 percentage points during the downturn. The annualized growth rates of the industrial sector, goods-producing sector and the service-producing sector are plotted in Figures IV-3a and IV-3b along with the OECD industrial production index[4].

To sum up, an examination of the time series data on sectoral output as measured by gross domestic product as well as on employment reveals the following. First, there has been a significant shift in the relative size of different sectors in the Canadian economy over the period under study. In particular, the service-producing sector grew at a much faster rate than either the goods-producing sector or the industrial sector. Second and perhaps more important, these structural shifts appear to bear a close connection with general economic fluctuations. On closer examination, it appears that the industrial sector in particular has outperformed the service-producing sector by a small margin during the expansionary phases, while the service-producing sector has outperformed the industrial sector by a larger margin during the contractionary phases of business cycles. Thus, the declining trend in the relative size of the industrial sector appears to have followed a cyclical pattern. This asymmetric period growth pattern holds for the goods-producing sector *vis a vis* the service-producing sector with a much greater force.

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[4]Similar calculations were made for the goods-producing sector. The results indicated that the goods-producing sector underperformed the service-producing sector by .48 percentage points during the expansionary phases and by 1.00 percentage points during the contractionary phases. Thus, over the entire period, goods-producing sector underperformed the service-producing sector by .74 percentage point on average.

Figure IV–3a
Cyclical asymmetry in growth patterns of the industrial and the service producing sectors, 1962–83

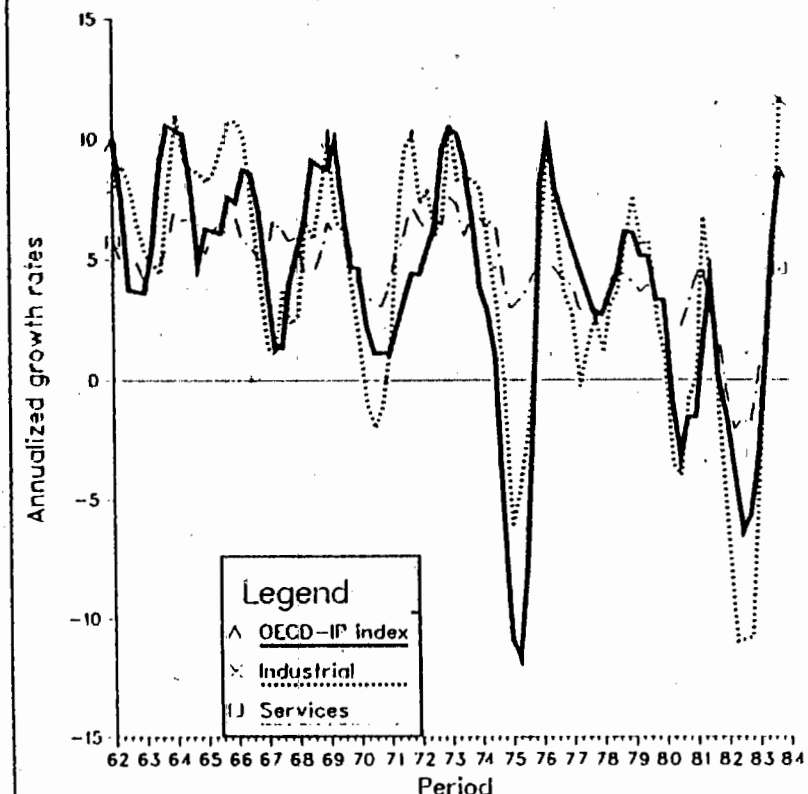
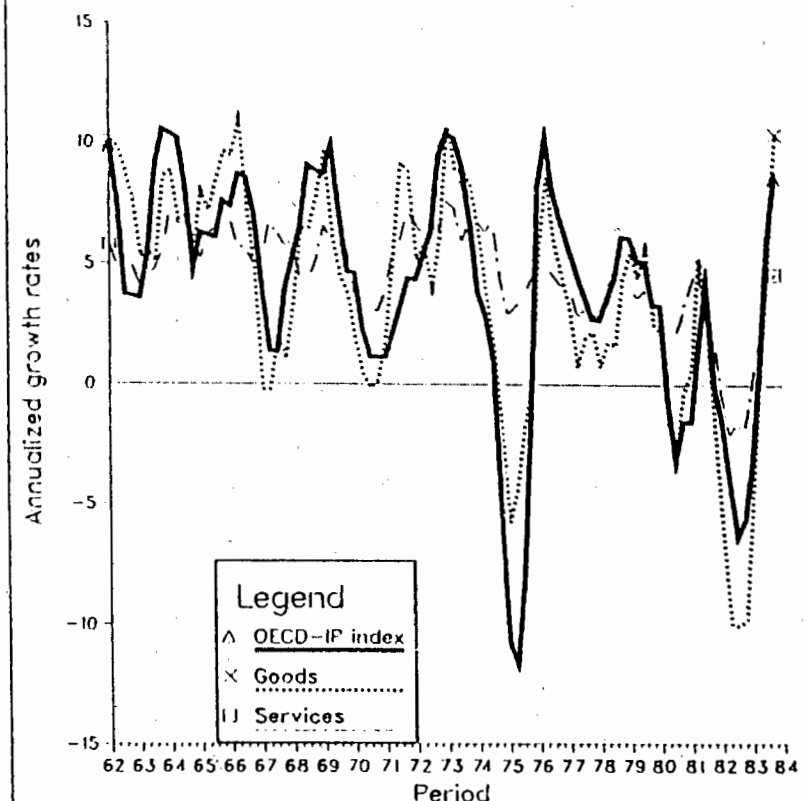


Figure IV–3b
Cyclical asymmetry in growth patterns of the goods and the service producing sectors, 1962–83



IV-5 Asymmetric Sectoral Growth-Causes and Consequences

The two major findings of the preceding analysis are, first that the service-producing sector has grown at a faster rate than the rest of the economy, and second, that this growth has been relatively stable over time compared with other sectors of the economy. The issue of faster relative growth of the service producing sector was examined in Chapter II of this study. Traditionally, the main explanations are sought in income elasticity, productivity and factor price differentials[5]. The elasticity approach has been criticized on two main grounds. It is at best incomplete because income elasticity is only one of many factors that actually influence growth in a given sector. The other problem with this approach is the inherent difficulty in the measurement of output. However, this latter criticism is likely to strengthen the argument rather than weaken it as the measurement error is likely to cause downward bias.

The productivity differential between goods and service-producing sectors is sometimes cited as the main reason for this asymmetric sector growth. The argument is very simple. Since productivity increases at a much slower rate in the service producing sector, any increase in demand for service output leads to a significant increase in demand for labour. Hence, there is a faster rate of employment growth in this sector than in the rest of the economy. However, this argument does not necessarily hold for output. The Kaldorian wisdom would suggest that output would grow at a much slower pace. Thus, a productivity differential does not seem to explain the relative growth of the service-producing sector.

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[5]High relative growth of the service-producing sector is also attributed to the process of urbanization. See Stanback (1979).

The factor price differential is the third factor which is believed to have caused the service-producing sector to grow at a faster rate than the rest of the economy. The argument runs like this. The labour profile in this sector is different from the goods-producing sector in general and the industrial sector in particular. For instance, the service-producing sector has a high proportion of female and part-time workers. It also employs a greater proportion of unskilled and semi-skilled labour. This particular labour profile along with a relatively small size of operations generally means a lower degree of concentration and unionization. As a result, wages play an asymmetric role both between sectors and between different phases of the business cycle. During the upturn, wages do not increase as fast as in the rest of the economy, while during the downturn, wage demands may show a significant moderation. Thus, over each cycle, the relative factor cost moves in favour of the service-producing sector.

The second issue relates to the relatively stable performance of the service-producing sector as depicted in Figure IV-3. The income elasticity approach suggests that the service-producing sector will be subject to the same cyclical swings as the rest of the economy. The explanation of relative stability of this sector therefore, must lie somewhere else. The inventory theory of business cycles seems to provide a plausible explanation. This theory suggests that wide swings in unexpected inventory cause cyclical fluctuations in the level of economic activity. The service-producing sector by and large has no need for maintaining inventories and hence there is little chance for unexpected boom and bust. In most cases, output is produced only when there is a demand for it and hence there is no discrepancy between demand and supply. As Fuchs says,

> "One of the reasons for the stability of output in services is the fact that the output cannot be stored. This sector, therefore, is spared the effects of swings in inventory investment, swings which make a major contribution to cyclical fluctuations of the economy" (1965, pp. 21).

Another explanation for relative stability of this sector is that some of its segments are immune to cyclical swings in income because of a very stable demand for their output. For instance, demand for medical care in general; needs of the aging population; educational and recreational needs; police, fire and sanitational needs; are all very stable. However, demand for some services can be as cyclical as the demand for goods. For instance, the demand for what Grubel (1986a) calls intermediate services will tend to fluctuate with the economy in general. Thus, with some segments enjoying stable demand and the rest being no more cyclical than the goods-producing sector, the service-producing sector as a whole is generally more stable than the goods-producing sector.

It seems appropriate to examine briefly the consequences of a structural change which is characterized by growing importance of the service-producing sector[6]. Firstly, as the service-producing sector is relatively more stable than the rest of the economy, a growing importance of this sector may mean an economy less sensitive to business fluctuations. Secondly, there is evidence to suggest that the service-producing sector has a larger proportion of female and part-time workers than rest of the economy. It also has a greater proportion of self-employed workers. This may have implications for the changing profile of the labour force in the economy. Thirdly, the goods-producing sector on average is more capital intensive than the service-producing sector. Therefore, it may have implications for long term demand for physical capital. Fourthly, the increasing share of output of the service-producing sector may have some balance of payments implications for the western industrialized economies. This concern is reflected in the recent efforts to liberalize trade in services.

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[6]The implications of servicization were examined in detail in Chapter II. Fuchs (1965) and Stanback (1979) provide a good discussion of some of these points.

Finally, the growing importance of the service-producing sector could mean a less efficient allocation of available resources provided the public sector plays an increasingly greater role in the provision of services, and if allocation of resources by non-market forces is non-optimal[7]. Public sector involvement in the service-producing sector can be both direct through ownership and control and indirect through regulations[8]. The following is a brief account of public sector involvement in various service-producing sectors in Canada. The transportation segment of the service-producing sector is characterized by both direct and indirect government involvement. For instance, Air Canada and CN railways are both public sector enterprises. There is also a significant degree of government regulation in this area. Although there is no direct government participation in the financial sector, it is a highly regulated sector. The inefficiency in the trade sector may not be due to government control and regulation but rather due to the presence of underground economy. In the community business and personal services sector, the government provides a considerable amount of services, and hence it can be subject to inefficiency. And finally, public administration and defence is entirely a public sector concern which can be a source of similar inefficiency.

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[7]I am grateful to Professor Spindler for pointing this out to me. An examination of this issue is both challenging and worthwhile. I expect this to become an important item on the agenda for my future research.

[8]This is not to imply that public sector involvement is limited to the service-producing sector. Petro-Canada is one of many examples of government involvement in the goods-producing sector.

IV-6 Asymmetric Sectoral Growth and Cyclical Structural Change

For the purpose of this section, four variables are arbitrarily defined to represent structural change. These are PQT, PQR, PQI and PQM which are the tradeable, resource, industrial and the manufacturing sector output respectively, each expressed as a percentage of total output. It is then postulated that any change in one or all of these ratios over time amounts to a structural change. The null hypothesis therefore is that structural change as defined above does not follow a cyclical time path. The task is to see whether one can reject this hypothesis at a reasonable level of significance.

For this purpose, the OECD index of industrial production, (IPROQ) and each of the above four ratios were separately regressed against time and time series data of deviations from trend were obtained. Since all data were seasonally adjusted, these series can be treated as measures of cyclical fluctuations, assuming that there was no irregular element in the data. Each of these series of deviations from trend for PQT, PQR, PQI and PQM are plotted along with the deviations for IPROQ in Figures IV-4a, IV-4b, IV-4c and IV-4d. A visual inspection of these figures indicates a definite relationship. The following four equations using the deviations from trend of PQT, PQR, PQI and PQM as the dependent variables and deviations from trend of IPROQ as the independent variable were estimated.

$$PQTD=\alpha_0+\alpha_1 IPROQD \quad \ldots \quad \ldots \quad (4.1)$$

$$PQRD=\beta_0+\beta_1 IPROQD \quad \ldots \quad \ldots \quad (4.2)$$

$$PQID=\gamma_0+\gamma_1 IPROQD \quad \ldots \quad \ldots \quad (4.3)$$

$$PQMD=\delta_0+\delta_1 IPROQD \quad \ldots \quad \ldots \quad (4.4)$$

Figure IV–4a
Procyclical behaviour of the goods–producing sector, 1962–83

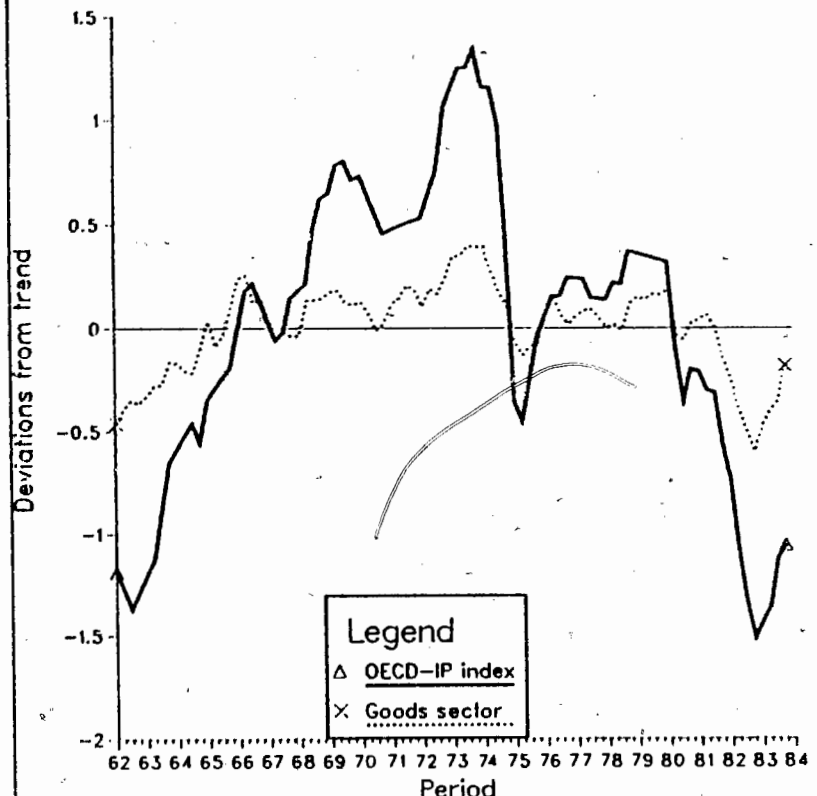


Figure IV–4b
Procyclical behaviour of the resource sector, 1962–83

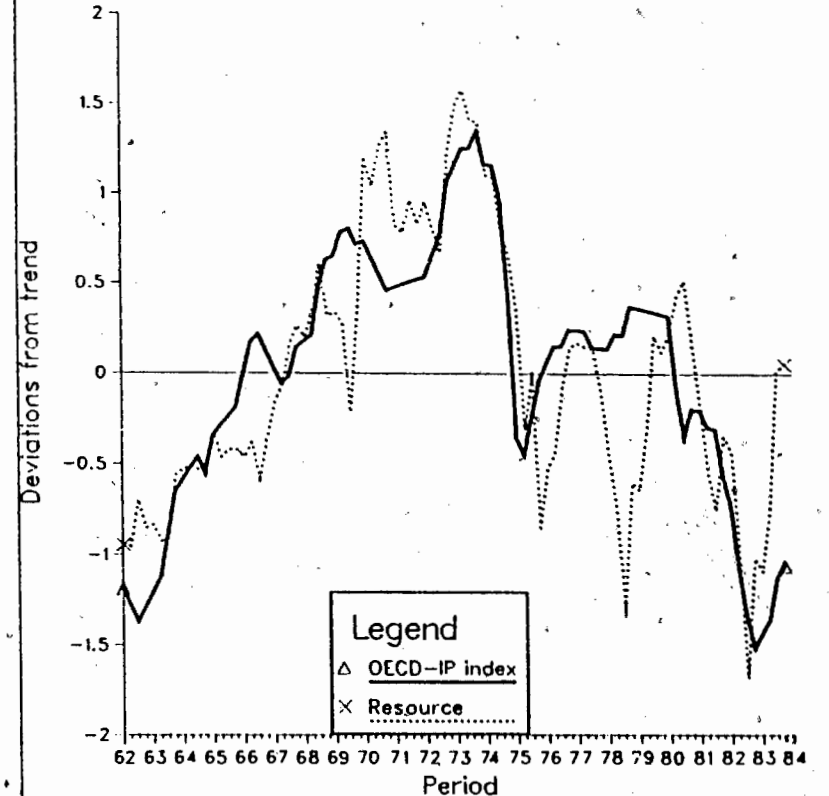


Figure IV–4c
Procyclical behaviour of the industrial sector, 1962–83

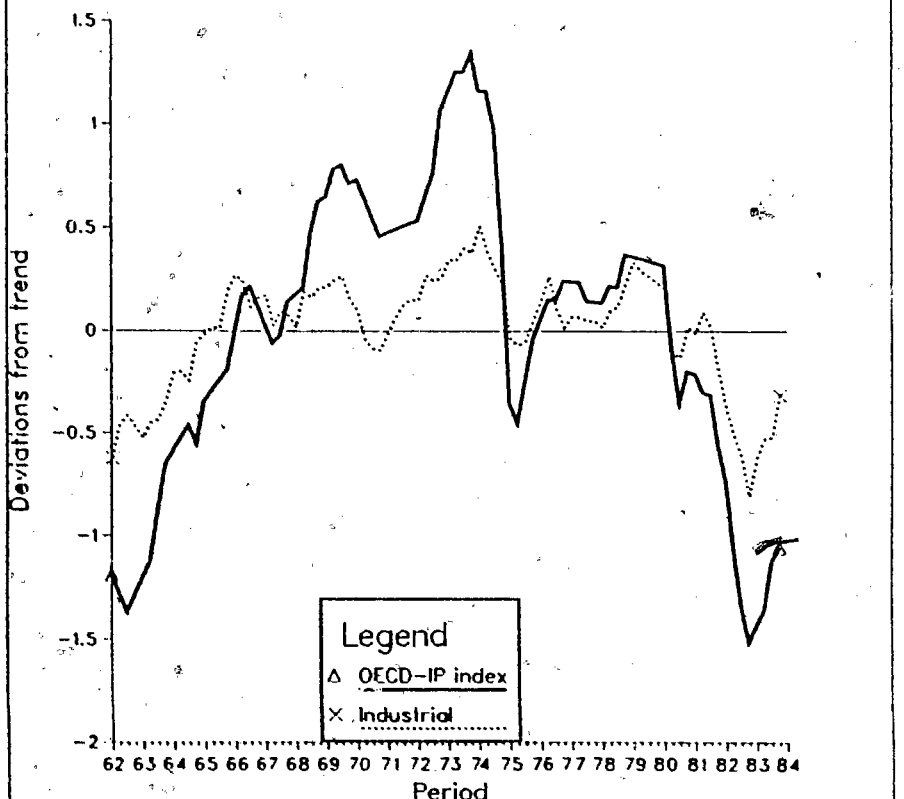
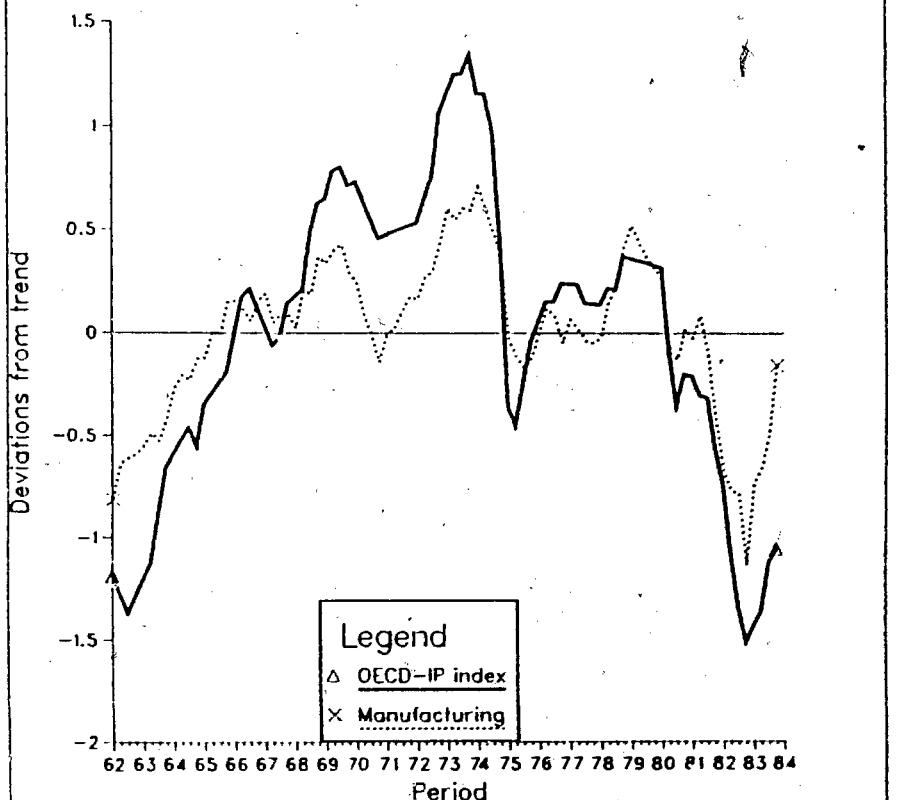


Figure IV–4d
Procyclical behaviour of the manufacturing sector, 1962–83



The equations were first estimated using the ordinary least squares technique[9]. However, a significant degree of first order autocorrelation was detected. Therefore, all four equations were re-estimated using the generalized least squares techniques in order to achieve increased efficiency. The results of estimation are presented in Table IV-6. The slope coefficient in each equation had a positive sign and was significant at the five percent level. Similarly, all the F-values were significant at the five percent level, indicating a good fit. Thus, on the basis of these results, the null hypothesis of no cyclical path of structural change can be rejected[10].

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[9]Equation (4.2) was estimated using a modified definition of the resource sector output which excluded agriculture and fishing and trapping. The rationale for doing this was that these two sectors are more affected by the vagaries of nature rather than the market forces of demand and supply.

[10]The simple correlation coefficients of .94, .78, .91 and .93 between the respective pairs of variables were found significant at the five percent level.

Table IV-6

Regression results of equations (4.1), (4.2), (4.3) and (4.4), estimated over the period 1962-83.

	Equation (4.1)	Equation (4,2)	Equation (4.3)	Equation (4.4)
Coeff	0.284* (13.20)	0.565* (3.79)	0.352* (9.93)	0.477* (10.74)
Const.	0.000	0.002	0.000	0.000
R^2	.67	.13	.53	.57
F-value	174.13	14.40	98.56	115.26
SE	0.01	0.03	0.05	0.01
DW	1.75	1.85	2.01	1.96
Rho 1	.64	.81	.73	.72

* significant at the 5 percent level using a two-tailed test. T-values are in parentheses.

CHAPTER V

STRUCTURAL CHANGE IN A RESOURCE-BASED ECONOMY-A THEORETICAL FRAMEWORK

This chapter is a central part of this study. Essentially, there are two main objectives in this chapter. The first objective is to examine the taxonomy of structural change in a resource-based economy. In particular, the issue of a demand-induced resource boom is re-examined. This is done by examining the relationship between global recovery and rising prices of basic raw materials. Then, it is shown how this exogenous resource boom can lead to a rise in the general wage level in the resource sector and how under competitive market conditions, wages in the non-resource sectors tend to rise in tandem with wages in the resource sector.

The second objective is to develop a theoreticial framework for analyzing structural change in a resource-based economy. This entails developing a two-part model. First of all, reduced-form equations for the tradeable and the non-tradeable sectors are formally derived. These reduced-form equations can be estimated to see how well they explain the actual movement of these sectors through time. Secondly and more importantly, a model is derived which allows estimation of the process of structural adjustment by using output of various sectors in ratio form as the dependent variable. A dummy variable approach can be adopted in order to test for presence of asymmetry both between sectors and between various phases of the business cycles.

V-1 A Taxonomy of Structural Change in a Resource-Based Economy

Before examining some of the major links in the chain of the structural adjustment process, it seems appropriate to restate the main arguments in this study. In this thesis, it is proposed that the process of structural change in a resource-dominated economy such as Canada is of a cyclical nature. While this hypothesis does not refute the current views on the structural adjustment process, it may have some additional cost implications. Unlike the secular trend hypothesis where the process of adjustment is gradual over time and therefore predictable, and unlike the Dutch-disease hypothesis where the adjustment is more violent but of once-and-for-all nature, the cyclical structural adjustment is of recurring nature. It is argued that even when the structural adjustment process is secular, it is not without serious consequences.

There is considerable evidence in the literature to suggest that the industrial sector fosters growth by generating dynamic forces in the economy. Therefore, a stagnating industrial sector is bound to have serious long term growth consequences[1]. In this study, it is argued that since structural adjustment in a resource-based economy is generally of a cyclical nature, it will tend to exacerbate the problem of structural unemployment. And finally, since economic fluctuations are difficult to predict, a cyclical structural adjustment can mean higher adjustment costs.

It is perhaps important to point out here that although the process of structural adjustment is postulated to be cyclical, there is an asymmetry in this process. That is, while during contractionary periods the industrial sector shrinks in a relative sense, during the expansionary periods, it does not necessarily

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[1]This issue was examined in Chapter II, in some detail.

rebound to regain lost ground. Thus, there is a ratchet effect of a sort, which makes the process by and large irreversible.

A Demand-induced Resource Boom-A Re-examination

In Chapter III, this issue was examined in some detail. It was shown empirically that the behaviour of exports of natural resources is indeed procyclical, and also that there is in fact a strong positive relationship between volume and price indexes of exports in general. In this section, the demand-induced nature of the resource boom is re-examined and then some additional evidence of its procyclical character is provided.

Whenever there is a general surge in economic activity in the major industrialized countries, the demand for resources increases[2]. The impact of a global recovery on the demand for the resource sector's output, and resource prices, can be studied in the usual demand and supply framework. This is done in the following figure.

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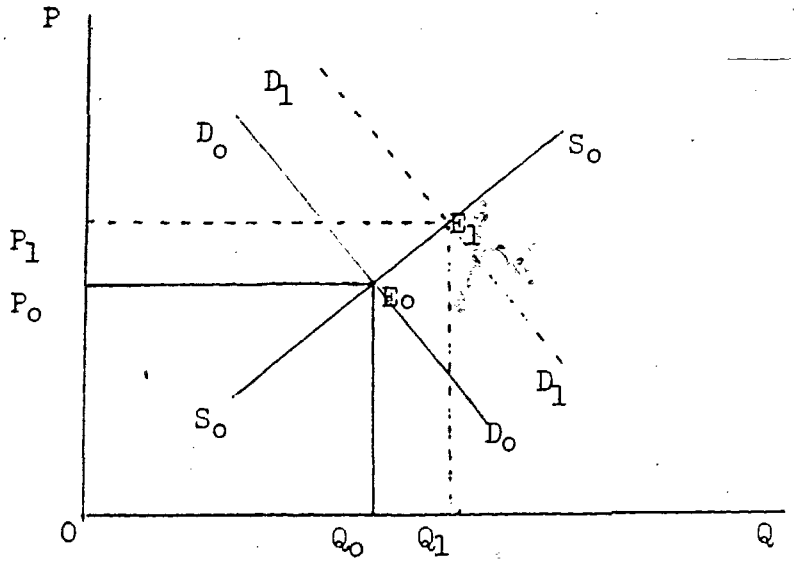
[2]The underlying assumption is that major market economies are highly integrated and therefore, business fluctuations are closely synchronized. In view of recent experience, this seems like a reasonable assumption. For instance, in 1972-73, all seven major industrialized countries (Canada, USA, Japan, France, Italy, Germany and the UK) experienced a sharp increase in their industrial production, and in 1973, each one of them slumped into one of the deepest recessions of the post-war era. Unprecedented advances in transportation and communication coupled with a more integrated monetary policy in recent years may account for this growing synchronization.

Figure V-1



Point E_0 is the initial equilibrium at which P_0 and Q_0 are the equilibrium price and quantity of resource sector output respectively. Suppose that there is a sharp upturn in the major industrialized economies, which results in an outward shift of the demand curve to DD_1. Now, point E_1 is the new equilibrium following the initial impact of the boom, and P_1 and Q_1 are the new equilibrium price and quantity. The resource boom is demand-induced as both the price and the quantity, increase as a result of the demand shift. Thus, unless the supply curve is perfectly inelastic, there will always be some increase in quantitiy along with an increase in prices.

There are at least two reasons why the supply curve will not generally be vertical, even in the short run. First, there may be excess inventory, especially during periods of slow growth. And second, some augmentation of the production level is usually possible on short notice. Figures V-2a and V-2b show the procyclical movement of resource prices both for the all commodities group and

Figure V–2a
Time series behaviour of OECD industrial production and prices of basic commodities, 1962–83

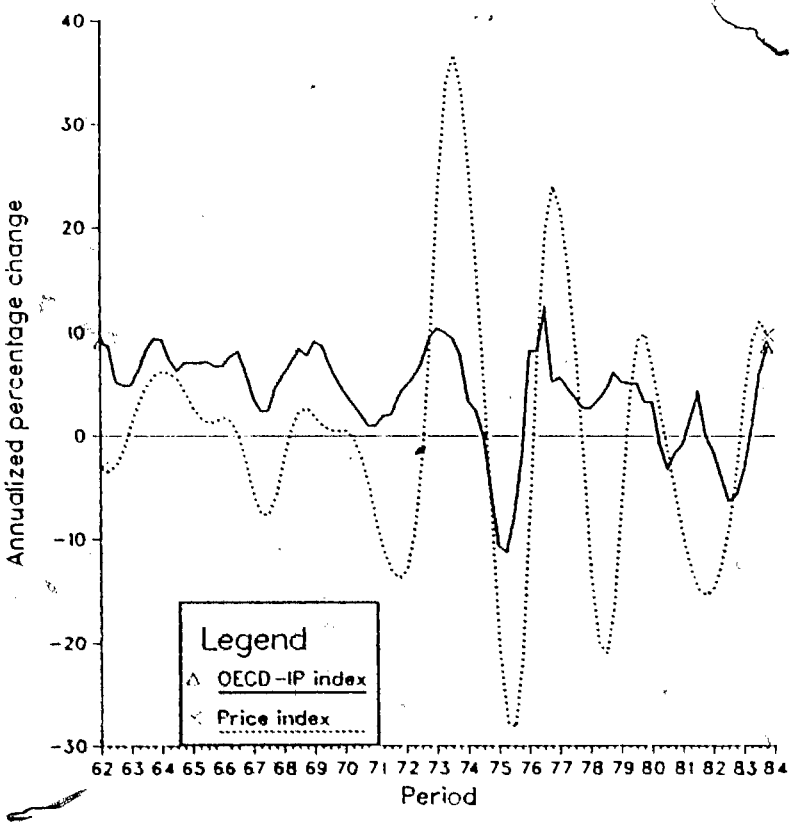
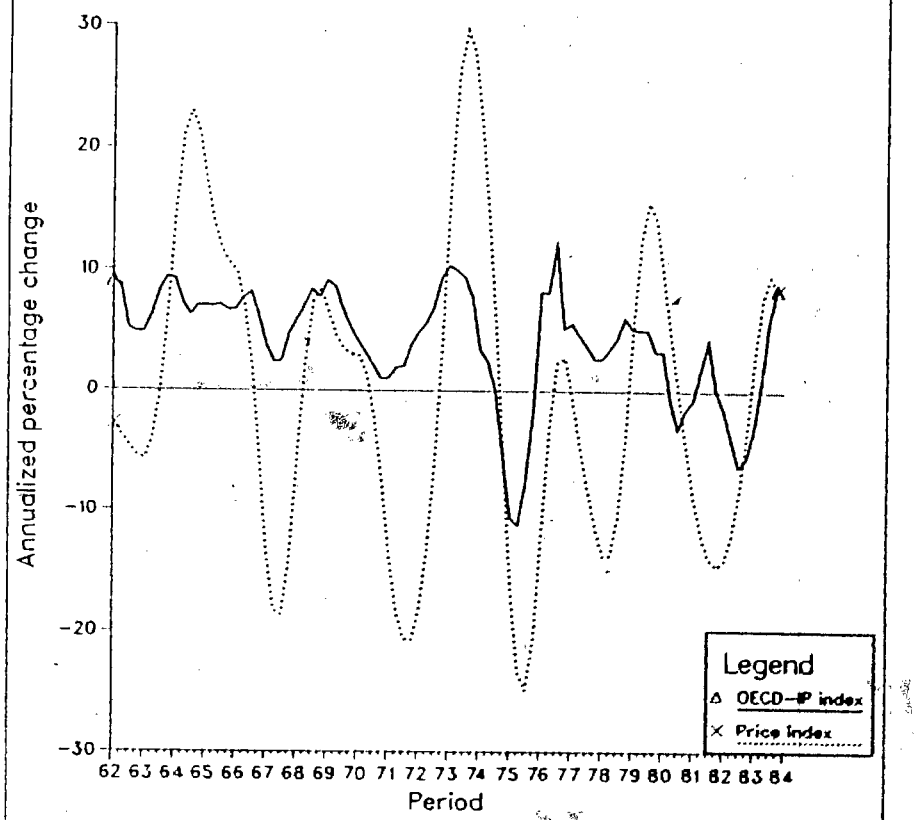


Figure V–2b
Time series behaviour of OECD industrial production and prices of basic metals and minerals, 1962–83



the metals and minerals group[3]. As it is clear from these figures, 1964, 1973 and 1979 represent the periods of greatest resource boom in recent years, marked by a dramatic increase in prices.

In order to find a more precise measure of this procyclical behaviour, the following regression equation was estimated, using the index of metal and mineral prices (CMP) in constant dollars as the dependent variable, and the OECD industrial production index (IPROQ) as the explanatory variable[4].

$$CPM_t = \alpha_0 + \alpha_1 T + \alpha_2 T^2 + \Sigma \alpha_{3i} IPROQ_{t-i} \quad \ldots \quad (5.1)$$

Equation (5.1) was estimated using Almon distributed lags. A five period lag with a second degree polynomial seems to yield the best result. Since this equation was estimated in double log form, the coefficients can be interpreted as elasticities. There were no endpoint restrictions imposed on the parameters. The time variable was introduced in order to account for the presence of a trend in the data. The results are summarized in Table V-1. Looking at the table, an adjusted R^2 of .72 and a F-value of 46.14 indicated strong support for the contention that the metal and mineral prices behave in a procyclical manner. The long run elasticity of 1.004 with a t-value of 3.38 was significant at the five percent level, and so were the first four short run coefficients. However, the presence of serious autocorrelation as indicated by a low value of the

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[3]The all commodity group consists of 33 basic commodities excluding energy, while the metal and mineral group consists of 8 major kinds of metals and minerals. Both price indexes are in constant dollars and are based on 1979-81=100.

Source: World Bank Economic Analysis & Projections Department, Commodity Studies & Projections Division.

[4]The reason for using the metal and mineral price index rather than the more comprehensive all commodity group in this equation is that Canada is very poorly represented in the all commodity group except for the metals and minerals included in the metal and mineral group.

Table V-1

Regression results of equation (5.1), estimated over the period 1962-83.

T	Coefficients	T-values
0	0.316	(3.97)*
1	.0.333	(4.67)*
2	0.275	(3.57)*
3	0.143	(2.01)*
4	-0.063	(-0.79)
$\Sigma\alpha_i$	1.004	(3.38)*
R^2=.72	F=46.14	SE=.01
DW=.72	Rho1=1.86	Rho2=-.97

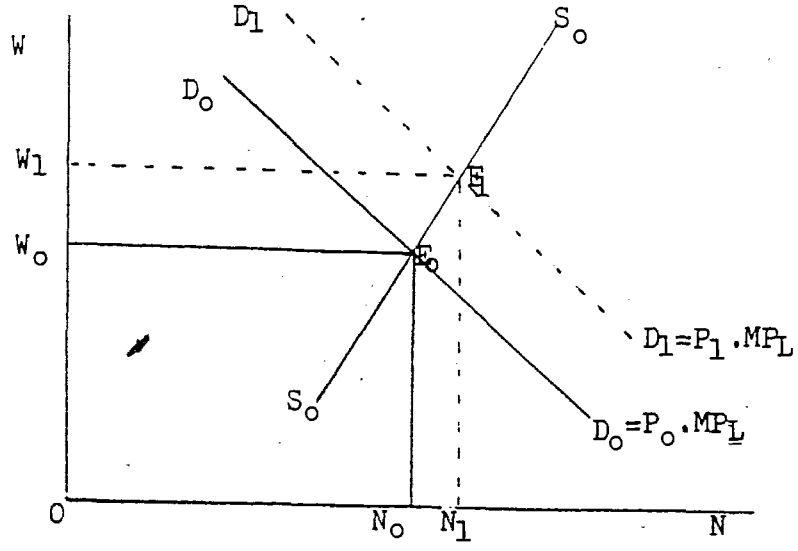
* significant at the 5 percent level using a two-tailed test.

Durbin-Watson statistic undermines these results. Thus, there appears to be some evidence in support of the hypothesis that the resource sector experiences a significant rise in its output prices following a rise in the level of economic activity in the industrialized countries. Figure V-3 shows a close relationship between growth in the level of economic activity as measured by the OECD industrial production index and the growth of the resource sector in Canada.

A Resource Boom and Wages in the Resource Sector

Like the demand for basic raw materials, the demand for labour is also a derived demand. A change in the product price generally leads to a shift in the demand for labour. The impact of a resource boom on wages in the resource sector is illustrated in the following figure.

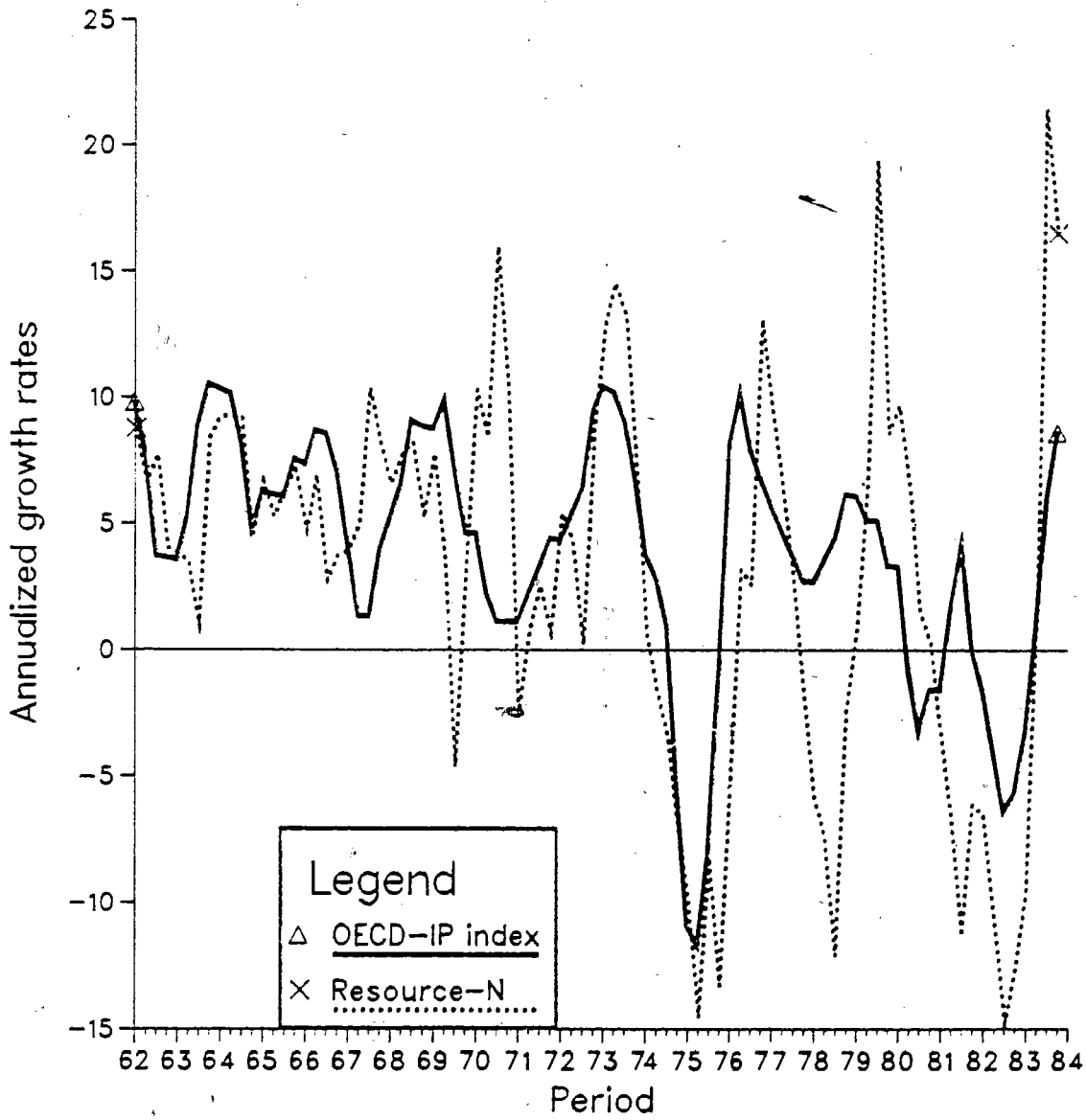
Figure V-4



The point E_o is the initial equilibrium with W_o and N_o being the equilibrium nominal wage and amount of labour demanded, respectively. Becuase of a shift

Figure V–3

Relationship between growth in the level of economic activity, in the OECD countries and the Canadian resource sector, 1962–83



in the demand for resources, resource prices rise from P_0 to P_1, as explained in the preceding section. Other things remaining the same, the demand curve for labour will shift to the right. As a result, a new equilibrium occurs at point E_1 where W_1 and N_1 are the new equilibrium wages and employment.

However, a rise in nominal wages from W_0 to W_1 will not mean a rise in real wages if the rise in general price level is large enough to offset the rise in nominal wages. It is assumed here that during expansionary periods, resource prices tend to rise faster than consumer prices, and therefore, even with a rise in consumer prices, the shift in demand for labour will be large enough to more than compensate the dampening effect of a rise in consumer prices on real wages. The net outcome of this analysis is that both nominal and real wages rise during economic expansion. The procyclical behaviour of wages in the resource sector is depicted in Figure V-5[5].

It should be pointed out here that if it is assumed that the initial equilibrium is at less than full employment, then wages will rise rather slowly in the beginning. But as the boom persists and the economy moves toward a higher level of employment, wages will rise faster. This particular feature of the labour market can be incorporated in the present analysis by introducing a supply curve which is concave upward. In such a case, the wage effect of the boom will be further magnified.

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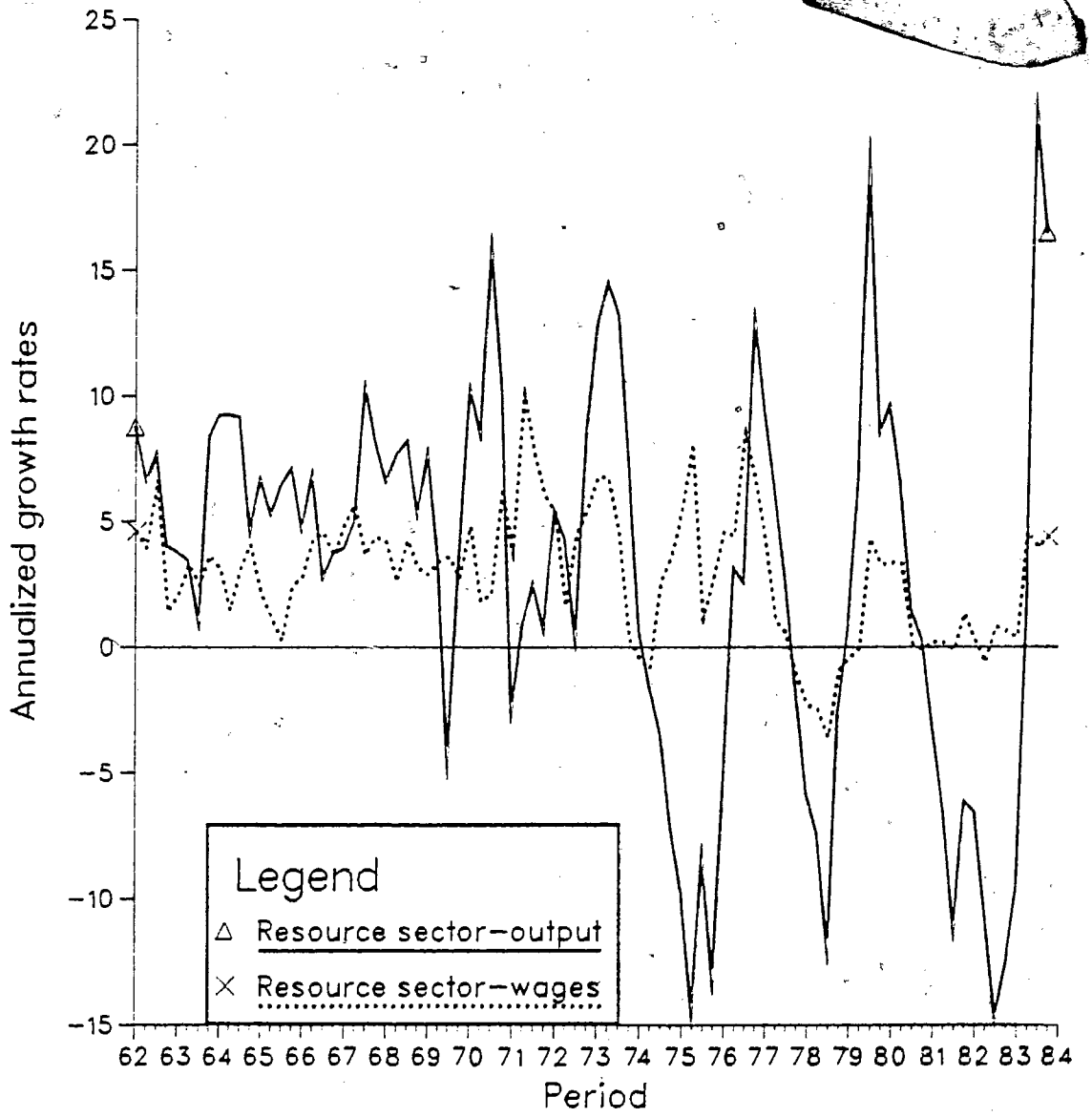
[5]In this figure, the resource sector includes only forestry and mining because wage data are unavailable for agriculture and fishing and trapping. The correlation coefficients of .380 and .248 for the current period and one-period lag respectively were found significant at the five percent level. The value became statistically insignificant after that.

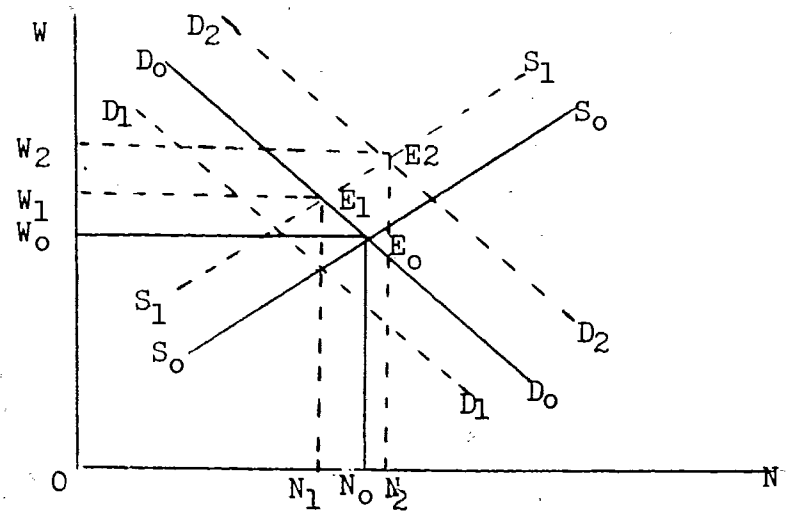
Figure V–5
Procyclical behaviour of output and wages in the Canadian resource sector, 1962–83



A Resource Boom and Wages in Rest of the Economy

It has been shown that in the resource sector, both real wages and quantity of labour demanded increase during economic expansion. Even at less than full employment, some of the additional labour demanded by the resource sector will come from the rest of the economy. This is referred to as the resource movement effect in the Dutch-disease literature. Before analyzing the taxonomy of wages in rest of the economy, two points are worth mentioning here. First, the underlying assumption in the present analysis is that the labour is mobile between sectors. This assumption is made in full cognizance of the fact that at any given time, there may exist some labour that is sector specific. Not all workers are skilled miners and loggers at the same time. Second, in this study a distinction is made between wage behaviour in the industrial (non-resource, non-service) sector and in the service-producing sector. The behaviour of wages in the industrial sector is illustrated in the following figure.

Figure V-6



In the above figure, E_0 is the initial equilibrium with W_0 and N_0 as the equilibrium wage and quantity of labour demanded. As a result of the resource movement effect, some labour has left which means an inward shift of the supply curve to SS_1. Wages rise to W_1 and employment falls to N_1 at point E_1. But now, the resource cost is higher because of the rise in raw material prices. This means less resource per worker (assuming capital is unchanged) and hence the marginal physical product of labour falls. With product prices unchanged, this means a downward shift of the labour demand curve to DD_1. Finally, during expansionary periods, the product prices will unambiguously increase. Therefore, the demand curve for labour shifts out to DD_2 and there is a new equilibrium at E_3 with W_3 and N_3 being the equilibrium wage and quantity of labour demanded respectively.

The net outcome of these shifts in the demand and supply curves of labour is not readily obvious. It will very much depend on the magnitudes of the shifts, the elasticities of the two curves, and the amount of change in the product and the raw material prices. However, it seems reasonable to postulate the following. The net effect on the level of employment is indeterminate. But even a net increase in the level of employment does not by itself contradict the hypothesis, because it is the relative behaviour of employment and output and not the absolute change which is relevant for the purpose of the present investigation. However, the wage in the industrial sector is expected to rise as downward shift of the demand curve due to the resource movement effect is likely to be smaller than the upward shift due to the price effect. Moreover, organized labour would demand parity with wages in the resource sector. Thus, wages in the industrial sector would rise in tandem with a rise in the resource sector. In other words, the resource sector seems to behave as the wage-leader.

In order to test whether there is a significant relationship between the industrial wage and wages in the resource sector, wages in the manufacturing sector (WMAN), the construction sector (WCON), the utilities sector (WUTL) as well as the wages in the industrial sector as a whole (WIND) were regressed on wages in the resource sector (WRES). The four equations are:

$$WMAN_t = \alpha_0 + \alpha_1 T + \alpha_2 WRES_t + \Sigma \alpha_{3i} WRES_{t-i} \quad \ldots \quad \ldots \quad (5.2)$$

$$WCON_t = \beta_0 + \beta_1 T + \alpha_2 WRES_t + \Sigma \beta_{3i} WRES_{t-i} \quad \ldots \quad \ldots \quad (5.3)$$

$$WUTL_t = \gamma_0 + \gamma_1 T + \alpha_2 WRES_t + \Sigma \gamma_{3i} WRES_{t-i} \quad \ldots \quad \ldots \quad (5.4)$$

$$WIND_t = \delta_0 + \delta_1 T + \delta_2 WRES_t + \Sigma \delta_{3i} WRES_{t-i} \quad \ldots \quad \ldots \quad (5.5)$$

The current term in each equation has been kept free and the Almon distributed lag method was applied only on the lagged terms. A second degree polynomial with a five period lag structure yielded the best results. No endpoint restrictions were imposed on the parameters. All equations were estimated using a double log specification and therefore all coefficients are also measures of elasticity. The results are summarized in Table V-2a. Looking at the table, the current term in each equation had produced the expected sign. However, the current term was statistically significant only in three of the four equations. More importantly, all lagged coefficients in each equation produced the expected signs and all with the exception of the first lagged term in equation (5.3) were statistically significant. Similarly, all long run coefficients were significant at the five percent level. Thus, these results suggest that there is a significant relationship between wages in the resource sector and wages in the industrial sector, as postulated in this study. But this is at best a partial test of the hypothesis, as this does not rule out the existence of a reverse causality. For this, all four equations were reestimated by reversing the variables and by

Table V-2a

Regression results of equations (5.2), (5.3), (5.4) and (5.5), estimated over the period 1962-83.

T	Equation (5.2)	Equation (5.3)	Equation(5.4)	Equation (5.5)
k1	0.318*	0.301*	0.089	0.219*
	(6.15)	(2.42)	(1.14)	(3.65)
1	0.110*	0.065	0.185*	0.105*
	(2.18)	(0.53)	(2.47)	(1.79)
2	0.077*	0.120**	0.176*	0.118*
	(2.37)	(1.45)	(3.81)	(2.94)
3	0.062**	0.158*	0.164*	0.127*
	(1.65)	(1.68)	(3.01)	(2.79)
4	0.065*	0.179*	0.152*	0.133*
	(1.99)	(2.15)	(3.21)	(3.31)
5	0.086*	0.181**	0.138*	0.135*
	(1.74)	(1.51)	(1.84)	(2.33)
Σ_{k3i}	0.400*	0.704*	0.815*	0.617*
	(3.51)	(2.29)	(5.40)	(4.14)
Const.	0.992	-0.713	0.003	1.436
R^2	.82	.32	.86	.61
F-value	80.66	9.23	111.81	28.54
SE	0.01	0.02	0.01	0.01
DW	1.87	1.71	2.25	1.51
Rho1	0.93	0.98	0.89	0.98

* significant at the 5 percent and ** 10 percent levels using a one-tailed test. T-values are in parentheses.

keeping all other specifications intact. The results are presented in Table V-2b. As the table reveals, both equations (5.2) and (5.5) produced statistically insignificant long run coefficients. Thus, the direction of the causality seems to be consistent with the hypothesis both in case of the manufacturing and the industrial sectors. Equations (5.3) and (5.4), representing construction and utilities however, produced significant long run coefficients, signifying a two-way causation. However, it should be pointed out that the size of the long run coefficients is smaller in both cases than in Table V-2a. On the basis of this comparison, one can argue that there is sufficient support for the hypotheses as postulated in this study. In other words, these results seem to provide some evidence in support of the contention that the wages in the resource sector lead wages in all segments of the industrial sector individually as well as collectively.

So far as the behaviour of wages in the service-producing sector is concerned, two things were established in Chapter IV. First, the wage level in the service-producing sector is lower than the industrial composite wage. And second and more important, the rate of growth of wages in the service-producing sector is much slower than in the rest of the economy. As a matter of fact, the mean quarterly growth in the service-producing sector over the entire period 1962-83 was only .425 percentage points compared with .637 percentage points in the industrial sector, and .723 percentage points in the resource sector. See Table IV-3.

Beside this intersectoral asymmetry in the growth rates, there seems to be an asymmetry of another kind. Since behaviour of wages in different sectors of the economy during the expansionary and the contractionary periods is of special interest, the mean quarterly rates of growth of wages on an annualized basis for

Table V-2b

Regression results of equations (5.2), (5.3), (5.4) and (5.5), estimated with the variables reversed.

T	Equation (5.2)	Equation (5.3)	Equation(5.4)	Equation (5.5)
k1	0.909*	0.192*	0.181**	0.462*
	(5.50)	(2.14)	(1.38)	(2.58)
1	0.028	0.017	0.147	-0.053
	(0.17)	(0.19)	(1.25)	(-0.29)
2	0.015	0.109*	0.123*	0.104
	(0.16)	(2.34)	(1.67)	(1.02)
3	0.009	0.123*	0.122	0.152
	(0.07)	(2.03)	(1.28)	(1.17)
4	0.010	0.057	0.143*	0.093
	(0.12)	(1.28)	(2.10)	(1.10)
5	0.018	-0.087	0.187**	-0.075
	(0.11)	(-1.00)	(1.47)	(-0.45)
Σ_{k3i}	0.079	0.219*	0.722*	0.221
	(0.43)	(1.99)	(4.75)	(1.16)
Const.	0.822	3.921	1.168	1.678
R^2	.97	.92	.97	.96
F-value	497.03	203.40	490.87	415.72
SE	0.01	0.01	0.01	0.01
DW	2.17	2.18	2.02	2.11
Rho1	0.72	0.80	0.67	0.71

* significant at the 5 percent and ** 10 percent levels using a one-tailed test. T-values are in parentheses.

various sectors during the two phases of the business cycles were computed. The results are presented in Table V-3. The major points emerging from this exercise are as follows. The wages in the goods-producing sector seem to have decelerated by about the same margin as the industrial composite wage during the contractionary periods. Within the goods-producing sector, wages in the resource sector displayed the smallest deceleration (-0.19) which is significantly less than the industrial composite wage (-0.24). The manufacturing sector displayed a much larger deceleration (-0.44) than the industrial composite wage. However, the industrial sector wage as a whole showed a somewhat smaller deceleration (-0.33) than manufacturing but still larger deceleration than the industrial composite wage. When a comparison was made with the service-producing sector, the asymmetry in wage behaviour became more acute. For example, the deceleration in the service-producing sector (-0.49) exceeded deceleration in any other sector. In fact, this deceleration was twice as much as for the industrial composite wage. When these calculations were made for the service-producing sector excluding transportation, the deceleration was even larger.

Induced Capital Inflows and Structural Adjustment

The issue of induced capital inflow was examined in Chapter II. However, the main arguments are recapitulated here, in order to complete the discussion of the taxonomy of structural change. In this thesis, it is proposed that capital inflow in a resource-based economy is by and large of an induced nature. The booming sector needs additional capital to finance expansion. Part of this capital requirement is met by domestic sources, but some comes from outside the country. Furthermore, a sharp increase in real income in the rest of the world creates additional supply of investment funds. Foreign portfolios are readjusted and some of the foreign funds flow into the Canadian economy, especially the

Table V-3

Asymmetric behaviour of real wages in major sectors during the business cycles, 1962-83.

Major sectors	Expansionary periods	Contractionary periods	Difference
GOODS SECTOR:	2.90	2.63	-0.27
RESOURCE	3.03	2.84	-0.19
MANUFACTURING	2.27	1.83	-0.44
INDUSTRIAL	2.82	2.49	-0.33
SERVICE SECTOR*	2.04	1.55	-0.49
Ind. comp.	1.86	1.62	-0.24

*When transportation was excluded from the service-producing sector, the annualized growth rate during the contractionary periods declined to 1.26 from 1.77 during the expansionary periods, a deceleration of -0.51 percentage point.

Source: Employment and Average Weekly Wages and Salaries, Stat. Can. cat. no. 72-002

resource sector. This additional capital inflow *ceteris paribus* has a positive impact on the value of the domestic currency. An appreciating currency hurts the tradeable sector of which the industrial sector is an important part. The service-producing sector on the other hand, remains largely unaffected. To sum up, the balance of payments effect of a resource boom in a resource-based economy is such that the share of the industrial sector in the national output is under constant downward pressure.

There have been several contentions in this part of the thesis, and each has the potential of becoming a testable hypothesis. Some of these hypotheses have been subjected to preliminary investigation in order to verify the broad thrust of the issue.

V-2 Theoretical Models of Structural Change

In this section, a formal model of structural change for a small open economy is derived. The model is essentially a two-sector general equilibrium model. Although the dichotomy between tradeable and non-tradeable sectors is questionable, it has been kept for expositional simplicity. Thus, there are two product markets, one each for the tradeable and the non-tradeable sectors. It is assumed that non-tradeable prices are determined in the domestic market. The tradeable prices on the other hand, are determined in the international market. The model uses two tradeable prices, namely foreign and domestic. A small country assumption and the purchasing power parity postulate seem to make this distinction redundant. However, since the focus in this study is on the cyclical nature of the structural adjustment process, there is some justification for letting

the two tradeable prices to diverge in the short run[6].

Both the exchange rate and the interest rate are assumed to be exogenous. Similarly, the wages in the tradeable and the non-tradeable sectors are exogenously determined. In view of the crucial role that relative wages play in this model, the exogeneity of wages is a matter for concern[7]. Finally, both foreign income and domestic government expenditures are assumed to be exogenous, and therefore they are both shift parameters.[8].

Both the role of relative wages and government expenditures in this model need further comment. Relative wages have been often cited as an important cause for the relative growth of the service-producing sector. This model intends to capture the structural role of relative wages. This is also consistent with the Dutch-disease hypothesis where a resource boom leads to an escalation of wage demands in the booming sector. Although wages in other sectors of the economy tend to rise in tandem, there is an asymmetry in the rate of increase across sectors. During the contractionary phase of the business cycle, there is a

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[6]Winters (1981) in his model of the export sector, makes the assumption that UK exports are differentiated both from the goods produced elsewhere in the world and from the goods produced in the UK for the home market. This assumption allows him to postulate that the two tradeable prices may diverge. He also mentions changes in corporate tax policies, long run economies of scale and 'learning by doing' which may cause a change in the relationship between export prices and prices in the home market. According to him the export price will lag behind the cost price (domestic tradeable price) because (1) exporters adopt historical cost price, (2) exporters fail to realize that competitor's prices have changed, (3) there may be some bureaucratic and technical rigidities, and (4) there are some administrative costs associated with the frequency of price changes.

[7]An attempt to include separate labour markets in the model created some serious problems in working out the algebra and made the interpretation of the coefficients very difficult. The labour market and the process of wage determination was discussed in the first section of this chapter.

[8]The exclusion of terms of trade effect in this model is consistent with the small country assumption.

similar asymmetry in that some sectors show a higher degree of wage moderation than others. See Table V-3. for some empirical evidence.

The so-called Bacon-Eltis thesis, as explained earlier, tries to explain the relative growth of the service-producing sector in terms of expanding government expenditures. The inclusion of government expenditures in the present model is therefore intended to test this hypothesis.

A Model of the Goods Producing-Tradeable Sector

In this section, a mathematical model for the tradeable sector is derived. The exercise begins by separating the domestic sources of demand (D) from the foreign sources of demand (F). Thus, the demand for output of a given tradeable sector, i, is written as follows.

$$Q^d_{Ti} = D_i + F_i \quad \ldots \quad (1) \qquad i = 1,2,\ldots\ldots n_1$$

Here, the domestic sources of demand (D_i) consist of consumption (C_i), investment (I_i) and government (G_i). For simplicity, it is assumed that government expenditures are exogenous. The foreign source of demand for domestic output consists of exports (X_i) and (M_i) denotes domestic demand for foreign outputs. Using this notation, the expression (1) is written as,

$$Q^d_{Ti} = C_i + I_i + G_i + X_i - M_i \qquad \ldots \qquad (2)$$

which is an identity. It is assumed that the components of (2) are determined as follows.

$$C_i = f_1(Y_{DN}, P_{Nj}, P_{Ti}) \quad \ldots \quad (2a) \qquad j=1,2,..n_2$$

$$I_i = f_2(R_N, P_{Ti}) \quad \ldots \quad (2b)$$

$$X_i = f_3(Y_{FN}, P_{Fi}, P_{Ti}) \quad \ldots \quad (2c)$$

$$M_i = f_4(Y_{DN}, P_{Fi}, P_{Ti}) \quad \ldots \quad (2d)$$

$$G_i = G_0 \quad \ldots \quad (2e), \text{ where}$$

Y_{DN} = domestic income in nominal terms,

Y_{FN} = foreign income in nominal terms,

P_{Nj} = non-tradeable prices,

P_{Ti} = domestic tradeable prices,

P_{Fi} = foreign tradeable prices adjusted for exchange rates,

R_N = nominal interest rate

Using P_{Ti} as the numeraire, equations (2a) through (2e) can be written as follows.

$$C_i = f_1(Y_D, RP_{Nj}) \quad \ldots \quad (3a)$$

$$I_i = f_2(R) \quad \ldots \quad (3b)$$

$$X_i = f_3(Y_F, RP_{Fi}) \quad \ldots \quad (3c)$$

$$M_i = f_4(Y_D, RP_{Fi}) \quad \ldots \quad (3d)$$

$$G_i = G_0 \quad \ldots \quad (3e), \text{ where}$$

$$RP_{Nj}=P_{Nj}/P_{Ti}, \text{ and } RP_{Fi}=P_{Fi}/P_{Ti}$$

For expositional simplicity, it is assumed that each of the functions (3a) through (3e) can be written in the following linear forms.

$$C_i = a_0 + a_1 Y_D + a_2 RP_{Nj} \quad \ldots \quad (4a)$$

$$I_i = b_0 - b_1 R \quad \ldots \quad (4b)$$

$$X_i = x_0 + x_1 Y_F + x_2 RP_{Fi} \quad \ldots \quad (4c),$$

$$M_i = m_0 + m_1 Y_D - m_2 RP_{Fi} \quad \ldots \quad (4d), \text{ and}$$

$$G_i = G_0 \quad \ldots \quad (4e), \text{ where}$$

all coefficients >0, and $0<m_1<a_1<1$

The model is further simplified by combining equations (4c) and (4d) as,

$$F_i=(X_i-M_i) = (x_0-m_0)-m_1 Y_D+x_1 Y_F+(x_2+m_2)RP_{Fi} \quad \ldots \quad (5)$$

Or

$$F_i = c_0-c_1 Y_D+c_2 Y_F+c_3 RP_{Fi} \quad \ldots \quad (6), \text{ where}$$

all c_i's are implicitly defined by (5)

Now, expression (2) can be rewritten by collecting the appropriate terms from equations (4a), (4b), (4e) and (6) as follows.

$$D^d_{Ti} = (a_0+b_0+c_0+G_0)+(a_1-c_1)Y_D+c_2 Y_F-b_1 R+c_3 RP_{Fi}+a_2 RP_{Nj} \quad \ldots \quad (7)$$

The following is the interpretation of the causal relationship of each variable in equation (7). Domestic real income (Y_D) has two opposing effects on the demand for the tradeable output. First, it has a positive effect through consumption manifested by the marginal propensity to consume (a_1) and second, it has a negative effect through marginal propensity to import (c_1). However, the net effect of domestic real income is expected to be positive because, in the aggregate, the marginal propensity to import is almost always less in absolute terms than the marginal propensity to consume. The formal expression (a_1-c_1),

therefore implies that the net marginal propensity to consume domestic output is positive. Foreign real income (Y_F) is expected to have a positive relationship because a rise in the foreign real income would, *ceteris paribus,* lead to a rise in demand for exports. The real interest rate (R) is assumed to be negatively related to domestic investment demand and hence to the demand for tradeable output.

The relative price variable (RP_{Fi}) affects the demand for tradeable output through net exports and is expected to have a positive relationship to the domestic tradeable output because a rise in the domestic price (P_{Ti}) relative to the foreign price (P_{Fi}) would, *ceteris paribus,* lead to an increased demand for imports and discourage exports. The other relative price variable (RP_{Nj}) is also expected to have a positive relationship with the demand for tradeable output. If P_{Ti} declines relative to P_{Nj}, the consumption demand for tradeable output will increase.

Next, it is assumed that supply of tradeable output can be written in the following functional form.

$$Q^S_{Ti} = f(W_{Ti}, P_{Nj}, P_{Ti}) \quad \ldots \quad (8), \text{ where}$$

W_{Ti} = nominal wages in the tradeable sector,

Once again, using P_{Ti} as the numeraire, equation (8) can be written as follows.

$$Q^S_{Ti} = f(W_{Ti}, RP_{Nj}) \quad \ldots (9)$$

The following simple linear supply equation for the sectoral output in the tradeable sector is assumed.

$$\alpha^{s}_{Ti} = d_0 - d_1 W_{Ti} - d_2 RP_{Nj} \quad \ldots \quad (10)$$

In equation (10), the wage variable, (W_{Ti}) has a negative coefficient because a rise in tradeable wages would, *ceteris paribus,* lead to a decline in the supply of tradeable output. The relative price variable (RP_{Nj}), is expected to have a negative sign because a rise in the price of tradeable output relative to non-tradeable output, would mean a fall in RP_{Nj} and hence supply of tradeable output should increase.

The equilibrium condition is given by the following equation.

$$\alpha^{d}_{Ti} = \alpha^{s}_{Ti} \quad \ldots \quad (11)$$

Substituting (7) and (10) into (11), the equilibrium price (RP^{e}_{Nj}) and quantity (α^{e}_{Ti}) are solved in terms of all exogenous variables and y_D. After some algebraic manipulations the following equation of the equilibrium relative prices is obtained.

$$RP^{e}_{Nj} = \frac{(d_0 - a_0 - b_0 - c_0 - G_0)}{(a_2 + d_2)} - \frac{(d_1)}{(a_2 + d_2)} W_{Ti} - \frac{(a_1 - c_1)}{(a_2 + d_2)} Y_D - \frac{(c_2)}{(a_2 + d_2)} Y_F + \frac{(b_1)}{(a_2 + d_2)} R - \frac{(c_3)}{(a_2 + d_2)} RP_{Fi} \quad \ldots \quad (12)$$

Substituting equation (12) into equation (10), the equation of the equilibrium quantity is obtained as follows.

$$Q^{e}_{Ti} = \frac{(a_2d_0+d_2a_0+d_2b_0+d_2c_0+d_2G_0)}{(a_2+d_2)} - \frac{(d_1a_2)}{(a_2+d_2)} W_{Ti} + \frac{(d_2a_1-d_2c_1)}{(a_2+d_2)} Y_D + \frac{(d_2c_2)}{(a_2+d_2)} Y_F - \frac{(d_2b_1)}{(a_2+d_2)} R + \frac{(d_2c_3)}{(a_2+d_2)} RP_{Fi} \quad \ldots \quad (13)$$

A careful examination of equation (13) yields the following interpretation of each of the coefficients. The denominator in each term is identical and positive. Therefore, the wage variable has a negative relationship with the equilibrium quantity. The domestic real income variable has a positive sign because (a_1-c_1) is assumed to be positive. The foreign real income variable has a positive sign. Similarly, the real interest rate has a negative sign. And finally, the relative price variable, RP_{Fi}, has a positive sign. Thus, equation (13) can be rewritten as follows.

$$Q^{e}_{Ti} = \alpha_0 - \alpha_1 W_{Ti} + \alpha_2 Y_D + \alpha_3 Y_F - \alpha_4 R + \alpha_5 RP_{Fi} \quad \ldots \quad (14), \text{ where all } \alpha\text{'s are implicitly defined by (13)}$$

A Model of the Service Producing-Non-tradeable Sector

At the outset, it is assumed that the output of the service-producing sector is non-tradeable. However, there are five different sectors lumped together in this broad classification. There are some sectors, say transportation and finance

which may have some tradeable output, whereas some other sectors such as trade, community business and personal services, and public administration are basically non-tradeable. However, conventionally all these sectors are treated as non-tradeable sectors.

It is assumed that the demand function can be written in the following implicit form:

$$Q^d_{Nj} = f(Y_{DN}, P_{Nj}, P_{Ti}) \quad \ldots \quad (15)$$

$$j = 1,2 \ldots n_2$$

Again, using P_{Ti} as the numeraire, equation (15) can be written as

$$Q^d_{Nj} = f(Y_D, RP_{Nj}) \quad \ldots \quad (16), \text{where}$$

all variables are as previously defined.

If it is assumed that the demand function for the non-tradeable output is linear, the demand equation can be written in an explicit form as follows.

$$Q^d_{Nj} = w_0 + w_1 Y_D - w_2 RP_{Nj} \quad \ldots \quad (17)$$

Furthermore, it is assumed that the supply equation can also be written in a linear form as follows.

$$Q^s_{Nj} = z_0 - z_1 W_{Nj} + z_2 RP_{Nj} + z_3 GX \quad \ldots \quad (18), \text{ where}$$

GX=government expenditures deflated by P_{Ti},

and all other variables are the same as before.

The rationale for including government expenditure follows from the Bacon-Eltis thesis. It is assumed here that government expenditure is biased in favour of the non-tradeable sector. Therefore, an increase in government expenditure would lead to an increase in the supply of service sector output. The equilibrium condition is given by

$$\alpha^{d}_{Nj} = \alpha^{s}_{Nj} \qquad \ldots \qquad (19)$$

Substituting equations (17) and (18) into (19), the following equation of the equilibrium relative prices is obtained.

$$RP^{e}_{Nj} = \frac{(w_0 - z_0)}{(w_2 + z_2)} + \frac{(z_1)}{(w_2 + z_2)} W_{Nj} + \frac{(w_1)}{(w_2 + z_2)} Y_D$$

$$- \frac{z_3}{(w_2 + z_2)} GX \qquad \ldots \quad (20)$$

Substituting equation (20) into (18), the following equation of the equilibrium output is obtained.

$$\alpha^{e}_{Nj} = \frac{(w_2 z_0 + z_2 w_0)}{(w_2 + z_2)} - \frac{(w_2 z_1)}{(w_2 + z_2)} W_{Nj} +$$

$$\frac{(w_1 z_2)}{(w_2 + z_2)} Y_D + \frac{w_2 z_3}{(w_2 + z_2)} GX \qquad \ldots \qquad (21)$$

The interpretation of equation (21) is relatively easy. Each term has the same positive denominator. Thus, the wage variable has a negative relationship because a rise in non-tradeable wages would generally lead to a fall in the supply of non-tradeable output. Domestic real income and government expenditure

both have a positive relationship with the equilibirum quantity. Simplifying equation (21), the following equation is obtained.

$$\alpha^{e}_{Nj} = \beta_0 - \beta_1 W_{Nj} + \beta_2 Y_D + \beta_3 GX \quad \ldots \quad (22), \text{ where}$$

all β's are implicitly defined by (21)

The Final Reduced-Form Equations

For ease of exposition, Y_D was treated as an exogenous variable and equations (14) and (22) were obtained. Now, the model is closed with the following equation for Y_D.

$$Y_D = Q_{Ti} + Q_{Nj} \quad \ldots \quad (23)$$

And now, from equations (14) and (22), the following equations are obtained.

$$Q_{Ti} = g_0 - g_1 W_{Ti} + g_2 Y_D + g_3 Y_F - g_4 R + g_5 RP_{Fi} \quad \ldots \quad (24), \text{ where}$$

$$g_n = \alpha_{ni} \qquad n=0,1,2\ldots5, \text{ and}$$

$$Q_{Nj} = h_0 - h_1 W_{Nj} + h_2 Y_D + h_3 GX \quad \ldots \quad (25), \text{ where}$$

$$h_n = \beta_{nj} \qquad n=0,1,2,3$$

Therefore, after some simplification, equation (23) can be written as follows[9].

$$Y_D = \frac{g_0+h_0}{\Delta} - \frac{g_1}{\Delta} W_T - \frac{h_1}{\Delta} W_N +$$

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[9]For the sake of simplicity, the subscripts i and j will be suppressed in the rest of the analysis.

$$\frac{g_3}{\Delta} Y_F - \frac{g_4}{\Delta} R + \frac{h_3}{\Delta} GX + \frac{g_5}{\Delta} RP_F \quad \ldots \quad (26)$$

where $\Delta = 1-g_2-h_2$

The denominator in each term on the right-hand side of equation (26), $(1-g_2-h_2)$, is positive because (g_2+h_2) must be less than one. Therefore, equation (26) can be written as follows where all θ's are positive[10].

$$Y_D = \theta_0 - \theta_1 W_T - \theta_2 W_N + \theta_3 Y_F - \theta_4 R + \theta_5 GX + \theta_6 RP_F \quad \ldots \quad (27)$$

Substituting enquation (27) into (14), the final reduced-form equation of the equilibrium quantity in the tradeable sector is obtained as follows.

$$Q_T^e = (\alpha_0+\alpha_2\theta_0) - (\alpha_1+\alpha_2\theta_1)W_T - (\alpha_2\theta_2)W_N + (\alpha_3+\alpha_2\theta_3)Y_F - (\alpha_4+\alpha_2\theta_4)R + (\alpha_2\theta_5)GX + (\alpha_5+\alpha_2\theta_6)RP_F \quad \ldots \quad (28)$$

Now, defining RW_T as a ratio of tradeable to non-tradeable wages, equation (28) can be rewritten as follows.

$$Q_T^e = \lambda_0 - \lambda_1 RW_T + \lambda_2 Y_F - \lambda_3 R + \lambda_4 GX + \lambda_5 RP_F \quad \ldots \quad (29)$$

---

[10] Let $\frac{d_2}{a_2+d_2} = k < 1$, and $\frac{z_2}{w_2+z_2} = l < 1$

Then, $1-\Delta = \Sigma k_i(a_{1i}-c_{1i}) + \Sigma l_j w_{1i}$

Or $< \Sigma(a_{1i}-c_{1i}) + \Sigma w_{1i}$, since $k_i, l_j < 1$

Or < 1, and therefore, $\Delta > 0$

The same procedure is followed to obtain the final reduced-form equation of the equilibrium quantity in the non-tradeable sector by substituting equation (27) into (22).

$$Q_N^e=(\beta_0+\beta_2\theta_0)-(\beta_1+\beta_2\theta_2)W_N-(\beta_2\theta_1)W_T+(\beta_2\theta_3)Y_F-(\beta_2\theta_4)R+(\beta_2+\beta_2\theta_5))GX+(\beta_2\theta_6)RP_F \quad \ldots \quad (30)$$

Therefore, equation (30) can be rewritten as follows.

$$Q_N^e=\phi_0+\phi_1 RW_T+\phi_2 Y_F-\phi_3 R+\phi_4 GX+\phi_5 RP_F \quad \ldots \quad (31)$$

A Model of Asymmetric Structural Change

Although the two final reduced-form equations (29) and (31) can be estimated to explain the performance of individual sectors, the main objective is to derive a model which can explain the relative performance of various sectors. To do that, the following four variables are arbitrarily defined to represent structure. These variables are then used as the dependent variables in this study.

$$RQT = \frac{Q_T}{Q_N} = \text{ratio of tradeable sector output to non-tradeable sector output}$$

$$RQR = \frac{Q_R}{Q_N} = \text{ratio of resource sector output to non-tradeable sector output}$$

$$RQI = \frac{Q_I}{Q_N} = \text{ratio of industrial sector output to non-tradeable sector output}$$

$$RQM = \frac{Q_M}{Q_N} = \text{ratio of manufacturing sector output to non-tradeable sector output}$$

As the reduced-form equations (29) and (31) indicate, the behaviour of each sector's output is explained by the same set of variables namely, RW_T, Y_F, R, GX, and RP_F. It is reasonable to expect that the same set of variables would explain their relative performance also. Therefore, each of the above ratios can be written as some function of those variables as follows.

$$RQT = f(RW_T, Y_F, R, GX, RP_F) \quad \ldots \quad (32)$$

$$RQR = g(RW_R, Y_F, R, GX, RP_F) \quad \ldots \quad (33)$$

$$RQI = h(RW_I, Y_F, R, GX, RP_F) \quad \ldots \quad (34)$$

$$RQM = k(RW_M, Y_F, R, GX, RP_F) \quad \ldots \quad (35)$$

Here, each one of the wage variables is the ratio of the wages in that sector to the wages in the non-tradeable sector as a whole. The relative wage variable would assume a negative relationship in each case. This is because a rise in this variable would mean a cost disadvantage for tradeable sectors *vis a vis* the non-tradeable sectors. All other variables are as defined earlier.

Since the investigation of the asymmetric structural change during the two phases of the business cycle is of special interest, equations (32) through (35) can be estimated using a slope dummy variable defined to take a value one during the expansionary phase and zero during the contractionary phase. This will help in quantifying the asymmetric impact of one or all of the explanatory variables, as the case may be.

CHAPTER VI

AN EMPIRICAL ANALYSIS OF STRUCTURAL CHANGE

This chapter tests four models of structural change each with the process of structural change defined in a different way. Each definition is expected to provide additional insights into the nature and causes of structural change in the Canadian economy. In a broad sense, structural change is defined as a change in the relative shares of various sectors or groups of sectors in the economy. And therefore, a test of structural change must of necessity involve the measurement of changes in sectoral shares over time.

The four definitions of structural change used in this study are the following. The first, a structural change is defined as a change in the ratio of tradeable sector output to total output. Section VI-1 provides a detailed discussion of this model followed by econometric testing of a relevant equation. Second, a structural change is defined as a change in the ratio of the resource sector output to total output. Section VI-2 is devoted to discussion and estimation of this model. Third, a structural change is defined as a change in the ratio of industrial sector output to total output. Section VI-3 provides the detailed discussion of this model followed by an econometric estimation. Fourth, a structural change is defined as a change in the ratio of manufacturing sector output to total output. Section VI-4 provides the details of this model and examines the results of the empirical testing of this model. Section VI-5 provides results of some additional empirical testing of these models. And finally, Section VI-6 summarizes the main findings of the empirical investigation.

The above four definitions of structural change yield the same set of structural variables as was used in Section IV-6. The formal model of structural

change was derived in Chapter V, using the tradeable-non-tradeable dichotomy. This was adapted to obtain equations (32), (33), (34) and (35). Although, these four equations can be estimated in their original forms, this is likely to give a biased picture of structural change. For instance, if output of a slow-growth tradeable sector is expressed as a proportion of output of a fast-growth non-tradeable sector, the resulting downward trend is bound to be sharper than if the numerator is expressed as a proportion of total output. Since structural change involves a change in sectoral share, it is appropriate to analyze behaviour of output of a sector or of a group of sectors in relation to total output. Equations (32), (33), (34) and (35) of Chapter V are therefore further adapted for estimation purposes.

There are three objectives of these models. The first objective is to identify the factors which may explain structural change defined in the above four senses, and to quantify their impacts. This is expected to test the validity of the structural model as developed in Chapter V. The second objective is to find the time pattern of this structural adjustment process by using an appropriate lag structure on the explanatory variables.

The last two models deal more directly with the issue of deindustrialization, and hence they are of special significance. Therefore, the third objective is to test the last two models for the asymmetric impact of the relative wage variable, in the spirit of the Dutch-disease hypothesis. For instance, it is shown that the relative wage variable causes an asymmetric structural change during the two phases of the business cycle. This is accomplished by using a slope dummy variable to account for the different impact of relative wages during the expansionary and contractionary phases of the cycle.

VI-1 An Econometric Model of Structural Change: The Tradeable Sector Model

Model Specifications

The model to be tested is the following equation in double log form[1].

$$PQT_t = \beta_0 - \Sigma\beta_{1i} PWT_{t-i} + \Sigma\beta_{2i} YF_{t-i} - \Sigma\beta_{3i} R_{t-i} - \Sigma\beta_{4i} PGX_{t-i} + \Sigma\beta_{5i} RPF_{t-i} \quad \ldots \quad (6.1)$$

The definition of each variable and the appropriate choice of data is presented below.

PQT: This is the dependent variable which is defined as a percentage ratio of output of the tradeable sector to total output. Gross domestic product in constant dollars has been used as the measure of output. If Q_{Ti} stands for output of the tradeable sector and GDP for total output, then

$$PQT = \frac{\Sigma Q_{Ti}}{GDP} \times 100$$

PWT: This is the relative wage variable defined as a ratio of the average weekly wages and salaries in the tradeable sector to the industrial composite wage. Thus, if W_{Ti} is the real weekly wages and salaries in each of the tradeable sectors and CW is the industrial composite wage, then

$$PWT = \frac{\Sigma W_{Ti}/5}{CW} \times 100 \qquad i=1,2,3,4,5$$

---

[1]The double log specification has two main advantages. First, the regression coefficients are measures of elasticities and therefore, can be directly compared. And second, the log transformation ensures that the residuals are normally distributed. Satisfying the normality condition is essential for a valid hypothesis testing.

As can be seen, the numerator is an average of only five sectors, although there are seven sectors included in the definition of the tradeable sector. This is because time series data on wages and salaries for agriculture and fishing and trapping are not available. It is proposed that any rise in this wage ratio would amount to a cost disadvantage to the tradeable sector *vis a vis* the economy as a whole. Therefore, the sign of the coefficient is expected to be negative.

YF: This variable represents foreign real income. Even if the income elasticity of demand for goods is assumed to be smaller than for services, it is positive nonetheless. Therefore, a rising foreign income would have a larger positive effect on the goods-producing sector than on the economy as a whole because the latter includes both the tradeable and the non-tradeable sectors and because the non-tradeable sector is assumed to be unaffected by any change in foreign income. A rising foreign income would mean increased foreign demand for Canadian goods. This is especially the case for Canadian resource output, which is needed in increased quantities as industrial production in the western industrialized countries expands. The increased demand for Canadian exportables will provide an opportunity for expansion and therefore the sign of the coefficient is expected to be positive.

Real income of the OECD countries would have been an appropriate choice for this variable. However, data for the OECD countries are available only from 1971 onward. Therefore, the US real income has been used as the second best choice. This does not appear unreasonable considering that about three-quarters of all Canadian trade is with the US.

R: This variable is the real interest rate and is being used as a proxy for the real cost of capital. It is generally believed that the degree of capital

intensity as measured by the capital/output ratio is greater in the tradeable sector than in the non-tradeable sector. If this is assumed to be correct, then a rise in the real interest rate will result in a relative cost disadvantage to the tradeable sector *vis a vis* the economy as a whole. Therefore, the expected sign of the coefficient of this variable is negative. The yield on long term government bonds deflated by the GNP implicit price index has been chosen as the appropriate proxy for this variable[2].

PGX: As explained earlier in this thesis, the government expenditures variable is expected to capture the so-called Bacon-Eltis effect. Government expenditure is considered expansionary in general. However, it is assumed here that the effect of government expenditure is not uniform accross sectors. To be more specific, government expenditure is assumed to have a greater effect on the non-tradeable sector than on the tradeable sector. This is because government expenditure is tilted towards the provision of services [3]. If this assumption is correct, then the effect of increased government expenditure on the ratio of output of the tradeable sector to total output is expected to be negative over time. This is because an increased government expenditure will have proportionately greater expansionary effect on the economy as a whole than on the goods-producing sector, as the former also includes service-producing

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[2]The series on real interest rate has been obtained by subtracting annualized quarterly percentage change in the GNP deflator from the yield on long-term government bonds.

[3]Commenting on Maddison (1980), Richard R. Nelson says, "In virtually all of the OECD countries, there have been significant increases in the magnitude of overall government expenditures. The shift into the services and away from manufacturing seems to be in considerable part a consequence of the growth of government expenditures and the pattern that this growth has taken. This has been disguised in countries like the United States, and earlier in Britain, by very large defense budgets, which were hardware manufacturing oriented. During recent years, if you identify increases in government expenditures in goods and services and try to trace where they have gone, you will find that the recipients are sectors like education and health-the service sectors" (1980, pp. 64).

sectors. In this model the sum of federal and provincial expenditures on goods and services expressed as a proportion of GNP has been used as the measure of PGX. Thus, the government transfer payments have been excluded.

RPF: This is the relative price of tradeables defined as a ratio of the foreign price of tradeables to the domestic price of tradeables[4]. Although the postulate of purchasing power parity is assumed to hold in the long run, the two tradeable prices are allowed to diverge in the short run. Any movement in the exchange rate enters the model through its impact on the foreign price of tradeables. Thus, a rise in this ratio would mean either increased exports or decreased imports or both. In any event, it is expected to have a positive impact on the domestic tradeable sector. Since the non-tradeable sector by and large is assumed to remain unaffected, the sign of the coefficient of this variable is expected to be positive.

However, the role of this variable in this model is more complex. This is because of an overlap between this relative price and the other relative price (RPN). The latter is defined as a ratio of the non-tradeable price to the domestic price of tradeables. Suppose for instance, that the relative price of tradeables (RPF) rises because the domestic price of tradeables falls. This should have a positive effect on the tradeable sector *vis a vis* the non-tradeable sector, as explained above. However, a falling domestic price of tradeables would also mean a rise in the relative price of non-tradeables (RPN). This means that the non-tradeable sector is experiencing a kind of price advantage. And depending on the relative strengths of the price elasticities of demand for and supply of non-tradeables, there may be a shift of resources out of the tradeable sector

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[4]A use of sector-specific relative prices would have been a more appropriate choice. However, for reasons of practicality and simplicity, construction of sector-specific relative price variable has not been attempted here.

and into the non-tradeable sector.

In short, a rise in the relative price of tradeables (RPF), due to a fall in the domestic price of tradeables may offer greater advantage to the non-tradeable sector than to the tradeable sector. If this is the case, then the sign of the coefficient of the relative price variable may actually be negative. This also holds in the present case where the analysis is in terms of tradeable sector and total output and not in terms of tradeable sector and non-tradeable sector output. This is because total output is a sum total of both the tradeable and non-tradeable output. There is however, no *a priori* basis for making a judgement on the sign of the coefficient. It is an empirical question wanting further investigation in order to ascertain the role of the two relative prices on the structural adjustment process. Since the validity of the present study is not dependent on this in any significant way, such an investigation is not undertaken. This however, may form part of the agenda for future research.

The US wholesale price index adjusted for the exchange rate has been used as the proxy for foreign price of tradeables. This is expressed as a ratio of the goods component of the Canadian CPI.

Results of Econometric Tests of Equation (6.1)

The data used in the estimation of equation (6.1) are quarterly observations. All variables are in real terms as explained in the preceding section. This model and the other three to follow were estimated over the period 1962–83. Thus, there were 88 observations on each data series. The basic estimation procedures employed were those of ordinary least squares (OLS). However, generalized least squares (GLS) procedures were used whenever appropriate in order to correct for the presence of serial correlation in the error terms. The model was estimated

using several specifications. However, a double log form seems to have produced the best results. The use of a double log form has an added advantage in that it allows the interpretation of the coefficients as measures of elasticities. For determining the time pattern of the adjustment process, the Almon method of distributed lags was applied (Almon, 1965). Various lengths of lag with different degrees of polynomial were tried. Finally, a five period lag with a second degree polynomial with no endpoint restrictions was selected.

The results of the estimation are summarized in Table VI-1. An examination of this table reveals a strong relationship, with an adjusted R^2 of .90 and a F-value of 52.34. There was strong evidence of serial correlation in the data which was corrected by applying the method of generalized least squares (GLS). Looking closely, each variable produced the expected sign on the long run coefficients. All five short run coefficients of the relative wage variable had the expected sign and were significant. The long run coefficient also had the expected sign and was significant at the five percent level. The foreign income variable produced somewhat mixed results. The first two short run coefficients had the expected sign and were significant at the five percent level. However, the last three short run coefficients had the opposite sign, one of which had a large t-value. However, the long run coefficient had the expected sign and was also significant at the five percent level.

The real interest rate variable also produced mixed results, as only three short run coefficients had the expected signs, one of which was significant at the five percent level. However, none of the coefficients with the opposite sign had a large t-value. The long run coefficient had the expected sign and was significant at the five percent level. The variable representing real government expenditure produced expected signs on all but one short run coefficients. And

Table VI-1

Regression results of equation (6.1), estimated over the period 1962-83.

T	PWT	YF	R	PGX	RPF
0	-0.242**	0.320*	-0.011*	-0.024	0.006
	(-1.65)	(4.72)	(-1.72)	(-0.85)	(0.16)
1	-0.170*	0.120*	-0.001	-0.062*	-0.005
	(-2.23)	(3.47)	(-0.32)	(-4.28)	(-0.24)
2	-0.155**	-0.012	0.003	-0.067*	-0.007
	(-1.61)	(-0.25)	(0.61)	(-3.74)	(-0.26)
3	-0.198*	-0.077*	0.001	-0.038*	-0.001
	(-2.46)	(-2.33)	(0.19)	(-2.73)	(-0.06)
4	-0.299*	-0.075	-0.007	0.024	0.012
	(-2.06)	(-1.15)	(-1.26)	(0.94)	(0.31)
$\Sigma_{j=0}^{4}$	-1.064*	0.276*	-0.016*	-0.168*	0.005
	(-6.22)	(7.08)	(-1.93)	(-4.00)	(0.10)
Const.=7.038	R^2=.90	F=52.34	SE=.006	DW=1.80	Rho1=.66

* significant at the 5 percent and ** 10 percent levels using a one-tailed test. T-values are in parentheses.

three of these short run coefficients were significant at the five percent level. The long run coefficient also had the expected sign and was significant at the five percent level. A comparison of the relative wage and government expenditure variables reveals an interesting point. It seems that the relative wage variable was more important than the government expenditure variable, judging by the size of the long run elasticity. The signs on the relative price of tradeables were mixed and none of the coefficients were significant.

Since the equation was estimated in a double log form, each coefficient is a measure of elasticity of the dependent variable with respect to the independent variables. For instance, a long run coefficient of -1.064 on the relative wage variable would mean that for each percentage point rise in the relative wage there would be 1.064 percentage points decline in the share of tradeables in total output. Thus, the relative wage variable with the long run coefficient of -1.064, was the most important variable in the model.

VI-2 An Econometric Model of Structural Change: The Resource Sector Model

Model Specifications

In this study the resource sector has been defined to include agriculture, fishing and trapping, forestry and mining. This sector is postulated to play a crucial role in this thesis, mainly as a catalyst in the structural adjustment process. This is primarily through the impact of a resource boom on the wage structure in various sectors of the economy. It therefore seems imperative to examine how this model performs in explaining the behaviour of the resource sector over time.

The model to be estimated is once again the double log form of the following.

$$PQR_t = \beta_0 - \Sigma\beta_{1i} PWR_{t-i} + \Sigma\beta_{2i} YF_{t-i} - \Sigma\beta_{3i} R_{t-i} - \Sigma\beta_{4i} PGX_{t-i} + \Sigma\beta_{5i} RPF_{t-i} \quad \ldots \quad (6.2)$$

As can be seen, all variables with the exception of the dependent variable (PQR) and the relative wage variable (PWR), remain exactly the same as before. The two new variables are defined as follows.

PQR: This is a percentage ratio of the resource sector output to total output. If Q_{Ri} stands for output of each of the resource sectors, and GDP for total output, then

$$PQR = \frac{\Sigma Q_{Ri}}{GDP} \times 100$$

PWR: This is the relative wage variable defined as a ratio of the average weekly wages and salaries in the resource sector to the industrial composite wage. Thus, if W_{Ri} is the weekly wages and salaries in the resource sectors and CW as the industrial composite wage, then

$$PWR = \frac{\Sigma W_{Ri}/2}{CW} \times 100 \qquad i=1,2$$

The numerator in the above ratio has a divisor of only two because data on wages and salaries for agriculture and fishing and trapping are not available. The denominator is the same as before. The expected sign of this variable is negative, because a rise in this ratio would, *ceteris paribus*, affect the resource sector adversely *vis a vis* the economy as a whole.

Results of Econometric Tests of Equation (6.2)

Equation (6.2) was estimated using a modified definition of the resource sector. For the reasons explained in Chapter IV, agriculture, fishing and trapping were excluded from this definition. The Almon method of distributed lags with a second degree polynomial produced the best results. All other specifications were the same as in equation (6.1). The presence of serial correlation in the error terms warranted use of the generalized least squares method. The results of the estimation are presented in Table VI-2. The model performed well with an adjusted R^2 of .34 and a F-value of 3.96. The relative wage variable produced mixed signs. And only one of the short run coefficients was significant at the ten percent level. The long run coefficient had the expected sign but was not significant. The foreign income variable produced mixed signs and neither the short run nor the long run coefficients were significant. Similarly, the real interest rate variable produced mixed signs, with only one of the short run coefficients being significant. The long run coefficient had the expected sign but was not significant. The variable representing government expenditures produced all expected signs, but only two of the five short run coefficients were significant. The long run coefficient also had the expected sign and was significant at the five percent level. The relative price variable had all negative signs and four of the five short run coefficients were significant. And so was the long run coefficient.

In another experiment, the same model was estimated by replacing the US real income with the OECD index of industrial production as a proxy for foreign real income. The rationale for this experiment was this. Since the output of the resource sector is used as an input in industrial production, any rise or fall in industrial production in the OECD countries would have a direct bearing on the

Table VI-2

Regression results of equation (6.2), estimated over the period 1962-83.

T	PWR	YF	R	PGX	RPF
0	0.099	0.148	-0.038	-0.018	-0.230**
	(0.33)	(0.46)	(-1.18)	(-0.14)	(-1.31)
1	0.161	0.083	0.008	-0.035	-0.219*
	(0.85)	(0.51)	(0.51)	(-0.49)	(-2.00)
2	0.095	0.016	0.023	-0.085	-0.200**
	(0.42)	(0.08)	(1.10)	(-1.00)	(-1.48)
3	-0.098	-0.054	0.007	-0.167*	-0.175**
	(-0.50)	(-0.33)	(0.43)	(-2.27)	(-1.58)
4	-0.419**	-0.126	-0.041**	-0.281*	-0.143
	(-1.34)	(-0.40)	(-1.35)	(-2.25)	(-0.77)
$\Sigma\beta_{ki}$	-0.162	0.068	-0.041	-0.586*	-0.968*
	(-0.26)	(0.37)	(-0.76)	(-2.35)	(-2.86)
Const.=7.687	R^2=.34	F=3.96	SE=.030	DW=1.99	Rho1=.85

* significant at the 5 percent and ** 10 percent levels using a one-tailed test. T-values are in parentheses.

demand for the resource sector output. Thus, the OECD index of industrial production appears to be a more appropriate proxy for foreign real income. This experiment did not change the R^2 or the F-value in any significant way. However, the foreign income variable showed a marked improvement in its performance. It produced one short run coefficient significant. The long run coefficient also had the correct sign and was significant at the five percent level.

VI-3 An Econometric Model of Structural Change: The Industrial Sector Model

Model Specifications

The phenomenon of deindustrialization in the Dutch-disease framework is defined as the declining share of the industrial sector in general, and of the manufacturing sector in particular, in national output and employment. Therefore, the industrial sector model of this section and the manufacturing sector model of the following section assume special importance in this study. The model in this section deals with the process of deindustrialization in the first sense, while the following section deals with the process of deindustrialization in the second sense. The model to be estimated is the double log form of the following.

$$PQI_t = \beta_0 - \Sigma\beta_{1i} PWI_{t-i} + \Sigma\beta_{2i} YF_{t-i} - \Sigma\beta_{3i} R_{t-i} - \Sigma\beta_{4i} PGX_{t-i} + \Sigma\beta_{5i} RPF_{t-i} \quad \ldots \quad (6.3)$$

In this model, the two new variables are defined as follows.

PQI: This is the dependent variable, defined as a percentage ratio of the industrial sector output to total output. If Q_{1i} represents output in each sector i, in the industrial sector, then

$$PQI = \frac{\Sigma Q_{Ii}}{GDP} \times 100$$

PWI: This is the relative wage variable defined as a ratio of average wages and salaries in the industrial sector to the industrial composite wage. That is, if W_{Ii} stands for the wages in the industrial sector and CW for the industrial composite wage, then

$$PWI = \frac{\Sigma W_{Ii}/3}{CW} \times 100 \qquad i = 1,2,3$$

The numerator has a divisor of three because there are three sectors included in the definition of industry, namely manufacturing, construction and utilities. The expected sign of this variable is negative for the reasons explained earlier.

Results of Econometric Tests of Equation (6.3)

Equation (6.3) was estimated with exactly the same specifications as equations (6.1) and (6.2). The results of the regression analysis are summarized in Table VI-3. Examination of the results suggests a good fit of the equation with an adjusted R^2 of .58 and a F-value of 8.97. The relative wage variable produced the expected signs. However, only two of the short run coefficients turned out significant. The long run coefficient also had the expected sign and was significant at the five percent level. The foreign income variable produced mixed signs. Three of the short run coefficients had the expected signs, but only one was significant at the five percent level. Only one of the short run

Table VI-3

Regression results of equation (6.3), estimated over the period 1962-83.

T	PWI	YF	R	PGX	RPF
0	-0.272**	0.376*	-0.007	-0.064*	0.002
	(-1.39)	(3.74)	(-0.77)	(-1.70)	(0.04)
1	-0.094	0.160*	-002	-0.077*	-0.018
	(-0.82)	(2.95)	(-0.41)	(-3.32)	(-0.64)
2	-0.043	0.009	0.000	-0.070*	-0.021
	(-0.30)	(0.15)	(0.05)	(-2.67)	(-0.56)
3	-0.119	-0.077*	-0.000	-0.044*	-0.007
	(-1.09)	(-1.68)	(-0.03)	(-2.08)	(-0.21)
4	-0.322*	-0.098	-0.003	0.001	0.024
	(-1.73)	(-1.05)	(-0.36)	(0.04)	(0.45)
$\Sigma\beta_{ki}$	-0.849*	0.371*	-0.011	-0.253*	-0.018
	(-2.27)	(3.99)	(-0.85)	(-3.51)	(-.25)
Const.=5.339	R^2=.58	F=8.97	SE=.008	DW=2.01	Rho1=.77

* significant at the 5 percent and ** 10 percent levels using a one-tailed test. T-values are in parentheses.

coefficients which had opposite signs had a large t-value. The long run coefficient however, had the expected sign and was significant at the five percent level. The interest rate variable produced four short run coefficients with expected signs. However, neither the short run nor the long run coefficients were significant. The variable representing government expenditures produced four coefficients with expected signs, all of which were significant at the five percent level. The long run coefficient also had the expected sign and was significant at the five percent level. The relative price variable produced mixed signs with none of the coefficients being significant.

VI-4 An Econometric Model of Structural Change: The Manufacturing Sector Model

Model Specifications

Quite often deindustrialization is defined as the decline in the relative size of the manufacturing sector. This sector is often considered as the most dynamic sector, and is by far the largest sector in the Canadian economy. The model is tested using this definition of structural change to see whether the basic model as developed in this study is broad enough in scope of its application to allow a test of structural change at a finer level of disaggregation.

The model to be estimated is the double log form of the following.

$$PQM_t = \beta_0 - \Sigma\beta_{1i} PWM_{t-i} + \Sigma\beta_{2i} YF_{t-i} - \beta\Sigma_{3i} R_{t-i} - \Sigma\beta_{4i} PGX_{t-i} + \Sigma\beta_{5i} RPF_{t-i} \quad \ldots \quad (6.4)$$

In this model, the two new variables are defined as follows.

PQM: This is the dependent variable defined as a ratio of the manufacturing sector output to total output. That is,

$$PQM = \frac{Q_M}{GDP} \times 100$$

PWM: This is the relative wage variable defined as a ratio of manufacturing wages to the industrial composite wage. That is,

$$PWM = \frac{RW_M}{CW} \times 100$$

Results of Econometric Tests of Equation (6.4)

The theoretical relationship between the dependent variable (PQM) and each of the independent variables remains the same as in the previous models. Once again, equation (6.4) was estimated in exactly the same way as the previous equations. The use of the double log form produced the best results. Similarly, the Almon method of distributed lags with a second degree polynomial with no endpoint restrictions was applied. The results of the regression analysis are summarized in Table VI-4.

Examination of the table reveals a good fit of the equation with an adjusted R^2 of .48 and a F-value of 6.30. The relative wage variable yielded four of the five short run coefficients with the expected signs. However, only two of the short run coefficients were significant at the ten percent level. Although, the last period lag produced an opposite sign, the t-value was small. The long run coefficient had the expected sign but was not significant. Although, the long run coefficient was not significant, the size of the coefficient was

Table VI-4

Regression results of equation (6.4), estimated over the period 1962-83.

T	PWM	YF	R	PGX	RPF
0	-0.045	0.386*	-0.000	-0.127*	0.065
	(-0.13)	(3.12)	(-0.05)	(-2.66)	(0.95)
1	-0.330**	0.149*	-0.001	-0.106*	0.014
	(-1.51)	(2.38)	(-0.24)	(-3.94)	(0.33)
2	-0.340**	-0.016	-0.000	-0.082*	-0.021
	(-1.50)	(-0.21)	(-0.03)	(-2.58)	(-0.41)
3	-0.250	-0.110*	0.003	-0.055*	-0.041
	(-0.97)	(-1.85)	(0.52)	(-2.11)	(-1.01)
4	0.113	-0.132	0.009	-0.025	-0.046
	(0.28)	(-1.09)	(0.75)	(-0.56)	(-0.66)
$\Sigma\beta_{ki}$	-0.910	0.277*	0.009	-0.394*	-0.030
	(-1.10)	(5.23)	(0.45)	(-4.80)	(-0.23)
Const.=6.206	R^2=.48	F=6.30	SE=.011	DW=1.86	Rho1=.80

* significant at the 5 percent and ** 10 percent levels using a one-tailed test. T-values are in parentheses.

larger than coefficient of any other variable in the model. The foreign income variable produced mixed signs. The first two short run coefficients had the expected signs and were significant at the five percent level. Only one of the short run coefficients with opposite sign also had a large t-value. The long run coefficient had the expected sign and was significant at the five percent level. The real interest rate variable produced mixed results, with none of the short run coefficients being significant. The long run coefficient had the opposite sign with small t-value. The variable representing government expenditures produced all expected signs, with four of the short run coefficients being significant at the five percent level. The long run coefficient also had the expected sign and was significant at the five percent level. The relative price variable had mixed signs, but neither the short run nor the long run coefficients were significant.

VI-5 Results of Additional Tests of the Econometric Models

In this section, results of two additional tests of the structural models are reported. First, all four equations were reestimated using annual data and with no lag on the explanatory variables. These results are presented in Table VI-A. And second, for the reasons to be explained later, the last two equations were reestimated using a dummy variable, assumed to take a value one during the expansionary and zero during the contractionary phases of the cycle. In both cases, the equations were estimated using double log specifications. The results of these estimations are presented in Tables VI-3A and VI-4A.

Looking at Table VI-A, all four equations seem to have produced strong results. Equation (6.1) representing the tradeable sector model, had an adjusted R^2 of .97 and a F-value of 139.20. The relative wage, foreign income, interest rate

Table VI-A

Regression results of equations (6.1), (6.2), (6.3) and (6.4), estimated over the period 1962-83.

Variables	Equation (6.1)	Equation (6.2)	Equation (6.3)	Equation (6.4)
Relative wages	-1.067• (-5.89)	-1.652• (-3.08)	-0.576•• (-1.57)	-1.078• (-1.94)
For. income	0.284• (7.12)	0.261• (1.91)	0.293• (3.20)	0.301• (6.28)
Interest rate	-0.007• (-1.76)	-0.031•• (-1.54)	-0.006 (-1.20)	-0.005 (-0.72)
Govt. exp.	-0.182• (-3.56)	-0.141 (-0.59)	-0.279• (-3.66)	-0.440• (-6.52)
Relative prices	-0.032 (-0.70)	-0.488• (-2.02)	-0.067 (-0.92)	-0.046 (-0.52)
Constant	6.792	9.694	4.510	6.605
R^2	.97	.89	.77	.83
F-value	139.20	36.00	14.69	22.18
SE	0.009	0.046	0.011	0.014
DW	2.11	2.02	1.71	1.70
Rho1	--	--	.65	.42

• significant at the 5 percent and •• 10 percent levels using a one-tailed test. T-values are in parentheses.

and government expenditure variables had the expected signs and their coefficients were significant at the five percent level. Equation (6.2) representing the resource sector model had an adjusted R^2 of .89 and a F-value of 36.00. All variables, with the exception of government expenditure produced significant coefficients. Equation (6.3) representing the industrial sector model had an adjusted R^2 of .77 and a F-value of 14.69. The relative wage, foreign income and government expenditures variables produced significant coefficients. Similarly, equation (6.4), representing the manufacturing sector model had an adjusted R^2 of .83 and a F-value of 22.18. And like equation (6.3), relative wages, foreign income and government expenditures variables produced significant coefficients. The two important points that seem to emerge from this experiment are the following. First, the relative wage, and foreign income variables produced significant coefficients in all four models. And second, the relative wage variable turned out to be the single most important explanatory variable in all four models; judging by the size of the coefficients.

Structural Change and Asymmetric Impact of Relative Wages

The asymmetric structural impact of the relative wage variable during the two phases of the business cycle has been the major theme running through this study. It is therefore imperative to elaborate this point further. It has been postulated that wages in the rest of the economy tend to move in tandem with the wages in the resource sector. Thus, whenever wages rise in the resource sector in the wake of an exogenous resource boom, wages in the industrial sector also tend to rise. The structural implication of this is as follows. The wages in the industrial sector rise much faster than in the non-tradeable sector, thereby sqeezing the industrial sector. This relative labour cost disadvantage may,

however, be partially offset by the positive influence exerted by the expansionary forces of the business cycle. Therefore, the relative wage variable is expected to yield a negative but small coefficient during the expansionary phase of the business cycle.

The scenario during the contractionary periods, however, is completely different. The wage rate is expected to decelerate somewhat faster in the non-tradeable sector than in the industrial sector. This, coupled with the negative influence of the contractionary forces of the business cycle, may cause the industrial sector to decline faster than the non-tradeable sector. Therefore, the relative wage variable is expected to yield a large negative coefficient during the contractionary phase. This conclusion also holds when the analysis is carried out in terms of the tradeable sector vs. the economy as a whole rather than in terms of tradeable vs. non-tradeable sectors[5].

Model Specifications

Because of the importance of this asymmetric structural effect of the relative wage variable, the industrial and the manufacturing sector models were tested using a dummy variable, D, which takes a value one for the expansionary phase and zero for the contractionary phase. Thus, the two models to be estimated are the double log forms of the following.

$$PQI_t = \beta_0 + \beta_1 D - \Sigma \beta_{2i} PWI_{t-i} + \Sigma \beta_{3i} PWID_{t-i} + \Sigma \beta_{4i} YF_{t-i} - \Sigma \beta_{5i} R_{t-i} - \Sigma \beta_{6i} PGX_{t-i}$$

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[5]Some evidence of these differential growth rates during the two phases of the business cycle was presented in Section IV-4 of Chapter IV. In particular, it was shown that during the expansionary phase of the business cycle, the industrial sector outperformed the economy by a small margin of .12 percentage points. During the contractionary phase on the other hand, the economy outperformed the industrial sector by a margin of .49 percentage points. Thus, over the entire cycle, the industrial sector on average grew at a rate .19 percentage points below the economy, causing a deterioration in the relative size of this sector.

$$+\Sigma\beta_{7i}RPF_{t-i} \quad \ldots \quad (6.3a)$$

$$PQM_t=\beta_0+\beta_1D-\Sigma\beta_{2i}PWM_{t-i}+\Sigma\beta_{3i}PWMD_{t-i}+\Sigma\beta_{4i}YF_{t-i}-\beta\Sigma_{5i}R_{t-i}-\Sigma\beta_{6i}PGX_{t-i}$$
$$+\Sigma\beta_{7i}RPF_{t-i} \quad \ldots \quad (6.4a)$$

Both equations (6.3a) and (6.4a) were estimated using both an intercept dummy and a slope dummy on the relative wage variable. The Almon method of distributed lags with a second degree polynomial produced the best results. No endpoint restrictions were imposed on the parameters. Due to the presence of serial correlation in the error terms, the equations were re-estimated using the generalized least squares method. The results of the regression analyses are summarized in Tables VI-3A and VI-4A.

Results of Econometric Tests of Equations (6.3a) and (6.4a)

Examination of Table VI-3A suggests a good fit of equation (6.3a). Although the adjusted R^2 of .42 was small, the F-value of 3.99 was significant at the five percent level[6]. All variables produced the expected signs on the long run coefficients. During the contractionary phase of the cycle, the relative wage variable produced correct signs on all short run coefficients as well as on the long run coefficient. However, only two of the short run coefficients were significant. The long run coefficient was also significant at the five percent level. The short run coefficients of this variable for the expansionary phase also produced the expected signs on three of the five short run coefficients. This can be checked by taking the difference between values in column four and the corresponding values in column three. Thus, as expected the size of the

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[6]Since the equation has been estimated using GLS, the size of the adjusted R^2 has little use as a measure of goodness of fit.

Table VI-3A

Regression results of equation (6.3a), estimated over the period 1962-83.

T	D	PWI	PWID	YF	R	PGX	RPF
0	-0.271**	-0.155	0.057**	0.253*	-0.002	-0.072*	0.013
	(-1.37)	(-0.70)	(1.40)	(2.23)	(-0.21)	(-1.79)	(0.26)
1	-0.036	-0.057	0.008	0.133*	-0.004	-0.084*	-0.014
	(-0.30)	(-0.39)	(0.33)	(2.08)	(-0.74)	(-2.85)	(-0.44)
2	0.081	-0.072	-0.016	0.044	-0.003	-0.074*	-0.018
	(0.60)	(-0.44)	(-0.58)	(0.63)	(-0.53)	(-2.26)	(-0.44)
3	0.080	-0.200**	-0.016	-0.014	-0.001	-0.040**	0.002
	(0.65)	(-1.43)	(-0.62)	(-0.24)	(-0.14)	(-1.56)	(0.05)
4	-0.038	-0.440*	0.009	-0.039	0.005	0.016	0.045
	(-0.18)	(-2.12)	(0.20)	(-0.37)	(0.51)	(0.44)	(0.80)
Σ_{ki}	-0.183	-0.923*	0.041	0.376*	-0.005	-0.254*	0.028
	(-0.33)	(-1.88)	(0.35)	(3.16)	(-0.31)	(-2.67)	(0.29)
Const.=5.419		R^2=.42	F=3.99	SE=.008	DW=2.14	Rho1=.86	

* significant at the 5 percent and ** 10 percent levels using a one-tailed test. T-values are in parentheses.

coefficients were smaller in absolute size during the expansionary phase than in the contractionary phase. It means that the relative wage variable had an adverse structural effect both during the expansionary and the contractionary phases of the business cycle, but the effect was more acute during the contractionary periods. The absolute size of the long run coefficient was also smaller with a negative sign as expected.

Three of the five short run coefficients of the foreign income variable yielded expected signs, with two being significant at the five percent level. The long run coefficient also had the expected sign and was significant at the five percent level. The first four short run coefficients of the real interest rate variable had the expected signs. However, neither the short run nor the long run coefficients were significant. The first four short run coefficients of the government expenditure had the expected signs and were significant. The last coefficient had the opposite sign with small t-value. The long run coefficient also had the expected sign and was significant at the five percent level. The relative price of tradeables produced mixed signs. However, neither the short run nor the long run coefficients were significant.

Examination of Table VI-4A reveals a good fit of equation (6.4a), with an adjusted R^2 of .50 and a F-value of 5.22. All coefficients of the relative wage variable produced negative signs during the contractionary periods, as expected. Three of the five short run coefficients turned out to be significant. The long run coefficient also had the expected sign and was significant at the five percent level. The short run coefficients during the expansionary phase were negative but smaller than in the contractionary phase in case of the first four periods. This can be checked by taking the difference between the values in columns three and four. The long run coefficient also had the negative sign and

Table VI-4A

Regression results of equation (6.4a), estimated over the period 1962-83.

T	D	PWM	PWMD	YF	R	PGX	RPF
0	-1.670*	-0.382	0.359*	0.363*	0.002	-0.112*	0.092**
	(-1.99)	(-1.06)	(2.00)	(2.58)	(0.17)	(-2.35)	(1.36)
1	-0.986*	-0.641*	0.212*	0.101**	-0.002	-0.097*	0.048
	(-2.02)	(-2.65)	(2.03)	(1.42)	(-0.35)	(-3.45)	(1.08)
2	-0.658	-0.670*	0.142	-0.052	-0.002	-0.078*	0.009
	(-1.15)	(-2.35)	(1.16)	(-0.63)	(-0.21)	(-2.39)	(0.16)
3	-0.686**	-0.468*	0.148**	-0.094**	0.003	-0.053*	-0.028
	(-1.36)	(-1.73)	(1.37)	(-1.38)	(0.52)	(-2.00)	(-0.65)
4	-1.070	-0.036	0.231	-0.027	0.013	-0.023	-0.060
	(-1.24)	(-0.09)	(1.25)	(-0.19)	(1.10)	(-0.53)	(-0.87)
$\Sigma\beta_{ki}$	-5.071*	-2.197*	1.093*	0.291*	0.014	-0.364*	0.061
	(-2.37)	(-2.32)	(2.38)	(5.49)	(0.70)	(-4.18)	(0.45)
Const.=11.567		R^2=.50	F=5.22	SE=.011	DW=2.04	Rho1=.80	

* significant at the 5 percent and ** 10 percent levels using a one-tailed test. T-values are in parentheses.

was smaller in absolute size than during the contractionary periods. The smaller absolute size of the coefficients during the expansionary phase indicates that the structural effect of relative wages was more acute during the contractionary phase of the cycle than in the expansionary phase.

The foreign income variable produced mixed signs. the first two short run coefficients had the expected signs and were significant. The last three coefficients had the opposite signs, one of which had a large t-value. However, the long run coefficient of this variable had the expected sign and was significant at the five percent level. The interest rate variable had mixed signs, but neither the short run nor the long run coefficients were significant. The variable representing government expenditures also had the expected signs, with the first four being significant at the five percent level. The long run coefficient also had the expected sign and was significant at the five percent level. Finally, the relative price variable had mixed signs, with only one short run coefficient being significant. The long run coefficient had the expected sign but was not significant.

VI-6 Summary of Results

The following is a brief summary of the major findings. First, the model of structural change as developed in Chapter V appears to be quite general in character. It allows empirical testing of structural adjustment processes under a broad range of definitions and at different levels of disaggregation. Four such definitions of structural change were tested, one each for the tradeable, resource, industrial and the manufacturing sectors. Each model produced satisfactory results, judging by the usual statistical standards. Second, all key explanatory variables

by and large performed well in explaining the process of structural adjustment in the Canadian economy. Of the five explanatory variables, the relative wage variable is of crucial importance as it is mainly through the wage effect that structural change is proposed to take place in a resource-based open economy like Canada. The strong performance of the relative wage variable lent support to this hypothesis. This was also in accord with the basic tenets of the Dutch-disease hypothesis. The use of a dummy variable in the last two models captured the asymmetric effect of the wage variable during the two phases of the business cycle.

There are however, some imperfections in the data which may have biased the results. The time series data on weekly wages and salaries for agriculture, fishing and trapping were not available. This may have distorted the numerator in the relative wage variable in equations (6.1) and (6.2). For instance, the relative wage variable in the first model was based on only five sectors in the numerator instead of seven. Depending on whether the average of the missing series in the numerator is larger or smaller than the average of the five sectors actually used, the relative wage variable would be biased downward or upward. And therefore, the coefficients would be biased downward or upward.

Third, the variable representing government expenditure also performed well in the model. To be more precise, the long run coefficient of this variable was significant in nine of the ten estimations carried out. If it is accepted that government expenditure is biased towards the non-tradeable sector as government gets increasingly involved in the provision of services, and that as government expands, so does the size of the bureaucracy, then the strong performance of this variable may be cited as an evidence in support of the Bacon-Eltis thesis. However, the relative wage variable remained one of the most important

variables, as it produced long run coefficients which were significant in eight estimations. Moreover, the size of the long run coefficients was larger than any other variable in nine estimations.

Fourth, real foreign income is another variable which produced significant coefficients nine times out of ten. This result is also not surprising considering the open character of the economy. The real interest rate seemed to rank fourth in terms of performance as it produced significant long run coefficients in three out of ten estimations. The relative price variable seemed to rank last as it produced mixed results in most of the cases and the coefficients were significant only in two of the ten estimations. The mixed performance of this variable was consistent with the explanations provided earlier in this chapter.

CHAPTER VII

CONCLUSIONS AND POLICY IMPLICATIONS

One of the most significant developments in the world growth pattern has been the increasing share of the service-producing sector. This has come to be known as 'servicization'. However, while this process has been consistent with a rising share of the industrial sector in the developing countries, in the industrialized countries, there has been a simultaneous decline in the share of the industrial sector. This declining trend is referred to as 'deindustrialization'. Unlike 'deruralization' which meant a shift of resources from less dynamic to more dynamic sectors of the economy during early years of development, this recent trend is raising some concern.

The present study began with an overview of the current literature on this subject, which can be classified into two broad categories. The first category emphasizes forces operating on the demand side, while the second emphasizes forces operating on the supply side. The two main strands of thoughts belonging to the first category are represented by the secular trend view and the so-called Cambridge view. The secular trend view suggests that countries first industrialize and then develop into post-industrial societies. This transition amounts to society reallocating available resources according to changing preferences. The Cambridge view suggests that the real cause lies in the growing inability of the export sector to pay for rising imports. The two main strands of thoughts in the second category are represented by the Bacon-Eltis view and the Dutch-disease view. The Bacon-Eltis view suggests that the rapid expansion of the public sector causes the manufacturing sector to shrink as resources move out of this sector. The Dutch-disease view on the other hand, suggests that a sudden boom

in one of the basic sectors leads to a movement of resources away from the manufacturing sector because of the direct resource movement and spending effects.

The principal arguments put forward in this study can be summarized as follows. An export boom is demand-induced in the sense that whenever there is an upturn in the major western economies, the demand for exports of Canadian natural resources increases. The increased profit potential creates an atmosphere for higher wage demands in the resource sector, followed by similar wage demands in the rest of the economy. Moreover, the expanding resource sector draws in additional labour and capital from other sectors- a resource movement effect. In addition, an increased profit potential may attract foreign capital which puts upward pressure on the domestic currency. Rising exports means an improvement in the trade balance which, *ceteris paribus,* would lead to further appreciation. Since resources constitute basic raw materials for the industrial sector, and since a demand-induced export boom means higher prices of these raw materials, there is a further increase in the cost of production in the industrial sector. As a consequence, the industrial sector is squeezed between the rising cost of labour and raw materials on the one hand, and appreciation of the domestic currency, on the other.

The main focus in this study however, was on the structural effects of a resource boom through its impacts on relative wages in the economy. It was proposed that acceleration in wage increases in the resource sector following a resource boom is followed by a similar acceleration in wages in the rest of the economy. It was further proposed that there is an intersectoral asymmetry in the behaviour of wages. Since there is a higher degree of unionization in the industrial sector than the non-tradeable sector, the acceleration of wages in the

industrial sector far exceeds that in the non-tradeable sector. This creates a factor cost disadvantage for the industrial sector *vis a vis* the rest of the economy. Such a relative wage disadvantage, *ceteris paribus,* leads to asymmetric sectoral growth.

But, the scenario during the contractionary phase is different. The industrial sector, because of its high degree of unionization, is likely to experience a smaller deceleration in wage increases than the non-tradeable sector. This creates a significant factor cost disadvantage for the industrial sector. This, coupled with other contractionary forces associated with the cycle, exerts a far stronger squeeze on the industrial sector than on the non-tradeable sector. Thus, there is likely to be a significant asymmetry in the growth pattern of the industrial sector *vis a vis* the rest of the economy.

A main objective of this study was to show that the structural adjustment process in the Canadian economy follows a cyclical path, and that asymmetry in the wage behaviour plays a major role in this process. First, a theoretical framework for analyzing structural change in a resource-based economy was developed. Then, a mathematical model of structural change was formally derived. A distinguishing feature of this model is that it integrated the main arguments of both schools of thoughts- one emphasizing the demand aspect and the other emphasizing the supply aspect of the problem. It is essentially a two-sector general equilibrium model based on a tradeable, non-tradeable dichotomy. The reduced-form equations of the equilibrium output in the two sectors were obtained, and then adapted to facilitate a test of the main hypotheses. The model allowed empirical testing of structural change under a broad range of definitions and at different levels of disaggregation. Four such definitions of structural change were tested. Each model produced satisfactory results, judging

by the usual statistical standards.

The following is a brief summary of major findings. First, most of the explanatory variables performed well in explaining the process of structural adjustment in the Canadian economy. Of the five explanatory variables, the relative wage variable is of crucial importance as it is mainly through the wage effect that structural change is proposed to take place in a resource-based open economy. This is in accord with the basic tenets of the Dutch-disease hypothesis. This variable was highly significant in all models. The use of a dummy variable in the last two models captured the asymmetric effect of the wage variable during the two phases of the business cycle.

Second, the variable representing government expenditure also performed well in the model. If it is accepted that government expenditure is biased towards the non-tradeable sector as government gets increasingly involved in the provision of services; and that as government expands, so does the size of the bureaucracy, then the strong performance of this variable may be cited as an evidence in support of the Bacon-Eltis thesis.

Third, the foreign real income variable also exhibited robustness. This result is not surprising considering the open character of the economy. The real interest rate variable ranked fourth in terms of performance as it produced significant long run coefficients only in a few cases. The variable representing the relative prices of tradeables ranked last as it produced mixed results for reasons explained in the text.

There are two major flaws in this study. The first concerns the way wages were treated in the model. In view of the crucial role that this variable is postulated to play, wage determination should have been made an integral part

of the model. Instead, wages were analyzed separately. Whether or not this would have altered the main results is not obvious. But an integrated model would have put the entire analysis on a sounder footing and provided added credibility to the results.

The second shortcoming concerns some imperfections in the data which may have biased the results. The time series data on weekly wages and salaries for agriculture, fishing and trapping were not available. This may have distorted the numerator of the relative wage variable. Therefore, the coefficients could be biased downward or upward.

The relative wage was one of the most important explanatory variables both on the basis of consistency of performance and size of the coefficients. The two most important features of the existing wage structure in the Canadian economy are the following. First, the wage level in the service-producing sector in general is lower than in the industrial sector. And second, the rate of increase in wages during the expansionary periods is lower in the service-producing sector than in the industrial sector. Similarly, during the contractionary periods, the degree of wage moderation is larger in the former than in the latter sector. Higher relative wages and a lower degree of wage flexibility (higher degree of wage rigidity) seem to put the industrial sector at a relative cost disadvantage. Thus, the industrial sector, *ceteris paribus*, loses ground over each successive business cycle. The policy recommendations should include efforts directed at increasing wage flexibility in the economy in general and in the industrial sector in particular. These efforts should include such measures as reducing institutional rigidities in the wage structure, and on-the-job training and relocation of labour to achieve a greater degree of labour mobility. The importance of bonus pay systems to increase real wage flexibility has received

considerable attention in recent years. See Grubel and Spindler (1984), Grubel and Ng (1986c), Hashimoto (1983) and Weitzman (1983, 1984, and 1985). Its introduction in Canada merits serious consideration.

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