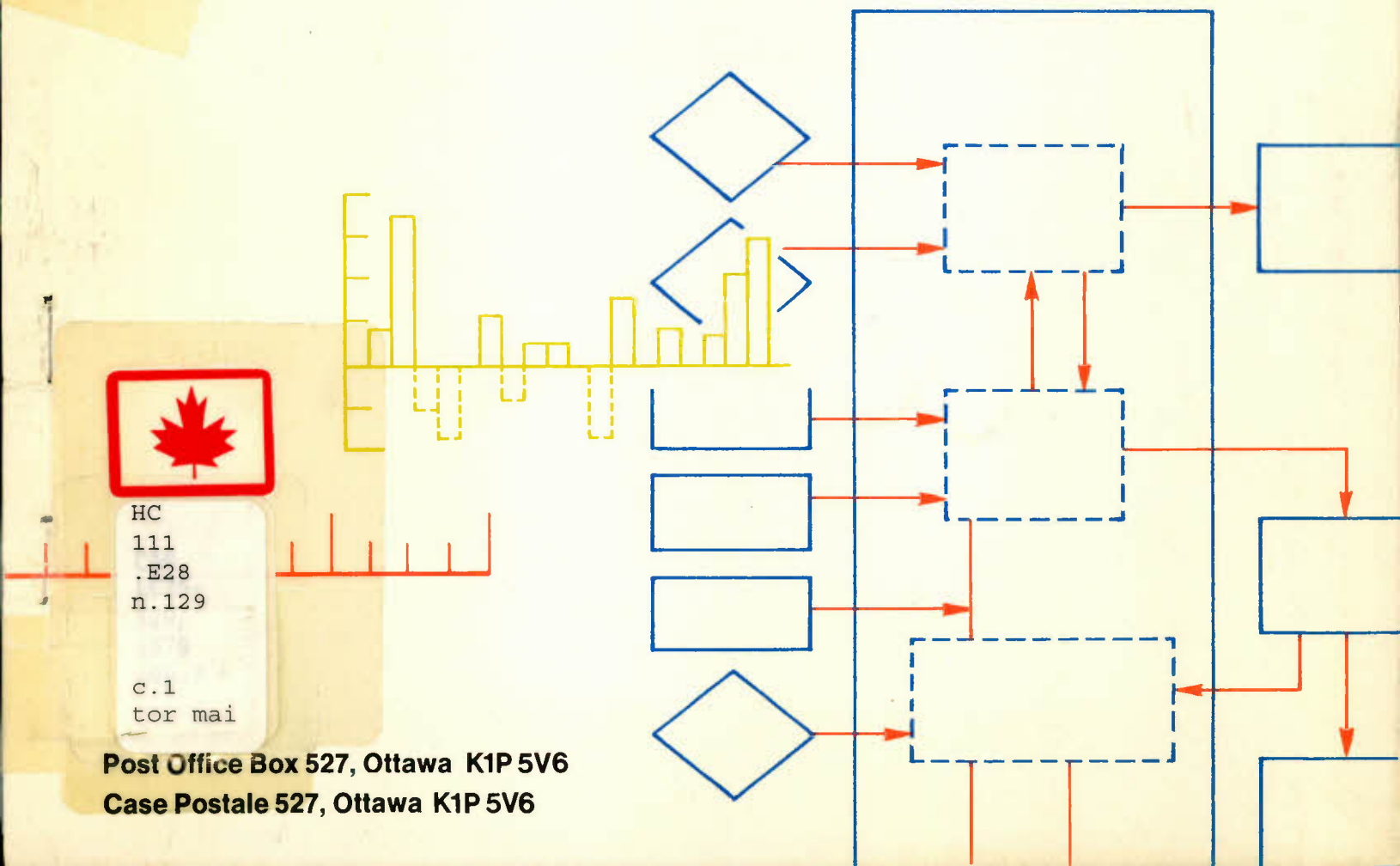
Economic Council of Canada
Conseil économique du Canada

[redacted]



Post Office Box 527, Ottawa K1P 5V6
Case Postale 527, Ottawa K1P 5V6

DISCUSSION PAPER NO. 129

Canada and the Future of the International Economy: A Global Modeling Analysis

by Harry H. Postner

The findings of this Discussion Paper are the personal responsibility of the author and, as such, have not been endorsed by Members of the Economic Council of Canada.

Discussion Papers are working documents made available by the Economic Council of Canada, in limited number and in the language of preparation, to interested individuals for the benefit of their professional comments.

Requests for permission to reproduce or excerpt this material should be addressed to:

Council Secretary
Economic Council of Canada
Post Office Box 527
Ottawa, Ontario
K1P 5V6

March 1979

ABSTRACT

World economic growth is increasingly characterized by global economic interdependence between the major geographical regions. The presently less developed regions are gaining a larger share of the world's international economic activity. In this light it becomes important to consider Canada's future international trade in the context of a global modeling analysis. This paper represents a first attempt to work out national implications of a long-term world model.

The starting points are: (a) the United Nations World Development Model built upon a 1970 data base linking 15 major geographical regions, and (b) revised U.N. model scenarios to the year 2000 constructed by Brandeis University at the request of the Economic Council of Canada. The model lumps Canada and the United States in a North American Region (NAR). The main problem of this paper is to disaggregate Canada from NAR without formally reconstructing the world model into, say, 16 regions.

A simple 46-sector Canadian long-term model is constructed including 10 nonrenewable resource sectors. This model is linked to NAR in the world system through estimates of Canada's shares of NAR nonresource exports and resource productions. Four different Canadian gross domestic product (GDP) targets are set for the year 2000 in the context of four different global model scenarios. The Canadian model then yields detailed pictures of production, investment and international trade for Canada in 2000. Business investments in fixed capital stocks and inventories are endogenous; so are all imports and resource exports. Endogenous variables are solved through a stepwise solution procedure; the fixed GDP targets are achieved by iteration involving scalar adjustments of personal consumption expenditures. Special calculations reveal Canadian balance-of-trade, terms-of-trade and sectoral comparative advantage under alternative scenarios in the year 2000.

It will be clear that global modeling and its national implications are still at an exploratory level; much more work remains to be done. This paper could be regarded as a contribution and guide to methodology for researchers interested in further developing the Canadian impacts of global modeling analysis. Such an analysis permits comparisons of the Canadian economy in the year 2000 with that of other regions in the global system using a consistent and interdependent framework.

RÉSUMÉ

De plus en plus, la croissance économique mondiale se caractérise par une interdépendance économique globale entre les principales régions géographiques. Les régions moins développées s'approprient actuellement une plus grande part du commerce mondial. Dans cette perspective, il devient important de considérer l'avenir du commerce international du Canada dans le contexte d'une analyse fondée sur un modèle global. Cet exposé représente une première tentative pour déterminer les répercussions possibles sur le Canada de cette évolution, à l'aide d'un modèle mondial à long terme.

Comme point de départ, l'auteur a utilisé : (a) le modèle du développement international des Nations-Unies, qui se fonde sur une base de données de 1970 et établit des rapports entre 15 importantes régions géographiques, et (b) des scénarios établis à partir d'une version révisée du modèle de l'O.N.U. et projetés jusqu'à l'an 2000. Ce modèle, construit par l'Université Brandeis, à la demande du Conseil économique du Canada, regroupe le Canada et les États-Unis en une Région nord-américaine (R.N.A.). La grande difficulté de cet exposé est de séparer le Canada de la R.N.A sans avoir à reconstituer le modèle mondial, disons en seize régions.

Un simple modèle canadien à long terme comprenant 46 secteurs, dont 10 de ressources non-renouvelables, a été construit. Ce modèle a ensuite été relié à la R.N.A. du système mondial par des estimations de la part canadienne des exportations de produits non-primaires et de production de produits primaires. Dans le contexte de quatre scénarios différents du modèle global, l'exposé fixe quatre différents niveaux de produit national brut (P.N.B.) à viser en l'an 2000. Le modèle canadien fournit ensuite des projections sur la production, l'investissement et le commerce international du Canada en l'an 2000. Les investissements des entreprises en immobilisations et en stocks sont endogènes; il en va de même pour les importations ainsi que pour les exportations de ressources. Les variables endogènes sont déterminées par un procédé de résolution par étapes; les objectifs fixés du P.N.B. sont atteints par une itération comprenant des corrections scalaires des dépenses de consommation des particuliers. Des calculs spéciaux servent à projeter en l'an 2000 la balance commerciale, les termes de l'échange et les avantages comparatifs des secteurs au Canada selon divers scénarios.

Il est évident que les modèles mondiaux et les répercussions de l'évolution du commerce international sur le Canada forment un domaine de recherche récent qui devra faire l'objet de nombreux travaux plus approfondis. Ce document pourrait être considéré comme une contribution et un précis de méthodologie destiné aux chercheurs qui s'intéressent à poursuivre, à l'aide de modèles mondiaux, l'étude des répercussions sur le Canada de l'évolution du commerce mondial. Les analyses ainsi produites permettent de faire des comparaisons entre l'économie du Canada et celle d'autres régions du système global en l'an 2000, par l'intermédiaire d'un cadre d'analyse uniforme et interdépendant.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF TABLES (cont'd)

LIST OF TABLES (cont'd)

ACKNOWLEDGEMENT

Special thanks go to Professors Anne Carter and Peter Petri of Brandeis University for providing documentation and guidance to their global model. Pierre Mercier of the Economic Council performed the difficult job of programming all the calculations reported in this study. Dennis Nerland served as research assistant during the summer of 1977 and his notes were used to write Appendix B. Discussions with André Barsony, Director of the International Development Project, were helpful in clarifying Canadian economic policy issues. Thanks are also due to the Structural Analysis and Input-Output Divisions of Statistics Canada for supplying much of the statistical data. The study is based on data available in August 1977.

All errors or inadequacies in this study are the responsibility of the author.

I INTRODUCTION

In recent years a number of global models have been constructed for the purpose of long-term economic projections. So far there appears to be little attempt to work out the national implications of these models even though most economic decision-making is still performed at the national level. This study is directly concerned with the Canadian implications of the United Nations World Development Model [22]. Canadian long-term economic projections to the year 2000 are worked out on the basis of a revised version of the U.N. model formulated by Professors Anne Carter and Peter Petri at Brandeis University [4]. The study provides background material for the Economic Council of Canada's Report *For A Common Future* [10].

I.1 Scope and Outline of Study

It is well-known that international trade plays an important role in the Canadian economy. Canadian long-term projections are particularly sensitive to the future of the international trading economy. Events of recent years have shown the critical significance of considering Canada's future international trade in a consistent and global interdependence framework. Hence this study is primarily orientated towards analysing Canadian international trade opportunities and problems in the long-term future (the year 2000). This provides the "rationale" for linking a Canadian long-term model to the United Nations global model (discussed in further detail in Chapter II). Other aspects of the Canadian future economy are

also introduced and analysed, such as personal consumption and business investment, but their roles are largely secondary -- supporting the international trade analysis. Thus the study has a limited, but specific, scope. The reader will certainly *not* find an analysis of possible future Canadian problems concerning,e.g., government expenditures on health and education, which are primarily of domestic origin.

Before outlining the study contents, one other point should be stressed. It appears that the subject-matter might be of wide interest. Therefore, the text is written in an essentially nontechnical manner. Technical details are relegated to the Appendices. There are no elaborate, or should we say "confusing", references to the literature. The references given are only those directly concerned with the issue at hand.

Chapter II provides a brief account of the U.N. model and its attractive features from the Canadian viewpoint. This is followed by a description of the Canadian long-term model and the particular linkage mechanism with the global model. It must be emphasized that we do *not* examine only one future of the international economy; the methodology permits the analysis of alternative Canadian futures in the context of alternative global modeling scenarios. The first scenario analysed (Chapter III), exhibits a"business-as-usual" or "control" picture of Canadian and world future economic development. The Canadian simulation results are spelled out in a complete series of tables -- so the reader has the opportunity of performing his

(or her) own analysis. However, many specific examples of analysis are given for the reader's guidance. The chapter also contains additional methodology best explained in an empirical context.

Chapters IV and V provide two other scenarios related to the control scenario of Chapter III. All Canadian scenarios are projected to the year 2000 and linked in a consistent manner with the U.N. global model. In Chapter VI a Canadian petroleum energy conservation scenario is described in the context of a worldwide energy conservation future. Here the simulation results must be regarded as tentative due to the "short-cut" procedure used and the possibility of some inconsistency between the Canadian projections and those of the global model. Nevertheless, it is felt that the results are useful and suggestive.

Chapter VII is mainly concerned with a macrovariable differential impact analysis of the four scenarios. Here are the most important policy-orientated results of the study concerning Canadian future balance-of-trade, terms-of-trade and comparative advantage. (Some of these results are summarized in the following section.) Finally, it will be clear that much more work remains to be done even within the limited scope of the present study. Thus, Chapter VIII provides specific guidelines for further research and suggestions for other alternative global modeling scenarios to which a Canadian model can be appropriately linked.

The study concludes with two technical Appendices. Appendix A gives the Canadian model in concise mathematical form together with the stepwise solution (iteration) procedure. Appendix B outlines the statistical data sources and transformations required to implement the model. All references are compiled in the Bibliography.

I.2 Summary of Results

This section presents a list of what the author believes are the ten most important results of the study. However, the reader could easily disagree, after examining the tables, and wish to emphasize other aspects of the study. In any case, it should be recognized that long-term global modeling and its national economic implications are still at an exploratory level. The Canadian model and, indeed, the U.N. world model are relatively simple and there is considerable room for improvement. It is hoped that this study will stimulate further methodological effort in this area. Although there is much policy interest and speculation concerning Canadian long-term futures with respect to international trade, there also appears to be little serious analysis in a consistent and global framework. So the following results are listed to provide a sense of direction and substance to future Canadian policy research. Most of these results compare the Canadian economic projections for the year 2000 with the situation in the early 1970s (the model's statistical base). Moreover, many of the results are quite invariant with respect to the alternative scenarios analysed.

(i) Canada will become more dependent on international trade than ever before. Both future projected exports and imports represent significantly larger proportions of gross domestic product (GDP).

(ii) Without a specific program of petroleum energy conservation or substitution, Canada experiences sizeable (unsustainable) balance-of-trade deficits by the year 2000. This occurs even though the real growth rate 1970-2000 of Canadian petroleum consumption is considerably less than that of GDP.

(iii) With petroleum energy conservation, a Canadian GDP average annual growth rate of about 3.6 per cent appears sustainable over the period 1970 to 2000 in the U.N. global model context.

(iv) The prime sectoral sources of Canadian comparative *advantage* in international trade continue to be determined, directly and indirectly, by Canadian natural resource abundance. However, there is a distinct shift away from nonrenewable natural resource-based comparative advantage towards renewable natural resource-based sectors (even with generally optimistic projections concerning Canadian supply of nonrenewable resources).

(v) Special note must be taken of the Canadian wood and paper products primary manufacturing sectors. These sectors together account for over 20 per cent of Canadian projected exports in the year 2000; up from about 14 per cent in the early 1970s.[1]

(vi) The labour-intensive manufacturing sectors are all even more characterized by Canadian comparative *disadvantage* in international trade by the year 2000 than in 1970. This is not generally true for other secondary manufacturing sectors distinguished by capital-intensive processes.

(vii) Some of the most rapidly growing Canadian future export opportunities occur among secondary manufacturing sectors where Canadian import growth rates 1970-2000 are *also* high. So, intrasectoral international trade in manufactures continues to be important, but with some significant changes based on sectoral comparisons.

(viii) Without petroleum energy conservation, there is a small decline in the Canadian terms-of-trade 1970 to 2000. With petroleum conservation, the terms-of-trade improve slightly.

(ix) The projected changes in Canadian future export and import composition all point in the direction that

---

1 This result presupposes appropriate Canadian forest management investment during the future period analysed.

Canada-U.S. trade by the year 2000 will be a significantly smaller proportion of Canadian total trade than in 1970. The proportion of Canadian international trade with developing nations will probably grow correspondingly.

(x) Canadian business total investment increases at a higher growth rate than GDP in all scenarios. There is a relative shift in the destination of fixed capital stock towards energy, utilities, communications and the service sectors; and away from most manufacturing sectors.

The above results were presented in quite general terms. Much more detail is available in the text and some fifty tables that follow. In interpreting the results, it should be realized that neither the Canadian model nor the U.N. world model contain public policy instruments designed to "guarantee" the various projections. Rather, the idea is to *deduce* the economic consequences of potential opportunities and structural changes estimated to occur on the statistical basis of long-term trends and resource constraints. For Canada, the deductions are drawn in the framework of an economic accounting model embodying standard economic assumptions and identities. This is described in the next chapter. The consequences of various scenarios are then examined for feasibility and required economic adjustments (with particular reference to international trade). This is described in subsequent chapters.

II CANADA AND THE WORLD MODEL: RATIONALE AND METHODOLOGY

The main purpose of this chapter is to provide a nonmathematical description of the Canadian model and the links to the world model. It must be noted that the description will probably not be satisfactory to technical readers and they are advised to proceed immediately to Appendix A. In order to understand the Canadian model it is also necessary to have some background knowledge of the United Nations world model and this is developed in the following sections. Some emphasis is given to the attractive features of the world model from the Canadian viewpoint.

II.1 The United Nations World Model

The world model is essentially a multiregional, multisectoral quasi-dynamic accounting model. All nations of the world are grouped into 15 geographical regions. Each region is described by a regional macrovariable projection model combined with a 43-sector input-output model. There are some 175 equations in the model for each region. The various regions of the world are linked through interregional trade, capital flows, aid transfers and foreign interest payments. While each region is constructed on a 1970 statistical data base, alternative projections are made every decade to the year 2000. Regional structural characteristics shift over time depending mainly on future changes in per capita income levels. For a more detailed description of the U.N. model, the reader is referred directly to Leontief *et al.* [22] and Carter and Petri [4]. Also, much more will be said about the U.N. model in this study, but in the context of tracing out Canadian implications.[1]

---

1 Chapter VIII gives references to critical appraisals of the U.N. model.

What are the attractive features of the U.N. model for a nation like Canada? In the model, Canada is simply "lumped" with the United States in the North American Region (NAR). So it is not difficult to disaggregate Canada from this region and still maintain reasonable links with the world system. At the same time, even though the Canadian economy is a relatively small proportion of the total North American economy (about 8 per cent in 1970 measured in terms of gross domestic product), Canada is not "swamped" by the United States in the world model's North American Region. The main reason for this is the world model's emphasis on international trade and considerable disaggregation of resource sectoral outputs in the various regions. For example, Canadian exports in 1970 equalled about 30 per cent of total NAR exports in that year and the Canadian proportion of some important NAR resource outputs is even higher. Thus Canada makes a significant contribution to some of the key North American variables in the world model (we will return to this again shortly).

All this provides some motivation for tracing out the implications for Canada of the U.N. model. We will be particularly interested in projecting and analysing Canadian international trade to the year 2000. However, the projections are best evaluated and used in conjunction with the results of the world model as a whole.

II.2 Disaggregation of Canada from North America

There are various ways of analysing Canadian economic prospects in the context of the U.N. model. The best way, perhaps, is to reconstruct the model into 16 interdependent regions (Canada and the United States become distinct regions in the world system).

For technical reasons, this method[1] was not available and, in any case, would require some active participation from the original builders of the world model. Another method is to adapt an existing Canadian model so that it may be linked, through international trade, to the world model. This approach, of course, is most appealing to those who are already involved in the construction of Canadian medium-term or long-term models. Economists who are included in this category are certainly encouraged to adopt this approach.

The method used in this study begins with the formulation of a simple Canadian long-term model which, generally, parallels each of the regional models in the world system. (There are *some* critical differences between the Canadian model and the world regional models and these will be explained in the following sections.) The Canadian model reflects distinct Canadian structural characteristics and is also built on a 1970 (adjusted) data base. The model is linked to the NAR through estimates of Canada's *shares* of NAR nonresource exports and resource productions. Alternative Canadian gross domestic product (GDP) targets are exogenously set for the year 2000 in the context of alternative world model scenarios. The Canadian model solution then yields detailed pictures of production, investment and international trade for Canada in 2000. Business investments in fixed capital stocks and inventories are endogenous; so are all imports and resource exports. Endogenous variables are solved through a stepwise solution procedure; the fixed GDP targets are achieved by iteration involving scalar adjustments of total personal consumption expenditures. It is then possible to compare the Canadian situation in the year 2000 with that of all other regions (including the

---

1 Permitting complete integration of Canada into the world system.

"residual" of NAR) in the world system. However, the methodology does not provide a complete and self-contained long-term Canadian model and the results should be interpreted in conjunction with the various world model scenarios. Finally, the model is particularly orientated to measuring the Canadian differential impacts of alternative world development scenarios.

II.3 Description of Canadian Model

The Canadian model can also be described as a macrovariable projection model combined with a 46-sector input-output table. The sectoral disaggregation generally corresponds with the 43 sectors used in the world model plus the addition of 3 dummy sectors. Appendix C provides a precise list of the commodity content for the 46 Canadian sectors together with the world model sectoral correspondence. For present purposes it is convenient to subdivide the 46 sectors into two parts: (1) the 35 nonresource sectors including 4 agricultural sectors, 22 manufacturing sectors, 6 essentially nontradable sectors and 3 input-output dummy sectors; and (2) the 10 nonrenewable resource[1] sectors (both mineral and energy sectors) plus 1 noncompetitive agricultural import sector.

The core of the Canadian model consists of the well-known input-output accounting identity complemented by a list of equations determining some of the key variables. The identity and equations are written for the year 2000 and all variables are measured in 1970 producers' prices.[2] Most of the model equations are projected,

---

1 The term "resource sector" will always refer to a nonrenewable resource sector in this study, unless otherwise specified.

2 See Statistics Canada [32] for an explanation of the producers' price concept.

directly or indirectly, on a 1970 statistical data base but more recent Canadian data up till 1976 were also used. We will now describe the model in somewhat more detail. The reader interested in the mathematics of the model and specific data sources is referred to Appendices A and B.

The input-output accounting identity states that total commodity[1] supply equals total commodity demand in any one year (the year 2000 in this case). Commodity supply consists of the summation of domestic output and all imports. Commodity demand equals the summation of industry intermediate demand plus final demand. Final demand itself is the summation of commodity demand for: (a) business nonresidential fixed capital formation (or investment), (b) economy-wide inventory investment, (c) personal consumption expenditures, (d) residential construction investment, (e) total, current plus capital, government net expenditures, and (f) all exports. The accounting identity is complemented by the following equations.

First, imports are endogenously determined by means of projected import coefficients which give the import shares of Canadian total domestic requirements (domestic output plus imports minus exports) in the year 2000. The import coefficients for the *manufacturing* sectors[2] are mostly projected on the basis of 1961-74 analyses of import coefficients' elasticities with respect to real gross domestic product (GDP) for that period. The estimated elasticities

---

1 The terms "commodity" and "sector" are used synonomously in this study.

2 The remaining nonresource import coefficients were mostly held constant at 1970 levels.

are then used together with the 1970 import coefficients and the ratio of the GDP target in 2000 to the base year GDP, to yield projected import coefficients in 2000. The *resource* import coefficients are mostly estimated on the basis of historical trends, judgment and prior knowledge (noncompetitive import coefficients are set equal to unity) while a special procedure was required for the petroleum import coefficient in the energy conservation scenario described in Chapter VI. Some examples of projected and base year import coefficients are given in the next chapter.

Second, business nonresidential capital investment is also endogenous in the Canadian model. The essential aspect here involves the distinction between business expansion investment in the year 2000 and business replacement investment. The equation for *expansion* investment is derived from the multisectoral acceleration principle together with an assumption that the commodity components of expansion investment grow linearly during the time period 1970 to 2000 (this implies decreasing growth rates).[1] The equation supposes a simple 1-year gestation lag for all sectors except for the following: transportation sector with a (uniform) maximum gestation lag of 2 years, mining and energy sectors with gestation lags of 3 years, and utilities sector with a maximum gestation lag of 7 years. Also, the concept of "capacity" output used in the acceleration principle equation is subject to an estimated normal margin of spare capacity. The derivation of the business *replacement* investment equation is much simpler and involves the estimation of a capital replacement coefficient flow matrix using expected life spans for all capital items and projected capital-output ratios by sector of destination

---

1 Ultimately reflecting expected declines in Canadian GDP growth rates 1970-2000.

for the year 2000 (examples are given in the next chapter). Then business total capital investment is the summation of expansion and replacement investment as outlined above.

Third, the inventory change or investment equation amounts to relating inventory change to incremental product sales by means of inventory stock-sales ratios by sector of origin. Note that product sales equal domestic output plus imports minus inventory change, so that a negative inventory change is indicative of additional sales. The correct specification of this equation is important for Canadian agricultural sectors where the stock-sales ratios are greatest. Again, inventory investment is made endogenous in the Canadian model.

Fourth, aggregate personal consumption expenditure in the year 2000 is initially[1] set equal to aggregate consumption in 1970 multiplied by the ratio of the GDP target in 2000 to the base year GDP. However, the commodity consumption pattern changes over the period depending on: (a) estimated (1961-76) Canadian arc elasticities of sectoral consumption expenditures per capita with respect to total consumption expenditures per capita, (b) the consumption pattern in the base year, and (c) the ratio of total population in 2000 to 1970 population. The calculated elasticities are, in effect, Engel elasticities suitably constrained to guarantee "adding-up".

Fifth, residential construction investment in 2000 is obtained by a procedure somewhat analogous to business expansion investment. Total residential construction stock is related to total personal consumption expenditures by means of a "desired" ratio with

---

1 But later modified to guarantee a fixed GDP target (see Appendix A).

an average 4-year negative lag and residential construction investment is assumed to grow linearly during the period 1970 to 2000 (again, a declining growth rate). Note that residential construction also includes the commodity component, real estate services.

Sixth, total, current plus capital, net government expenditures in the year 2000 is simply the product of total government expenditures in 1970 (using an adjusted 1971 commodity pattern) and the ratio of the GDP target in 2000 to the base year GDP. Our treatment of government in terms of *net* expenditures conforms with Canadian Income and Expenditures Accounts. We do not attempt to endogenize government commodity sales and revenue.

II.4 The Canadian Links to the World Model

The two major Canadian model links to the U.N. model involve the determination of Canadian nonresource exports and Canadian domestic resource outputs for the year 2000. These two links are now described in some detail.

Canadian nonresource exports are mainly[1] determined by estimating Canada's shares of NAR *gross* exports in the year 2000 directly from world model scenario printouts (the world model regional projections of nonresource exports are *gross*, and therefore do not net out intraregional international trade, implying that Canadian exports to the United States are fully accounted for). In most cases[2]

1 The method outlined in this paragraph does not apply to Canadian trade and transportation export margins which required special estimation techniques because of their dependence *both* on the remaining nonresource exports and on all (endogenous) resource exports.

2 Two exceptions are mentioned in Chapter III.

it is assumed that Canada will maintain its sectoral shares of NAR nonresource exports as observed in base year 1970.[1] It must be noted that the Canadian shares of some important NAR exports are quite high and have remained so for the time period around 1970 (1966-76): grain export share equals 0.25, food processing = 0.19, primary metal processing = 0.21, wood products = 0.69, paper products = 0.63, motor vehicles = 0.42. Thus the world model NAR gross export projections are already quite informative about Canadian potential exports (Canada is not "swamped" by NAR). Also, it should be noted that in the world model, regional sectoral shares of total world nonresource exports shift depending, mostly, on relative changes in regional per capita GDP. Since Canada's per capita GDP growth rate 1970-2000 is kept in line with that of NAR,[2] it is then reasonable to assume that Canada's shares of NAR exports do not change significantly (at least in the world model context). However, NAR sectoral shares of total world nonresource exports *do* change over the period 1970-2000 and so the Canadian shares of total world nonresource exports change in the same proportion. For example, NAR shares of world nonresource exports for the following aggregated sectors are:[3]

Sector	1970	2000
Agriculture	21.5	24.3
Materials	17.6	10.8
Light Manufacturing	14.5	10.3
Heavy Manufacturing	25.2	15.5

---

1 Actually an adjusted average of Canadian sectoral nonresource exports in 1970 and 1971 was used here.

2 This assumption is further discussed below.

3 From Carter and Petri [4], for scenario A (see Chapter III).

Canadian domestic resource outputs in the year 2000 are partly determined from NAR resource outputs as derived in the world model scenario printouts. But here Canada's shares of NAR resource outputs in 2000 *change* as compared to 1970. The estimated changes depend on: (a) 1966-76 trend analysis and (b) the most recent (high energy price) long-term projections prepared by the Department of Energy, Mines and Resources.[1] Again, for some resources, the Canadian shares of NAR outputs are very high in the base year and expected to remain so: nickel output share equals 0.95, zinc = 0.72, lead = 0.41, iron ore = 0.34. So the NAR in the world model is already particularly informative about Canadian resource productions (for bauxite and noncompetitive imports, Canadian resource production is identically zero). It is also important to note that Canadian resource exports cannot be estimated by a method analogous to that used for nonresource exports, since the world model calculations of resource trade are all in *net* terms (netting out *both* intraregional and intrasectoral trade, so that Canadian potential net resource trade with the United States is completely *unaccounted* for). This is the rationale for linking Canadian resource productions directly to the world model through the NAR resource outputs (complemented by other information).

Thus it is seen that all Canadian sectors, both resource and nonresource, have direct links to the U.N. model. But there are other, more indirect, links as well. For example, the Canadian model requires an input-output coefficient matrix for the year 2000. This matrix is essentially formed by modifying the observed base year coefficient matrix. Many of the modifier elements come from the world

---

1 See Appendix B for documentation.

model, and particularly NAR, documentation so that similar technological developments are assumed (especially in the mining and manufacturing sectors). The capital-output ratios projected for the Canadian mineral, and energy sectors also depend on NAR documentation. Most important, the Canadian exogenous GDP targets for the various scenarios depend on NAR endogenous growth rates for GDP. In each scenario it is assumed that the Canadian GDP per capita growth rate is approximately the same as that for NAR. This is a highly convenient assumption to make for the purpose of estimating Canadian nonresource exports (as seen above) and greatly simplifies the construction of the Canadian model. At the same time, the range of projected Canadian GDP growth rates 1970 to 2000, falls within that of other independent projections.[1] The particular iteration procedure used to achieve a Canadian GDP target in the year 2000 is described in the technical Appendix A.

However, there are some critical differences between the Canadian model and the world regional models that should be briefly noted. The Canadian model does not explicitly account for labour employed and so avoids the complications of projecting Canadian labour force and sectoral labour productivities. It is implicitly assumed that the various Canadian GDP targets are feasible in the context of alternative world model scenarios.[2] Similarly, the Canadian model abstracts from explicit consideration of pollution-abatement activity (see Stone [35]). On the other hand, the model embodies a 46-sector incremental capital coefficient matrix which permits detailed analysis of projected business investment activity. In particular it is

---

1 See Department of Finance [7] and Eyford [13].

2 See Chapter VIII for further discussion of this important point.

possible to estimate Canadian business capital stock requirements in the year 2000 both by sector of origin and by sector of destination. Moreover, the model contains an explicit treatment of tariffs on imports and future Canadian international trade is analysed both in 1970 prices and in projected world (relative) prices for the year 2000. The latter prices, explained in the next chapter, come from U.N. model documentation.

Finally it should be noted that future structural changes in both the Canadian and world models reflect long-term trends and income effects. Projected changes in relative commodity prices are informally incorporated, together with resource availabilities and constraints (see last paragraph of Appendix B). One of the key aspects of the alternative scenarios described in the following chapters is the valuation of future Canadian balance-of-trade in projected world prices. It will be seen that the search for a viable scenario yielding *sustainable* balance-of-trade simulates an informal economic adjustment mechanism.

III THE BUSINESS-AS-USUAL SCENARIO

This chapter discusses the basic scenario of the U.N. model and the implications for Canada. Here the detailed Canadian tabular results are first introduced and the meaning of the calculations are explained. It should be noted that this chapter discusses only the one scenario. The main comparative analysis of alternative scenarios, with emphasis on Canadian differential impacts, can be found in Chapter VII.

III.1 Canadian and U.N. Model Assumptions of Scenario A

The business-as-usual scenario of the U.N. model is here referred to as scenario A. (The Carter-Petri report uses scenario AA). Briefly, this is a control-type scenario. Future world development to the year 2000 is projected along business-as-usual lines: economic growth in the major developed regions, including NAR, is constrained by expected changes in available labour and labour productivity; economic growth in most developing regions is limited by foreign exchange earnings and financial savings needed to support the fixed capital requirements of higher income levels. For a more detailed description of this scenario, the reader is referred to Economic Council [10]; the complete description is in Carter and Petri [4].

In scenario A, the North American Region experiences an endogenous gross domestic product (GDP) average annual growth rate of 3.4 per cent over the period 1970 to 2000. Exogenous population growth for NAR is projected at 0.9 per cent, so that

the GDP per capita growth rate becomes 2.5 per cent for this same time period. On the other hand, the Canadian exogenous population growth rate projected for this scenario was chosen to be equal to 1.1 per cent. This growth rate represents a relatively low expected fertility rate combined with a medium expected net immigration rate over the period 1970 to 2000.[1] A basic assumption of our methodology is that the Canadian GDP per capita growth rate, 1970 to 2000, should be approximately the same as that for NAR in the *same* scenario to which the Canadian model is linked. This implies that the Canadian GDP average annual growth rate is set equal to 3.6 per cent in scenario A. The latter falls well within other projected Canadian economic growth rates from independent sources.

III.2 Description of Scenario Tables

We could now turn to the 12 tables included in this chapter. Each table presents an analysis of the sectoral results for a particular variable. A list of the 46 (or 47) sector names is also included here as Table 0 for the reader's convenience. Table 1 is a sectoral analysis of the Canadian gross output[2] variable 1970 to 2000. The first column in the table denotes the sector (e.g., sector number 3 represents grains). The second column gives the base year data for 1970 in millions of dollars

---

1 See Statistics Canada [33] for more details. The net immigration rate is about 100,000 per year.

2 Canadian or domestic gross output should not be confused with real value added by sector of origin. Gross output includes all intermediate inputs purchased from other sectors as well as own-sector primary inputs.

(some base year data are adjusted as explained in Chapter II). The third column presents the projection, or model solution, for the year 2000. Column four yields the sectoral gross output percentage shares of total gross output in 1970. Column five does the same job for the sectoral gross output data in the year 2000. The sixth column is merely the ratio of the projected results for 2000 to the base year observations for 1970. Finally, the last column transforms these ratios into average annual percentage compound growth rates. Thus the Canadian average annual percentage growth rate for the grains sector, measured in terms of domestic gross output in 1970 constant producers' prices, equals 3.31 per cent over the time period 1970 to 2000.

Table 2 is a sectoral analysis of Canadian total exports in constant 1970 prices. Note that this table includes an additional sector number 47 explained in the following section. Table 3 also analyses Canadian exports 1970 to 2000, but the projected exports for the year 2000 are calculated in terms of a projected world relative price vector[1] also for the year 2000. Thus Table 2 accounts only for physical changes in future Canadian exports while Table 3 *also* reflects changes due to sectoral export relative price (or valuation) shifts. Tables 4 and 5 are similar to the two previous tables, representing an analysis of Canadian total imports. Note that imports are valued in competitive producers' prices and, therefore, include tariff revenue. Thus Tables 6 and 7

---

1 The projected price vector represents *normalized* (no account of inflation) relative price ratios in the year 2000 as compared to 1970, obtained from world model documentation. See Leontief *et al.* [22] for more details.

present a sectoral analysis of this tariff revenue which should be used in conjunction with Tables 4 and 5 respectively (see Chapter VII). The tariff rates employed to calculate tariff revenue for 1970 are implicit *ad valorem* tariff rates for that year. Tariff rates are generally assumed to be unchanged 1970 to 2000.

The last five tables contain a sectoral analysis of business investment and capital stock. Table 8 represents business total nonresidential capital formation; the total of business expansion investment in Table 9 and business replacement investment in Table 10. Table 11 analyses the corresponding business total capital stock 1970 to 2000. Finally, all sectoral results so far shown are for sector of origin. In Table 12, business total capital stock is analysed after transformation into sector of destination (see next section for discussion).

III.3 Discussion of Results for Scenario A

This section concentrates on the individual sectoral results of scenario A. The macroresults, including a comparative analysis of such variables as balance-of-trade and terms-of-trade, are discussed in Chapter VII. First a number of points require clarification.

It is seen that the Canadian international trade variables in the tables contain 47 sectors. Sector number 47 accounts for tourist trade, so that exports of this sector represent Canadian tourist travel receipts and imports represent travel expenditures abroad. A distinctive treatment of this

sector is required because tourist trade is an unallocated commodity item in the Canadian input-output accounting system.[1] However, in the U.N. world model, tourist expenditures and receipts are somehow aggregated with the service sector and therefore form an important part of the NAR service exports. Thus Canadian tourist receipts (sector 47 exports) for the year 2000 are obtained by the same method used to estimate other Canadian nonresource exports; essentially by multiplying Canadian tourist receipts in 1970 by the *ratio*[2] of NAR service exports in 2000 to NAR service exports in base year 1970. On the other hand, Canadian tourist expenditures abroad in 2000 (sector 47 imports) are calculated by a formula using: (a) the arc elasticity of Canadian tourist expenditures per capita with respect to GDP per capita, estimated from 1964-76 data, (b) the ratio of the GDP target in 2000 to base year GDP, (c) the ratio of Canadian population in 2000 to population in 1970, and (d) Canadian tourist expenditures in the year 1970. Examining Tables 2 and 4, the Canadian tourist trade deficit[3] in 1970 equals 216 million; in the year 2000 this same trade deficit is projected at 1,841 million using 1970 constant prices. This may seem like an exaggerated deficit projection, but in 1977 the observed Canadian tourist trade deficit was already equal to 944 million (using 1970 prices).

---

1 See Statistics Canada [32] for the relevant discussion.

2 Taken from world model scenario printouts.

3 That is, imports minus exports for sector number 47.

Total Canadian international trade, as represented in the Canadian model, is simply the summation of the exports or the imports of all 47 sectors. This means that international trade covers: (a) all merchandise trade together with trade and transportation service margins, (b) business and financial services trade (the tradable portion of sector 27), and (c) tourist trade (sector 47). Our treatment does *not* cover other international current account items such as international interest and dividend transactions[1] and special government service transactions.

Many of the results for scenario A and other scenarios are critically dependent on the methodology for projecting Canadian *nonresource* import coefficients[2] to the year 2000 (as outlined in Chapter II). Thus it is instructive to observe how some of these coefficients change. For example, the textile import coefficient (sector 8) equals[3] 0.22 in 1970; the projected coefficient is 0.41 for the year 2000. Similarly, electrical products (sector 24) changes from 0.31 to 0.56. In fact, the import coefficients for most manufacturing sectors, particularly those featuring labour-intensive light industry, are projected to increase over the 1970 to 2000 period. As a final preliminary,

---

1 Note that the GDP concept used in the model includes investment income paid to nonresidents and excludes investment income received from nonresidents. This is the opposite of the gross national product (GNP) treatment.

2 The *resource* import coefficients are not so crucial and merely determine the individual level of gross exports and imports, but not the level of net exports or net imports (see Appendix A).

3 The import coefficients can be directly calculated from the tables by dividing imports by gross output plus imports minus exports (in 1970 prices).

it should be noted that the Canadian export projections for textiles and primary metal processing (sector 7) do not follow the "rules" outlined in Chapter II. The Canadian share of NAR textile exports is diminished by some 30 per cent and the Canadian share of primary metal processing exports is raised by 15 per cent (the latter reflecting a relative increase in Canadian metal resources). Two other Canadian nonresource export projections have also been slightly adjusted, namely printing products (downwards) and furniture and fixtures (upwards).

In effect the Canadian results for scenario A, as shown in the 12 tables, speak for themselves. But some guidelines could prove to be helpful.[1] The sectoral gross output growth rates of Table 1 should be compared with the overall GDP rate of growth (3.6 per cent) to distinguish those with above and below average growth. The *nonresource* sectoral growth rates reflect the direct and indirect influences of a complex set of factors both within and outside the Canadian economy. In some cases there are one or two outstanding factors. For example, the agricultural and food processing sectors display relatively slow growth, reflecting low personal consumption elasticities with respect to income. The machinery sector (23) also exhibits slow growth because of some increased import competition (see Table 4), but mainly because business new capital formation for machinery is sensitive to the declining GDP growth rates expected during the 1970 to 2000 period (see Table 9). On the other hand, the wood and paper products sectors experience relatively high growth,

---

1 A good summary analysis of scenario A can be found in Economic Council [10].

clearly due to increased export opportunities (Table 2). The electrical products sector (24) growth rate, slightly lower than average, results from a complexity of countervailing influences largely representing the aggregation of consumer and producer items in the *same* sector; the consumer items face dramatic import displacement but with some scope for domestic expansion due to a relatively high consumption elasticity; the producer items experience new export opportunities and new markets in domestic capital investment (there are some increases in capital-output ratios for rapidly growing sectors making heavy use of electrical industrial equipment).

The Canadian services sector (27) deserves special comment. The growth rate is about average, 3.63 per cent, and this results from some interesting factors. First, the direct personal consumption elasticity is less than unity, reflecting high growth of self-service activities[1] and increasing government provision of particular services (e.g., health services) formerly provided by the business sector. Also there is a slow-down in the growth of residential construction investment and complementary real estate services (the decreasing growth rate of new household formation). And, as already noted, the tourist service trade is officially unallocated and separately accounted for in the Canadian model. These factors responsible for dampening the measured growth of consumer services, are balanced by an above-average growth of Canadian producer services, indirectly effected by rapid growth of sectors which are heavy intermediate users of producer

---

1 See Skolka [29] and further discussion in Economic Council [11].

services (sometimes with increased projected service input coefficients). Even this factor is partly dampened by growing tradable producer service (business and financial services) import displacements (see Table 4). If one were to calculate the Canadian total domestic use of services,[1] *including* tourist services, in both 1970 and the year 2000, it would be found that the average annual growth rate of this overall service indicator equals 3.72 per cent. This is an above-average growth rate and virtually the same as that for the corresponding indicator of NAR, taken directly from world model scenario A printouts.

The Canadian *resource* sectoral growth rates of Table 1 are essentially based on the corresponding growth rates for NAR, modified by changes 1970 to 2000 in the Canadian shares of NAR resource outputs (this was explained in Chapter II). In effect, the Canadian net exports (positive) or net imports (negative) of resources become a residual depending on domestic resource production and the various sources of intermediate and final demand for domestic use. For example, the crude petroleum projected growth rate is very low (0.75 per cent in Table 1) and crude petroleum is consumed almost solely as an intermediate input of the petroleum refining sector. This sector has a domestic growth rate of 3.11 per cent, with the result that Canadian crude petroleum international trade changes from a net export position in 1970 equal to 158 million to a net import position of 1338 million in the year 2000 (all measured in 1970 producers' prices). On the

---

1 That is, gross output plus imports minus exports for the "combined" service sector.

other hand, the Canadian coal sector (45) experiences very rapid growth, 7.19 per cent, which is sufficient to reduce coal net imports from 167 million in 1970 to 113 million by the year 2000. The net imports of coal in 2000 are quite small relative to domestic production. The main reason why coal does not turn into a net export is because the major intermediate consumer of coal, namely the utilities sector, *also* experiences rapid growth (4.43 per cent) *and* is expected to increase its coal intermediate input coefficient by some 50 per cent over the period 1970 to 2000.[1] As a third example, Canadian natural gas exports are about the same 1970 and 2000, thanks to a moderate 2.90 per cent production growth rate combined with relatively low final consumer demand elasticity and only minor increases in natural gas intermediate input coefficients. All this is in terms of 1970 prices, i.e., holding physical units constant. However, when Canadian natural gas net exports in 2000 are evaluated in relative world prices for that year, net exports jump from 121 million in 1970 (1970 prices) to 975 million in the year 2000 (2000 prices). Clearly, many more interesting examples of shifts in Canadian trade can be constructed from Tables 2 to 5. This topic will be reconsidered in Chapter VII.

Turning now to Table 11, it is seen that the construction sector (30) is the largest component in the growth of total business capital stock; this is the most important *sector of origin* for business fixed capital stock.[2] But it is equally important to

---

1 This reflects greater relative use of thermal power for electricity generation (see Appendix B).

2 It might be noted that the high growth rate of the service sector (27) in this table is entirely due to the classification of "services incidental to mining" as a capital item combined with increased capital-output ratios 1970 to 2000 for most mining sectors (reflecting the extraction of lower quality reserves).

know the sectoral destination (or use) of fixed capital, and this is shown by Table 12. The growth rates of fixed capital stock by business[1] *sector of destination* reflect two principal factors: (a) the growth rate of the individual production sectors (shown in Table 1), and (b) the growth rate of capital-output ratios projected for each sector. For example, the service sector rate of growth in Table 1 equals 3.63 per cent, but fixed capital stock destined for this sector grows at an average annual rate of 4.67 per cent -- reflecting increased capital-output ratios and the so-called "industrialization of service".[2] Indeed the service sector, together with utilities, communications and natural gas, absorb a larger share of the business total capital stock required in the year 2000 as compared to 1970. Most manufacturing sectors end up with smaller shares of fixed capital stock over this time period.

To close this chapter it might be noted that the tables do not show business *capital formation* by sector of destination. However the growth rates 1970 to 2000 for business *capital stock* by sector of destination analysed in Table 12, could serve as a crude first approximation for a growth analysis of business capital formation over the same period. A method for precisely measuring the latter variable by sector of destination is available, but has not yet been implemented. Also, a sectoral growth analysis of inventory investment and inventory stock has been

---

1 The Canadian input-output sectors cover the total business economy.

2 See Levitt [24].

implemented (only sector of origin is relevant here), but is not shown in this study because of its relatively minor importance. Tables analysing the latter variables, for the various scenarios, are available from the author on request.

One final word concerning the tables that follow. It will be seen that the sectoral growth rates 1970-2000 for imports are identical to those for the corresponding tariff revenue variable (compare Tables 4 and 6). This is because tariff rates are assumed to be unchanged over the time period. However, it is still interesting to observe the sectoral shares columns 1970 and 2000 in the two tables. These are not the same since sectoral tariff rates differ considerably. It is also instructive to note that the growth rates in the replacement capital formation Table 10 are *almost* identical to those in the total capital stock Table 11. The sectoral growth rates would be identical if the expected life spans of individual capital items (by sector of origin) were completely invariant with respect to sector of destination. (This is almost true.) Again the sectoral share columns in Tables 10 and 11 are significantly different.

SECTOR NUMBERS AND NAMES

1	LIVESTOCK
2	OILCROPS
3	GRAINS
4	RESIDUAL AGRICULTURE
5	FOOD PROCESSING
6	PETROLEUM REFINING
7	PRIMARY METAL PROCESSING
8	TEXTILES, CLOTHING
9	WOOD PRODUCTS
10	FURNITURE, FIXTURES
11	PAPER PRODUCTS
12	PUBLISHING
13	RUBBER PRODUCTS
14	INDUSTRIAL CHEMICALS
15	FERTILIZERS
16	OTHER CHEMICALS
17	CEMENT
18	NONMETALLIC MINERAL PRODUCTS
19	MOTOR VEHICLES AND PARTS
20	OTHER TRANSPORTATION EQUIPMENT
21	AIRCRAFT AND PARTS
22	METAL PRODUCTS
23	MACHINERY
24	ELECTRICAL PRODUCTS
25	SCIENTIFIC INSTRUMENTS
26	OTHER MANUFACTURING
27	SERVICES
28	TRANSPORT
29	UTILITIES
30	CONSTRUCTION
31	TRADE MARGINS
32	COMMUNICATIONS
33	TRANSPORTATION MARGINS
34	SUPPLY, REPAIR SERVICES
35	TRAVEL, PROMOTION, ADVERTISING
36	NONCOMPETITIVE IMPORTS
37	COPPER
38	NICKEL
39	ZINC
40	LEAD
41	BAUXITE
42	IRON
43	CRUDE PETROLEUM
44	NATURAL GAS
45	COAL
46	RESIDUAL MINING
47	TOURIST TRADE

TABLE 1 OUTPUT VARIABLE SCENARIO A

SECTOR	BASE 1970	PROJ. 2000	%SHARES 1970	%SHARES 2000	RATIO	%GROWTH RATES
1	2544.3	5645.2	1.86	1.41	2.22	2.69
2	262.0	568.2	0.19	0.14	2.17	2.61
3	1057.4	2812.7	0.77	0.70	2.66	3.31
4	2509.8	6673.1	1.83	1.66	2.66	3.31
5	9516.4	21408.7	6.95	5.33	2.25	2.74
6	1908.0	4783.2	1.39	1.19	2.51	3.11
7	5129.6	12054.8	3.74	3.00	2.35	2.89
8	3809.3	9158.3	2.78	2.28	2.40	2.97
9	1987.6	7084.7	1.45	1.76	3.56	4.33
10	699.4	2151.8	0.51	0.54	3.08	3.82
11	4064.5	18905.3	2.97	4.71	4.65	5.26
12	1527.3	3969.1	1.11	0.99	2.60	3.23
13	549.1	1029.0	0.40	0.26	1.87	2.12
14	1456.1	3551.5	1.06	0.88	2.44	3.02
15	188.7	650.5	0.14	0.16	3.45	4.21
16	1518.1	4566.0	1.11	1.14	3.01	3.74
17	638.6	2030.5	0.47	0.51	3.18	3.93
18	642.9	2212.2	0.47	0.55	3.44	4.21
19	4644.3	14329.4	3.39	3.57	3.09	3.83
20	735.7	2278.9	0.54	0.57	3.10	3.84
21	496.9	1585.0	0.36	0.39	3.19	3.94
22	3201.1	9182.1	2.34	2.29	2.87	3.57
23	1966.7	5217.1	1.44	1.30	2.65	3.31
24	2787.9	7595.3	2.03	1.89	2.72	3.40
25	427.8	1396.0	0.31	0.35	3.26	4.02
26	685.1	1635.9	0.50	0.41	2.39	2.94
27	27400.7	79863.4	20.00	19.90	2.91	3.63
28	6774.6	21208.6	4.94	5.28	3.13	3.88
29	2198.7	8064.9	1.60	2.01	3.67	4.43
30	13698.7	40731.3	10.00	10.15	2.97	3.70
31	12719.7	40126.5	9.28	10.00	3.15	3.90
32	2358.6	9437.0	1.72	2.35	4.00	4.73
33	3061.9	9373.7	2.23	2.34	3.06	3.80
34	6140.2	19792.1	4.48	4.93	3.22	3.98
35	3120.4	9285.1	2.28	2.31	2.98	3.70
36	0.0	0.0	0.0	0.0	0.0	0.0
37	611.3	1678.0	0.45	0.42	2.74	3.42
38	651.2	952.5	0.48	0.24	1.46	1.28
39	312.8	641.6	0.23	0.16	2.05	2.42
40	96.6	203.8	0.07	0.05	2.11	2.52
41	0.0	0.0	0.0	0.0	0.0	0.0
42	510.4	1792.6	0.37	0.45	3.51	4.28
43	1270.9	1592.1	0.93	0.40	1.25	0.75
44	293.8	691.8	0.21	0.17	2.35	2.90
45	89.3	716.2	0.07	0.18	8.02	7.19
46	760.0	2789.4	0.55	0.69	3.67	4.43
TOTAL	137024.4	401415.3	100.00	100.00	2.93	3.65

TABLE 2 EXPORT VARIABLE (1970 PRICES) SCENARIO A

SECTOR	BASE 1970	PROJ. 2000	%SHARES 1970	%SHARES 2000	RATIO	%GROWTH RATES
1	65.0	167.2	0.33	0.27	2.57	3.20
2	150.8	434.6	0.78	0.70	2.88	3.59
3	701.2	2001.1	3.61	3.22	2.85	3.56
4	177.1	360.0	0.91	0.58	2.03	2.39
5	918.4	2317.9	4.73	3.73	2.52	3.13
6	94.9	0.0	0.49	0.0	0.0	-100.00
7	2170.4	5065.6	11.18	8.16	2.33	2.87
8	184.9	641.4	0.95	1.03	3.47	4.23
9	852.3	3267.3	4.39	5.26	3.83	4.58
10	35.9	71.8	0.18	0.12	2.00	2.34
11	1897.7	10381.7	9.78	16.72	5.47	5.83
12	37.1	223.6	0.19	0.36	6.02	6.12
13	31.0	124.2	0.16	0.20	4.00	4.73
14	278.6	876.7	1.44	1.41	3.15	3.90
15	135.7	500.0	0.70	0.81	3.68	4.44
16	126.0	600.9	0.65	0.97	4.77	5.35
17	28.9	57.8	0.15	0.09	2.00	2.34
18	67.4	418.1	0.35	0.67	6.20	6.27
19	3480.2	10658.2	17.93	17.16	3.06	3.80
20	208.2	416.4	1.07	0.67	2.00	2.34
21	380.7	1424.7	1.96	2.29	3.74	4.50
22	249.8	577.6	1.29	0.93	2.31	2.83
23	667.6	1819.1	3.44	2.93	2.72	3.40
24	439.7	2212.7	2.27	3.56	5.03	5.53
25	143.2	517.2	0.74	0.83	3.61	4.37
26	84.2	271.2	0.43	0.44	3.22	3.98
27	223.5	711.5	1.18	1.15	3.11	3.86
28	589.2	2343.2	3.04	3.77	3.98	4.71
29	37.4	115.4	0.19	0.19	3.09	3.83
30	0.0	0.0	0.0	0.0	0.0	0.0
31	721.9	2325.8	3.72	3.74	3.22	3.98
32	29.3	74.0	0.15	0.12	2.53	3.14
33	868.3	2789.6	4.47	4.49	3.21	3.97
34	0.0	0.0	0.0	0.0	0.0	0.0
35	0.0	0.0	0.0	0.0	0.0	0.0
36	0.0	0.0	0.0	0.0	0.0	0.0
37	134.0	499.3	0.69	0.80	3.73	4.48
38	182.0	43.6	0.94	0.07	0.24	-4.65
39	78.0	253.3	0.40	0.41	3.25	4.00
40	29.0	86.7	0.15	0.14	2.99	3.72
41	0.0	0.0	0.0	0.0	0.0	0.0
42	386.2	1452.7	1.99	2.34	3.76	4.52
43	687.3	54.1	3.54	0.09	0.08	-8.13
44	126.3	139.8	0.65	0.23	1.11	0.34
45	52.8	223.9	0.27	0.36	4.24	4.93
46	446.2	1828.0	2.30	2.94	4.10	4.81
47	1206.0	3755.8	6.21	6.05	3.11	3.86
TOTAL	19409.4	62103.7	100.00	100.00	3.20	3.95

TABLE 3 EXPORT VARIABLE (2000 PRICES) SCENARIO A

SECTOR	BASE 1970	PROJ. 2000	%SHARES 1970	%SHARES 2000	RATIO	%GROWTH RATES
1	65.0	209.7	0.33	0.33	3.23	3.98
2	150.8	527.7	0.78	0.83	3.50	4.26
3	701.2	2284.6	3.61	3.59	3.26	4.02
4	177.1	414.6	0.91	0.65	2.34	2.88
5	918.4	2288.1	4.73	3.60	2.49	3.09
6	94.9	0.0	0.49	0.0	0.0	-100.00
7	2170.4	6821.1	11.18	10.73	3.14	3.89
8	184.9	560.1	0.95	0.88	3.03	3.76
9	852.3	2974.7	4.39	4.68	3.49	4.25
10	35.9	61.9	0.18	0.09	1.72	1.78
11	1897.7	10102.2	9.78	15.89	5.32	5.73
12	37.1	179.7	0.19	0.29	4.84	5.40
13	31.0	113.1	0.16	0.18	3.64	4.40
14	278.6	858.9	1.44	1.35	3.08	3.82
15	135.7	558.9	0.70	0.88	4.12	4.83
16	126.0	581.9	0.65	0.92	4.62	5.23
17	28.9	73.6	0.15	0.12	2.55	3.17
18	67.4	380.8	0.35	0.60	5.65	5.94
19	3480.2	9879.7	17.93	15.54	2.84	3.54
20	208.2	326.8	1.07	0.51	1.57	1.51
21	380.7	1237.6	1.96	1.95	3.25	4.01
22	249.8	585.1	1.29	0.92	2.34	2.88
23	667.6	1547.1	3.44	2.43	2.32	2.84
24	439.7	1976.5	2.27	3.11	4.50	5.14
25	143.2	408.6	0.74	0.64	2.85	3.56
26	84.2	230.6	0.43	0.36	2.74	3.42
27	228.5	691.9	1.18	1.09	3.03	3.76
28	589.2	2187.5	3.04	3.44	3.71	4.47
29	37.4	96.4	0.19	0.15	2.58	3.21
30	0.0	0.0	0.0	0.0	0.0	0.0
31	721.9	2182.4	3.72	3.43	3.02	3.76
32	29.3	63.0	0.15	0.10	2.15	2.59
33	868.3	2604.2	4.47	4.10	3.00	3.73
34	0.0	0.0	0.0	0.0	0.0	0.0
35	0.0	0.0	0.0	0.0	0.0	0.0
36	0.0	0.0	0.0	0.0	0.0	0.0
37	134.0	1346.7	0.69	2.12	10.05	8.00
38	182.0	102.3	0.94	0.16	0.56	-1.90
39	78.0	576.2	0.40	0.91	7.38	6.89
40	29.0	211.6	0.15	0.33	7.30	6.85
41	0.0	0.0	0.0	0.0	0.0	0.0
42	386.2	1445.4	1.99	2.27	3.74	4.50
43	687.3	318.4	3.54	0.50	0.46	-2.53
44	126.3	1027.6	0.65	1.62	8.14	7.24
45	52.8	191.9	0.27	0.30	3.63	4.39
46	446.2	1764.8	2.30	2.78	3.96	4.69
47	1206.0	3577.5	6.21	5.63	2.97	3.69
TOTAL	19409.4	63571.4	100.00	100.00	3.28	4.03

TABLE 4 IMPORT VARIABLE (1970 PRICES) SCENARIO A

SECTOR	BASE 1970	PROJ. 2000	%SHARES 1970	%SHARES 2000	RATIO	%GROWTH RATES
1	33.2	112.5	0.19	0.16	3.39	4.15
2	54.0	90.4	0.30	0.13	1.67	1.73
3	46.1	103.6	0.26	0.15	2.25	2.73
4	343.4	890.4	1.92	1.28	2.59	3.23
5	775.8	1946.9	4.33	2.79	2.51	3.11
6	253.5	1056.5	1.42	1.52	4.17	4.87
7	671.5	2546.9	3.75	3.66	3.79	4.54
8	1001.2	5816.5	5.59	8.35	5.81	6.04
9	112.7	346.0	0.63	0.50	3.07	3.81
10	57.5	480.9	0.32	0.69	8.36	7.34
11	212.6	1020.7	1.19	1.46	4.80	5.37
12	281.2	1160.6	1.57	1.67	4.13	4.84
13	180.1	1164.0	1.01	1.67	6.46	6.42
14	558.0	1680.9	3.12	2.41	3.01	3.74
15	20.3	39.9	0.11	0.06	1.97	2.28
16	369.0	2054.5	2.06	2.95	5.57	5.89
17	4.8	8.9	0.03	0.01	1.85	2.08
18	229.5	454.5	1.28	0.65	1.98	2.30
19	3353.8	13311.1	18.72	19.10	3.97	4.70
20	109.5	508.0	0.61	0.73	4.64	5.25
21	427.3	1368.0	2.39	1.96	3.20	3.96
22	677.0	2054.8	3.78	2.95	3.04	3.77
23	2232.8	7502.9	12.47	10.77	3.36	4.12
24	1036.9	6886.8	5.79	9.88	6.64	6.51
25	599.2	2551.7	3.35	3.66	4.26	4.95
26	349.7	2111.7	1.95	3.03	6.04	6.18
27	700.6	2630.7	3.91	3.78	3.75	4.51
28	123.1	416.5	0.69	0.60	3.38	4.15
29	12.4	32.1	0.07	0.05	2.59	3.22
30	0.0	0.0	0.0	0.0	0.0	0.0
31	105.9	335.4	0.59	0.48	3.17	3.92
32	28.7	115.3	0.16	0.17	4.02	4.75
33	0.0	0.0	0.0	0.0	0.0	0.0
34	0.0	0.0	0.0	0.0	0.0	0.0
35	0.0	0.0	0.0	0.0	0.0	0.0
36	391.4	837.0	2.19	1.20	2.14	2.57
37	8.6	28.4	0.05	0.04	3.30	4.06
38	78.5	72.8	0.44	0.10	0.93	-0.25
39	0.0	0.0	0.0	0.0	0.0	0.0
40	0.0	0.0	0.0	0.0	0.0	0.0
41	140.0	261.9	0.78	0.38	1.87	2.11
42	33.0	73.0	0.18	0.10	2.21	2.68
43	529.1	1391.5	2.95	2.00	2.63	3.28
44	5.1	7.2	0.03	0.01	1.40	1.14
45	220.4	336.8	1.23	0.48	1.53	1.42
46	122.5	268.0	0.68	0.38	2.19	2.64
47	1422.0	5597.2	7.94	8.03	3.94	4.67
TOTAL	17911.9	69673.7	100.00	100.00	3.89	4.63

TABLE 5 IMPORT VARIABLE (2000 PRICES) SCENARIO A

SECTOR	BASE 1970	PROJ. 2000	%SHARES 1970	%SHARES 2000	RATIO	%GROWTH RATES
1	33.2	141.1	0.19	0.19	4.25	4.94
2	54.0	109.7	0.30	0.15	2.03	2.39
3	46.1	118.2	0.26	0.16	2.56	3.19
4	343.4	1025.5	1.92	1.36	2.99	3.71
5	775.8	1921.9	4.33	2.56	2.48	3.07
6	253.5	4093.3	1.42	5.45	16.15	9.72
7	671.5	3429.6	3.75	4.56	5.11	5.59
8	1001.2	5079.1	5.59	6.76	5.07	5.56
9	112.7	315.0	0.63	0.42	2.80	3.49
10	57.5	413.9	0.32	0.55	7.20	6.80
11	212.6	993.2	1.19	1.32	4.67	5.27
12	281.2	942.4	1.57	1.25	3.35	4.11
13	180.1	1059.9	1.01	1.41	5.89	6.09
14	558.0	1646.8	3.12	2.19	2.95	3.67
15	20.3	44.6	0.11	0.06	2.20	2.66
16	369.0	1989.6	2.06	2.65	5.39	5.78
17	4.8	11.3	0.03	0.02	2.36	2.90
18	229.5	414.0	1.28	0.55	1.80	1.99
19	3353.8	12338.7	18.72	16.42	3.68	4.44
20	109.5	398.7	0.61	0.53	3.64	4.40
21	427.3	1188.4	2.39	1.58	2.78	3.47
22	677.0	2081.7	3.78	2.77	3.07	3.82
23	2232.8	6381.0	12.47	8.49	2.86	3.56
24	1036.9	6151.6	5.79	8.18	5.93	6.11
25	599.2	2015.6	3.35	2.68	3.36	4.13
26	349.7	1795.4	1.95	2.39	5.13	5.60
27	700.6	2558.4	3.91	3.40	3.65	4.41
28	123.1	388.9	0.69	0.52	3.16	3.91
29	12.4	26.8	0.07	0.04	2.16	2.61
30	0.0	0.0	0.0	0.0	0.0	0.0
31	105.9	314.8	0.59	0.42	2.97	3.70
32	28.7	98.2	0.16	0.13	3.42	4.18
33	0.0	0.0	0.0	0.0	0.0	0.0
34	0.0	0.0	0.0	0.0	0.0	0.0
35	0.0	0.0	0.0	0.0	0.0	0.0
36	391.4	933.2	2.19	1.24	2.38	2.94
37	8.6	76.5	0.05	0.10	8.90	7.56
38	78.5	170.8	0.44	0.23	2.18	2.63
39	0.0	0.0	0.0	0.0	0.0	0.0
40	0.0	0.0	0.0	0.0	0.0	0.0
41	140.0	300.3	0.78	0.40	2.14	2.58
42	33.0	72.7	0.18	0.10	2.20	2.67
43	529.1	8191.6	2.95	10.90	15.48	9.56
44	5.1	52.6	0.03	0.07	10.32	8.09
45	220.4	288.7	1.23	0.38	1.31	0.90
46	122.5	258.7	0.68	0.34	2.11	2.52
47	1422.0	5331.4	7.94	7.09	3.75	4.50
TOTAL	17911.9	75163.9	100.00	100.00	4.20	4.90

TABLE 6 TARIFF REVENUE VARIABLE (1970 PRICES) SCENARIO A

SECTOR	BASE 1970	PROJ. 2000	%SHARES 1970	%SHARES 2000	RATIO	%GROWTH RATES
1	0.8	2.7	0.10	0.07	3.39	4.15
2	0.0	0.0	0.00	0.00	1.67	1.73
3	0.8	1.9	0.10	0.05	2.25	2.73
4	2.4	6.2	0.30	0.17	2.59	3.23
5	52.1	130.7	6.49	3.52	2.51	3.11
6	16.9	70.4	2.11	1.89	4.17	4.87
7	16.1	61.0	2.01	1.64	3.79	4.54
8	163.5	949.6	20.38	25.54	5.81	6.04
9	4.4	13.4	0.54	0.36	3.07	3.81
10	7.5	63.0	0.94	1.70	8.36	7.34
11	10.9	52.4	1.36	1.41	4.80	5.37
12	16.2	66.9	2.02	1.80	4.13	4.84
13	21.8	141.0	2.72	3.79	6.46	6.42
14	30.6	92.1	3.81	2.48	3.01	3.74
15	0.1	0.2	0.01	0.00	1.97	2.28
16	31.7	176.4	3.95	4.74	5.57	5.89
17	0.1	0.2	0.01	0.00	1.85	2.08
18	20.5	40.7	2.56	1.09	1.98	2.30
19	64.8	257.1	8.07	6.91	3.97	4.70
20	8.1	37.7	1.01	1.02	4.64	5.25
21	4.1	13.3	0.52	0.36	3.20	3.96
22	64.3	195.3	8.02	5.25	3.04	3.77
23	100.9	339.1	12.58	9.12	3.36	4.12
24	107.9	716.7	13.45	19.28	6.64	6.51
25	22.2	94.7	2.77	2.55	4.26	4.95
26	31.7	191.6	3.96	5.15	6.04	6.18
27	0.0	0.0	0.0	0.0	0.0	0.0
28	0.0	0.0	0.0	0.0	0.0	0.0
29	0.0	0.0	0.0	0.0	0.0	0.0
30	0.0	0.0	0.0	0.0	0.0	0.0
31	0.0	0.0	0.0	0.0	0.0	0.0
32	0.0	0.0	0.0	0.0	0.0	0.0
33	0.0	0.0	0.0	0.0	0.0	0.0
34	0.0	0.0	0.0	0.0	0.0	0.0
35	0.0	0.0	0.0	0.0	0.0	0.0
36	0.0	0.0	0.0	0.0	0.0	0.0
37	0.0	0.0	0.00	0.00	3.30	4.06
38	0.0	0.0	0.00	0.00	0.93	-0.25
39	0.0	0.0	0.0	0.0	0.0	0.0
40	0.0	0.0	0.0	0.0	0.0	0.0
41	0.0	0.0	0.0	0.0	0.0	0.0
42	0.0	0.0	0.00	0.00	2.21	2.68
43	1.2	3.3	0.16	0.09	2.63	3.28
44	0.0	0.0	0.00	0.00	1.40	1.14
45	0.1	0.1	0.01	0.00	1.53	1.42
46	0.2	0.4	0.02	0.01	2.19	2.64
TOTAL	802.1	3718.1	100.00	100.00	4.64	5.25

TABLE 7 TARIFF REVENUE VARIABLE (2000 PRICES) SCENARIO A

SECTOR	BASE 1970	PROJ. 2000	%SHARES 1970	%SHARES 2000	RATIO	%GROWTH RATES
1	0.8	3.4	0.10	0.10	4.25	4.94
2	0.0	0.0	0.00	0.00	2.03	2.39
3	0.8	2.2	0.10	0.06	2.56	3.19
4	2.4	7.1	0.30	0.20	2.99	3.71
5	52.1	129.0	6.49	3.60	2.48	3.07
6	16.9	272.7	2.11	7.60	16.15	9.72
7	16.1	82.1	2.01	2.29	5.11	5.59
8	163.5	829.3	20.38	23.11	5.07	5.56
9	4.4	12.2	0.54	0.34	2.80	3.49
10	7.5	54.2	0.94	1.51	7.20	6.80
11	10.9	51.0	1.36	1.42	4.67	5.27
12	16.2	54.4	2.02	1.51	3.35	4.11
13	21.8	128.4	2.72	3.58	5.89	6.09
14	30.6	90.3	3.81	2.52	2.95	3.67
15	0.1	0.2	0.01	0.00	2.20	2.66
16	31.7	170.8	3.95	4.76	5.39	5.78
17	0.1	0.2	0.01	0.01	2.36	2.90
18	20.5	37.0	2.56	1.03	1.80	1.99
19	64.8	238.3	8.07	6.64	3.68	4.44
20	8.1	29.6	1.01	0.83	3.64	4.40
21	4.1	11.5	0.52	0.32	2.78	3.47
22	64.3	197.8	8.02	5.51	3.07	3.82
23	100.9	288.4	12.58	8.04	2.86	3.56
24	107.9	640.2	13.45	17.84	5.93	6.11
25	22.2	74.8	2.77	2.08	3.36	4.13
26	31.7	162.9	3.96	4.54	5.13	5.60
27	0.0	0.0	0.0	0.0	0.0	0.0
28	0.0	0.0	0.0	0.0	0.0	0.0
29	0.0	0.0	0.0	0.0	0.0	0.0
30	0.0	0.0	0.0	0.0	0.0	0.0
31	0.0	0.0	0.0	0.0	0.0	0.0
32	0.0	0.0	0.0	0.0	0.0	0.0
33	0.0	0.0	0.0	0.0	0.0	0.0
34	0.0	0.0	0.0	0.0	0.0	0.0
35	0.0	0.0	0.0	0.0	0.0	0.0
36	0.0	0.0	0.0	0.0	0.0	0.0
37	0.0	0.0	0.00	0.00	8.90	7.56
38	0.0	0.0	0.00	0.00	2.18	2.63
39	0.0	0.0	0.0	0.0	0.0	0.0
40	0.0	0.0	0.0	0.0	0.0	0.0
41	0.0	0.0	0.0	0.0	0.0	0.0
42	0.0	0.0	0.00	0.00	2.20	2.67
43	1.2	19.3	0.16	0.54	15.48	9.56
44	0.0	0.1	0.00	0.00	10.32	8.09
45	0.1	0.1	0.01	0.00	1.31	0.90
46	0.2	0.4	0.02	0.01	2.11	2.52
TOTAL	802.1	3588.1	100.00	100.00	4.47	5.12

TABLE 8 TOTAL CAPITAL FORMATION BY SECTOR OF ORIGIN SCENARIO A

SECTOR	BASE 1970	PROJ. 2000	%SHARES 1970	%SHARES 2000	RATIO	%GROWTH RATES
1	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0	0.0
8	4.3	13.3	0.04	0.04	3.09	3.83
9	13.6	37.1	0.13	0.11	2.73	3.40
10	153.5	506.3	1.41	1.51	3.30	4.06
11	0.0	0.0	0.0	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0
13	8.2	18.6	0.08	0.06	2.27	2.77
14	0.0	0.0	0.0	0.0	0.0	0.0
15	0.0	0.0	0.0	0.0	0.0	0.0
16	0.0	0.0	0.0	0.0	0.0	0.0
17	0.0	0.0	0.0	0.0	0.0	0.0
18	13.0	25.8	0.12	0.08	1.99	2.31
19	631.6	2263.2	5.81	6.73	3.58	4.35
20	248.3	662.5	2.28	1.97	2.67	3.33
21	208.8	669.0	1.92	1.99	3.20	3.96
22	156.0	470.0	1.43	1.40	3.01	3.75
23	2046.0	5931.3	18.81	17.64	2.90	3.61
24	860.0	3017.3	7.91	8.97	3.51	4.27
25	191.2	625.6	1.76	1.86	3.27	4.03
26	21.5	94.3	0.20	0.28	4.39	5.05
27	147.5	594.6	1.36	1.77	4.03	4.76
28	0.0	0.0	0.0	0.0	0.0	0.0
29	0.0	0.0	0.0	0.0	0.0	0.0
30	5181.2	16350.4	47.64	48.62	3.16	3.91
31	858.2	2048.1	7.89	6.09	2.39	2.94
32	0.0	0.0	0.0	0.0	0.0	0.0
33	132.3	299.4	1.22	0.89	2.26	2.76
34	0.0	0.0	0.0	0.0	0.0	0.0
35	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	10875.2	33626.9	100.00	100.00	3.09	3.83

TABLE 9 NEW CAPITAL FORMATION SCENARIO A

SECTOR	BASE 1970	PROJ. 2000	%SHARES 1970	%SHARES 2000	RATIO	%GROWTH RATES
1	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0	0.0
8	1.0	2.1	0.02	0.01	2.16	2.60
9	3.7	13.5	0.07	0.08	3.64	4.40
10	51.2	185.4	0.90	1.16	3.63	4.39
11	0.0	0.0	0.0	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0
13	2.0	0.2	0.04	0.00	0.10	-7.25
14	0.0	0.0	0.0	0.0	0.0	0.0
15	0.0	0.0	0.0	0.0	0.0	0.0
16	0.0	0.0	0.0	0.0	0.0	0.0
17	0.0	0.0	0.0	0.0	0.0	0.0
18	3.9	4.5	0.07	0.03	1.14	0.44
19	78.7	640.4	1.39	4.01	8.14	7.24
20	120.1	305.8	2.12	1.92	2.55	3.16
21	42.4	226.1	0.75	1.42	5.33	5.74
22	58.5	179.1	1.03	1.12	3.06	3.80
23	885.4	2250.1	15.64	14.10	2.54	3.16
24	456.6	1325.0	8.07	8.30	2.90	3.62
25	67.0	220.5	1.18	1.38	3.29	4.05
26	3.3	28.0	0.06	0.18	8.56	7.42
27	49.6	107.4	0.88	0.67	2.17	2.61
28	0.0	0.0	0.0	0.0	0.0	0.0
29	0.0	0.0	0.0	0.0	0.0	0.0
30	3373.4	9759.6	59.60	61.16	2.89	3.60
31	399.1	622.8	7.05	3.90	1.56	1.49
32	0.0	0.0	0.0	0.0	0.0	0.0
33	64.3	86.3	1.14	0.54	1.34	0.99
34	0.0	0.0	0.0	0.0	0.0	0.0
35	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	5660.2	15956.9	100.00	100.00	2.82	3.52

TABLE 10 REPLACEMENT CAPITAL FORMATION SCENARIO A

SECTOR	BASE 1970	PROJ. 2000	%SHARES 1970	%SHARES 2000	RATIO	%GROWTH RATES
1	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0	0.0
8	3.3	11.2	0.06	0.06	3.35	4.12
9	9.9	23.6	0.19	0.13	2.39	2.95
10	102.3	320.8	1.96	1.82	3.13	3.88
11	0.0	0.0	0.0	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0
13	6.2	18.4	0.12	0.10	2.98	3.71
14	0.0	0.0	0.0	0.0	0.0	0.0
15	0.0	0.0	0.0	0.0	0.0	0.0
16	0.0	0.0	0.0	0.0	0.0	0.0
17	0.0	0.0	0.0	0.0	0.0	0.0
18	9.1	21.4	0.17	0.12	2.35	2.89
19	552.9	1622.7	10.60	9.18	2.94	3.65
20	128.2	356.8	2.46	2.02	2.78	3.47
21	166.4	442.9	3.19	2.51	2.66	3.32
22	97.5	290.9	1.87	1.65	2.98	3.71
23	1160.6	3681.2	22.25	20.83	3.17	3.92
24	403.4	1692.3	7.74	9.58	4.19	4.90
25	124.2	405.1	2.38	2.29	3.26	4.02
26	18.2	66.3	0.35	0.38	3.64	4.40
27	97.9	487.2	1.88	2.76	4.98	5.49
28	0.0	0.0	0.0	0.0	0.0	0.0
29	0.0	0.0	0.0	0.0	0.0	0.0
30	1807.8	6590.8	34.66	37.30	3.65	4.41
31	459.1	1425.3	8.80	8.07	3.10	3.85
32	0.0	0.0	0.0	0.0	0.0	0.0
33	68.0	213.1	1.30	1.21	3.13	3.88
34	0.0	0.0	0.0	0.0	0.0	0.0
35	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	5215.0	17670.0	100.00	100.00	3.39	4.15

TABLE 11 TOTAL CAPITAL STOCK BY SECTOR OF ORIGIN SCENARIO A

SECTOR	BASE 1970	PROJ. 2000	%SHARES 1970	%SHARES 2000	RATIO	%GROWTH RATES
1	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0	0.0
8	23.4	78.4	0.02	0.02	3.35	4.12
9	167.9	401.2	0.12	0.08	2.39	2.95
10	1739.9	5453.7	1.22	1.11	3.13	3.88
11	0.0	0.0	0.0	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0
13	18.5	55.2	0.01	0.01	2.98	3.71
14	0.0	0.0	0.0	0.0	0.0	0.0
15	0.0	0.0	0.0	0.0	0.0	0.0
16	0.0	0.0	0.0	0.0	0.0	0.0
17	0.0	0.0	0.0	0.0	0.0	0.0
18	90.8	213.5	0.06	0.04	2.35	2.89
19	5415.8	15825.9	3.79	3.23	2.92	3.64
20	3367.4	9175.3	2.35	1.87	2.72	3.40
21	1997.0	5314.9	1.40	1.09	2.66	3.32
22	1754.5	5236.4	1.23	1.07	2.98	3.71
23	22631.8	72151.7	15.83	14.73	3.19	3.94
24	8735.0	36722.8	6.11	7.50	4.20	4.90
25	1863.3	6076.3	1.30	1.24	3.26	4.02
26	218.7	795.9	0.15	0.16	3.64	4.40
27	979.1	4872.1	0.68	0.99	4.98	5.49
28	0.0	0.0	0.0	0.0	0.0	0.0
29	0.0	0.0	0.0	0.0	0.0	0.0
30	85217.9	299598.7	59.59	61.18	3.52	4.28
31	7705.2	24246.5	5.39	4.95	3.15	3.90
32	0.0	0.0	0.0	0.0	0.0	0.0
33	1079.4	3466.3	0.75	0.71	3.21	3.97
34	0.0	0.0	0.0	0.0	0.0	0.0
35	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	143005.8	489684.9	100.00	100.00	3.42	4.19

TABLE 12 TOTAL CAPITAL STOCK BY SECTOR OF DESTINATION SCENARIO A

SECTOR	BASE 1970	PROJ. 2000	%SHARES 1970	%SHARES 2000	RATIO	%GROWTH RATES
1	7278.9	19380.3	5.09	3.96	2.66	3.32
2	749.5	1950.8	0.52	0.40	2.60	3.24
3	3025.1	9656.2	2.12	1.97	3.19	3.94
4	2538.2	8098.3	1.77	1.65	3.19	3.94
5	5304.0	11932.2	3.71	2.44	2.25	2.74
6	2487.7	6236.4	1.74	1.27	2.51	3.11
7	5015.1	11785.8	3.51	2.41	2.35	2.89
8	2054.2	4938.7	1.44	1.01	2.40	2.97
9	1478.1	4741.7	1.03	0.97	3.21	3.96
10	236.1	653.7	0.17	0.13	2.77	3.45
11	6064.9	28210.0	4.24	5.76	4.65	5.26
12	1111.4	2888.2	0.78	0.59	2.60	3.23
13	363.3	680.9	0.25	0.14	1.87	2.12
14	2731.9	6663.3	1.91	1.36	2.44	3.02
15	269.0	927.3	0.19	0.19	3.45	4.21
16	720.9	2168.2	0.50	0.44	3.01	3.74
17	1696.6	4855.2	1.19	0.99	2.86	3.57
18	645.0	1997.5	0.45	0.41	3.10	3.84
19	1990.1	5526.1	1.39	1.13	2.78	3.46
20	239.3	667.2	0.17	0.14	2.79	3.48
21	353.5	1014.8	0.25	0.21	2.87	3.58
22	1681.4	4340.7	1.18	0.89	2.58	3.21
23	803.0	1917.2	0.56	0.39	2.39	2.94
24	1174.9	2880.8	0.82	0.59	2.45	3.03
25	152.9	499.0	0.11	0.10	3.26	4.02
26	284.6	679.7	0.20	0.14	2.39	2.94
27	14527.1	57160.9	10.16	11.67	3.93	4.67
28	25693.0	64347.7	17.97	13.14	2.50	3.11
29	20036.2	84517.4	14.01	17.26	4.22	4.92
30	2409.8	7165.2	1.69	1.46	2.97	3.70
31	9394.1	23708.2	6.57	4.84	2.52	3.13
32	9417.0	43330.2	6.59	8.85	4.60	5.22
33	0.0	0.0	0.0	0.0	0.0	0.0
34	0.0	0.0	0.0	0.0	0.0	0.0
35	0.0	0.0	0.0	0.0	0.0	0.0
36	0.0	0.0	0.0	0.0	0.0	0.0
37	804.8	6185.4	0.56	1.26	7.69	7.03
38	857.3	3134.9	0.60	0.64	3.66	4.42
39	411.8	2111.7	0.29	0.43	5.13	5.60
40	127.2	697.6	0.09	0.14	5.49	5.84
41	0.0	0.0	0.0	0.0	0.0	0.0
42	1477.8	5190.4	1.03	1.06	3.51	4.28
43	4391.3	19419.2	3.07	3.97	4.42	5.08
44	1015.2	19672.8	0.71	4.02	19.38	10.39
45	99.7	799.7	0.07	0.16	8.02	7.19
46	1894.6	6953.6	1.32	1.42	3.67	4.43
TOTAL	143006.5	489684.9	100.00	100.00	3.42	4.19

IV LESS CONSTRAINED GROWTH FOR DEVELOPING REGIONS SCENARIO

This alternative scenario requires only brief descriptions. The construction of the sector analysis tables is completely analogous to that explained in Chapter III.

IV.1 Canadian and U.N. Model Assumptions of Scenario S

The scenario of this chapter will be referred to as scenario S. In the world model scenario S, the treatment of the developed regions and the resource-rich developing regions (Middle East, tropical Africa, and part of Latin America) is identical to that of the previous scenario A. However, the balance-of-payments constraints on growth for resource-poor developing regions (Asia, arid Africa, resource-poor Latin America) are partly relaxed through increased foreign aid and capital flows. The GDP levels of these regions are raised by 20 per cent in the year 2000 as compared to scenario A. Since all regions are to some extent interdependent, at least through international trade, the effect of raising the GDP levels has important impacts on other regions, and particularly NAR exports. This will be discussed in the next section. But it does turn out that NAR gross domestic product in 2000 is virtually unaffected. Thus the GDP growth rate for NAR is the same in both scenarios A and S. Population growth is also the same in the two scenarios.

In order to construct a Canadian scenario, linked to the world model scenario S, which is sufficiently different from the scenario discussed in Chapter III, it was decided to choose

a Canadian population growth rate equal to 0.9 per cent for this case (in scenario A, the population growth rate is 1.1 per cent). The smaller population growth essentially represents a low level net immigration rate[1] to the year 2000. Since the Canadian GDP per capita growth rate "must" again be constrained to an average annual 2.5 per cent, this implies a Canadian GDP growth rate of 3.4 per cent in scenario S (compared to 3.6 per cent in A).

IV.2 Discussion of Results for Scenario S

This chapter contains 10 tables, tables numbers 13 to 22, paralleling the tables of the previous chapter. Two tables contained in Chapter III, namely the disaggregation of total business capital formation into business expansion and replacement investment, are not shown in this chapter.

It is instructive to compare some of the sectoral results of scenario S with the corresponding results of scenario A. Generally speaking, the lower GDP growth rate, reflecting lower population growth, has similar impacts on most sectoral growth rate variables, but there are some important exceptions. For example, the growth rate of the Canadian gross output variable for grains (sector 3) is virtually the same in the two scenarios (compare Tables 1 and 13). This comes from a balancing of the positive impact of greater grain exports in scenario S (compare Tables 2 and 14) with the negative impact of lower Canadian population growth and lower domestic demand for grains. One

---

1 See again Statistics Canada [33]. The net immigration rate equals about 60,000 per annum. This makes Canadian population growth equal to the NAR population growth as projected in the world model.

might state there is a "trade-off" with unitary elasticity between increased foreign aid, resulting in higher GDP levels in resource-poor developing regions and increased demand for grain imports (on the one hand); and a decreased net immigration rate, perhaps for immigrants coming from developing regions (on the other hand); at least with respect to demand for Canadian grains production. The gross production growth rates for such sectors as fertilizers and aircraft are actually larger under scenario S as compared to A, because of important export stimulation, presumably to developing regions. Other nonresource sectors such as paper products and motor vehicles remain about the same, with increased exports balanced by lower domestic demand. A more aggregate view of Canadian export opportunities in scenario S is given in Chapter VII.

Recalling the methodology explained in Chapter II, most manufacturing import coefficients are marginally lower in scenario S as compared to A (due to the smaller GDP target in year 2000). Thus, e.g., textile imports and electrical products imports are especially diminished (compare Tables 4 and 16) as are almost all other nonresource import requirements. Further discussion on the impact of alternative scenarios on Canadian import coefficients can be found in the next chapter.

Moving from scenario A to scenario S has very little effect on Canadian resource production. But the Canadian net resource trade is affected for some sectors. For example, Canadian net exports of natural gas increase significantly, due to lower domestic demand requirements combined with a slightly higher

production growth rate. Similarly, the Canadian trading position with respect to coal continues to improve. By the year 2000, under scenario S, Canadian net imports of coal equal only 79 million dollars compared to 167 million in 1970. Since coal production in the year 2000 equals 725 million, we could state that Canada attains effective self-sufficiency in coal for this scenario. Finally, the Canadian future situation with respect to nickel is not promising under either scenario. The production growth rate in both cases is very low, 1.28 per cent, and Canada switches from being an important net exporter of nickel in 1970 to being a small net importer in the year 2000, although with relative self-sufficiency.

TABLE 13 OUTPUT VARIABLE SCENARIO S

SECTOR	BASE 1970	PROJ. 2000	%SHARES 1970	%SHARES 2000	RATIO	%GROWTH RATES
1	2544.3	5355.6	1.86	1.38	2.10	2.51
2	262.0	564.7	0.19	0.15	2.16	2.59
3	1057.4	2811.2	0.77	0.73	2.66	3.31
4	2509.8	6513.2	1.83	1.68	2.60	3.23
5	9516.4	20289.9	6.95	5.23	2.13	2.56
6	1908.0	4590.7	1.39	1.18	2.41	2.97
7	5129.6	12062.3	3.74	3.11	2.35	2.89
8	3809.3	8835.4	2.78	2.28	2.32	2.84
9	1987.6	6978.6	1.45	1.80	3.51	4.28
10	699.4	2032.4	0.51	0.52	2.91	3.62
11	4064.5	18940.8	2.97	4.89	4.66	5.26
12	1527.3	3839.2	1.11	0.99	2.51	3.12
13	549.1	1033.1	0.40	0.27	1.88	2.13
14	1456.1	3531.8	1.06	0.91	2.43	3.00
15	188.7	678.9	0.14	0.18	3.60	4.36
16	1518.1	4432.9	1.11	1.14	2.92	3.64
17	638.6	1919.6	0.47	0.50	3.01	3.74
18	642.9	2159.1	0.47	0.56	3.36	4.12
19	4644.3	14591.8	3.39	3.76	3.14	3.89
20	735.7	2197.6	0.54	0.57	2.99	3.72
21	496.9	1650.6	0.36	0.43	3.32	4.08
22	3201.1	8861.5	2.34	2.29	2.77	3.45
23	1966.7	5215.1	1.44	1.35	2.65	3.30
24	2787.9	7540.9	2.03	1.95	2.70	3.37
25	427.8	1393.8	0.31	0.36	3.26	4.02
26	685.1	1606.3	0.50	0.41	2.34	2.88
27	27400.7	75726.9	20.00	19.54	2.76	3.45
28	6774.6	20704.2	4.94	5.34	3.06	3.79
29	2198.7	7688.5	1.60	1.98	3.50	4.26
30	13698.7	38422.3	10.00	9.91	2.80	3.50
31	12719.7	38093.7	9.28	9.83	2.99	3.72
32	2358.6	8928.7	1.72	2.30	3.79	4.54
33	3061.9	9223.7	2.23	2.38	3.01	3.74
34	6140.2	19127.8	4.48	4.93	3.12	3.86
35	3120.4	8918.9	2.28	2.30	2.86	3.56
36	0.0	0.0	0.0	0.0	0.0	0.0
37	611.3	1708.2	0.45	0.44	2.79	3.48
38	651.2	955.1	0.48	0.25	1.47	1.28
39	312.8	696.5	0.23	0.18	2.23	2.70
40	96.6	212.9	0.07	0.05	2.20	2.67
41	0.0	0.0	0.0	0.0	0.0	0.0
42	510.4	1800.3	0.37	0.46	3.53	4.29
43	1270.9	1592.1	0.93	0.41	1.25	0.75
44	293.8	692.8	0.21	0.18	2.36	2.90
45	89.3	725.0	0.07	0.19	8.12	7.23
46	760.0	2802.5	0.55	0.72	3.69	4.45
TOTAL	137024.4	387647.1	100.00	100.00	2.83	3.53

TABLE 14 EXPORT VARIABLE (1970 PRICES) SCENARIO S

SECTOR	BASE 1970	PROJ. 2000	%SHARES 1970	%SHARES 2000	RATIO	%GROWTH RATES
1	65.0	168.9	0.33	0.26	2.60	3.23
2	150.8	438.8	0.78	0.69	2.91	3.62
3	701.2	2037.7	3.61	3.19	2.91	3.62
4	177.1	371.9	0.91	0.58	2.10	2.50
5	918.4	2361.7	4.73	3.70	2.57	3.20
6	94.9	0.0	0.49	0.0	0.0	-100.00
7	2170.4	5171.9	11.18	8.10	2.38	2.94
8	184.9	657.2	0.95	1.03	3.55	4.32
9	852.3	3299.9	4.39	5.17	3.87	4.62
10	35.9	72.6	0.18	0.12	2.02	2.37
11	1897.7	10660.9	9.78	16.69	5.62	5.92
12	37.1	232.5	0.19	0.36	6.26	6.31
13	31.0	125.4	0.16	0.20	4.04	4.76
14	278.6	909.5	1.44	1.42	3.26	4.02
15	135.7	528.6	0.70	0.83	3.89	4.64
16	126.0	620.3	0.65	0.97	4.92	5.46
17	28.9	58.4	0.15	0.09	2.02	2.37
18	67.4	431.6	0.35	0.68	6.40	6.38
19	3480.2	10963.0	17.93	17.16	3.15	3.90
20	208.2	420.6	1.07	0.66	2.02	2.37
21	380.7	1486.1	1.96	2.33	3.90	4.64
22	249.8	593.2	1.29	0.93	2.37	2.93
23	667.6	1910.9	3.44	2.99	2.86	3.57
24	439.7	2297.9	2.27	3.60	5.23	5.67
25	143.2	541.1	0.74	0.85	3.78	4.53
26	84.2	280.9	0.43	0.44	3.34	4.10
27	228.5	731.1	1.18	1.14	3.20	3.95
28	589.2	2423.6	3.04	3.79	4.11	4.83
29	37.4	118.6	0.19	0.19	3.17	3.93
30	0.0	0.0	0.0	0.0	0.0	0.0
31	721.9	2395.6	3.72	3.75	3.32	4.08
32	29.3	76.1	0.15	0.12	2.60	3.23
33	868.3	2873.7	4.47	4.50	3.31	4.07
34	0.0	0.0	0.0	0.0	0.0	0.0
35	0.0	0.0	0.0	0.0	0.0	0.0
36	0.0	0.0	0.0	0.0	0.0	0.0
37	134.0	531.5	0.69	0.83	3.97	4.70
38	182.0	47.9	0.94	0.08	0.26	-4.35
39	78.0	308.7	0.40	0.48	3.96	4.69
40	29.0	96.0	0.15	0.15	3.31	4.07
41	0.0	0.0	0.0	0.0	0.0	0.0
42	386.2	1460.9	1.99	2.29	3.78	4.53
43	687.3	46.0	3.54	0.07	0.07	-8.62
44	126.3	164.2	0.65	0.26	1.30	0.88
45	52.8	247.5	0.27	0.39	4.68	5.28
46	446.2	1865.4	2.30	2.92	4.18	4.88
47	1206.0	3859.0	6.21	6.04	3.20	3.95
TOTAL	19409.4	63887.4	100.00	100.00	3.29	4.05

TABLE 15 EXPORT VARIABLE (2000 PRICES) SCENARIO S

SECTOR	BASE 1970	PROJ. 2000	%SHARES 1970	%SHARES 2000	RATIO	%GROWTH RATES
1	65.0	211.9	0.33	0.32	3.26	4.02
2	150.8	532.7	0.78	0.81	3.53	4.30
3	701.2	2326.4	3.61	3.55	3.32	4.08
4	177.1	428.3	0.91	0.65	2.42	2.99
5	918.4	2331.3	4.73	3.56	2.54	3.15
6	94.9	0.0	0.49	0.0	0.0	-100.00
7	2170.4	6964.2	11.18	10.62	3.21	3.96
8	184.9	573.9	0.95	0.88	3.10	3.85
9	852.3	3004.4	4.39	4.58	3.52	4.29
10	35.9	62.5	0.18	0.10	1.74	1.89
11	1897.7	10373.9	9.78	15.82	5.47	5.83
12	37.1	187.0	0.19	0.28	5.04	5.52
13	31.0	114.2	0.16	0.17	3.68	4.44
14	278.6	891.0	1.44	1.36	3.20	3.95
15	135.7	590.8	0.70	0.90	4.35	5.02
16	126.0	600.7	0.65	0.92	4.77	5.34
17	28.9	74.4	0.15	0.11	2.58	3.20
18	67.4	393.1	0.35	0.60	5.83	6.05
19	3480.2	10162.1	17.93	15.50	2.92	3.64
20	208.2	330.1	1.07	0.50	1.59	1.55
21	380.7	1291.0	1.96	1.97	3.39	4.15
22	249.8	601.0	1.29	0.92	2.41	2.97
23	667.6	1625.2	3.44	2.48	2.43	3.01
24	439.7	2052.6	2.27	3.13	4.67	5.27
25	143.2	427.4	0.74	0.65	2.98	3.71
26	84.2	238.8	0.43	0.36	2.84	3.54
27	228.5	711.0	1.18	1.08	3.11	3.86
28	589.2	2262.6	3.04	3.45	3.84	4.59
29	37.4	99.1	0.19	0.15	2.65	3.30
30	0.0	0.0	0.0	0.0	0.0	0.0
31	721.9	2248.0	3.72	3.43	3.11	3.86
32	29.3	64.8	0.15	0.10	2.21	2.68
33	868.3	2682.7	4.47	4.09	3.09	3.83
34	0.0	0.0	0.0	0.0	0.0	0.0
35	0.0	0.0	0.0	0.0	0.0	0.0
36	0.0	0.0	0.0	0.0	0.0	0.0
37	134.0	1433.7	0.69	2.19	10.70	8.22
38	182.0	112.4	0.94	0.17	0.62	-1.60
39	78.0	702.1	0.40	1.07	9.00	7.60
40	29.0	234.2	0.15	0.36	8.08	7.21
41	0.0	0.0	0.0	0.0	0.0	0.0
42	386.2	1453.6	1.99	2.22	3.76	4.52
43	687.3	270.9	3.54	0.41	0.39	-3.06
44	126.3	1206.6	0.65	1.84	9.55	7.81
45	52.8	212.1	0.27	0.32	4.01	4.74
46	446.2	1801.0	2.30	2.75	4.04	4.76
47	1206.0	3675.8	6.21	5.61	3.05	3.78
TOTAL	19409.4	65559.5	100.00	100.00	3.38	4.14

TABLE 16 IMPORT VARIABLE (1970 PRICES) SCENARIO S

SECTOR	BASE 1970	PROJ. 2000	%SHARES 1970	%SHARES 2000	RATIO	%GROWTH RATES
1	33.2	104.7	0.19	0.16	3.15	3.90
2	54.0	85.2	0.30	0.13	1.58	1.53
3	46.1	98.7	0.26	0.15	2.14	2.57
4	343.4	866.2	1.92	1.31	2.52	3.13
5	775.8	1819.6	4.33	2.75	2.35	2.88
6	253.5	994.8	1.42	1.50	3.92	4.66
7	671.5	2472.3	3.75	3.73	3.68	4.44
8	1001.2	5378.4	5.59	8.12	5.37	5.76
9	112.7	333.9	0.63	0.50	2.96	3.69
10	57.5	437.1	0.32	0.66	7.60	7.00
11	212.6	984.3	1.19	1.49	4.63	5.24
12	281.2	1093.7	1.57	1.65	3.89	4.63
13	180.1	1090.7	1.01	1.65	6.06	6.19
14	558.0	1628.5	3.12	2.46	2.92	3.63
15	20.3	40.0	0.11	0.06	1.97	2.28
16	369.0	1919.7	2.06	2.90	5.20	5.65
17	4.8	8.4	0.03	0.01	1.75	1.88
18	229.5	445.1	1.28	0.67	1.94	2.23
19	3353.8	12820.4	18.72	19.36	3.82	4.57
20	109.5	479.3	0.61	0.72	4.38	5.04
21	427.3	1337.5	2.39	2.02	3.13	3.88
22	677.0	1971.6	3.78	2.98	2.91	3.63
23	2232.8	7240.8	12.47	10.93	3.24	4.00
24	1036.9	6383.7	5.79	9.64	6.16	6.25
25	599.2	2440.2	3.35	3.69	4.07	4.79
26	349.7	1957.7	1.95	2.96	5.60	5.91
27	700.6	2465.6	3.91	3.72	3.52	4.28
28	123.1	403.6	0.69	0.61	3.28	4.04
29	12.4	30.6	0.07	0.05	2.47	3.06
30	0.0	0.0	0.0	0.0	0.0	0.0
31	105.9	316.8	0.59	0.48	2.99	3.72
32	28.7	109.1	0.16	0.16	3.80	4.55
33	0.0	0.0	0.0	0.0	0.0	0.0
34	0.0	0.0	0.0	0.0	0.0	0.0
35	0.0	0.0	0.0	0.0	0.0	0.0
36	391.4	796.1	2.19	1.20	2.03	2.39
37	8.6	28.3	0.05	0.04	3.29	4.05
38	78.5	72.7	0.44	0.11	0.93	-0.26
39	0.0	0.0	0.0	0.0	0.0	0.0
40	0.0	0.0	0.0	0.0	0.0	0.0
41	140.0	261.3	0.78	0.39	1.87	2.10
42	33.0	72.9	0.18	0.11	2.21	2.68
43	529.1	1265.0	2.95	1.91	2.39	2.95
44	5.1	6.9	0.03	0.01	1.34	0.99
45	220.4	326.7	1.23	0.49	1.48	1.32
46	122.5	261.2	0.68	0.39	2.13	2.56
47	1422.0	5369.0	7.94	8.11	3.78	4.53
TOTAL	17911.9	66218.2	100.00	100.00	3.70	4.45

TABLE 17 IMPORT VARIABLE (2000 PRICES) SCENARIO S

SECTOR	BASE 1970	PROJ. 2000	%SHARES 1970	%SHARES 2000	RATIO	%GROWTH RATES
1	33.2	131.3	0.19	0.18	3.96	4.69
2	54.0	103.4	0.30	0.15	1.91	2.19
3	46.1	112.7	0.26	0.16	2.44	3.02
4	343.4	997.6	1.92	1.40	2.91	3.62
5	775.8	1796.2	4.33	2.52	2.32	2.84
6	253.5	3854.4	1.42	5.42	15.20	9.50
7	671.5	3329.1	3.75	4.68	4.96	5.48
8	1001.2	4696.6	5.59	6.60	4.69	5.29
9	112.7	304.0	0.63	0.43	2.70	3.36
10	57.5	376.2	0.32	0.53	6.54	6.46
11	212.6	957.8	1.19	1.35	4.51	5.15
12	281.2	888.0	1.57	1.25	3.16	3.91
13	180.1	993.1	1.01	1.40	5.51	5.86
14	558.0	1595.4	3.12	2.24	2.86	3.56
15	20.3	44.7	0.11	0.06	2.20	2.66
16	369.0	1859.0	2.06	2.61	5.04	5.54
17	4.8	10.7	0.03	0.02	2.23	2.71
18	229.5	405.4	1.28	0.57	1.77	1.91
19	3353.8	11883.9	18.72	16.70	3.54	4.31
20	109.5	376.1	0.61	0.53	3.43	4.20
21	427.3	1161.9	2.39	1.63	2.72	3.39
22	677.0	1997.4	3.78	2.81	2.95	3.67
23	2232.8	6158.1	12.47	8.65	2.76	3.44
24	1036.9	5702.2	5.79	8.01	5.50	5.85
25	599.2	1927.5	3.35	2.71	3.22	3.97
26	349.7	1664.5	1.95	2.34	4.76	5.34
27	700.6	2397.8	3.91	3.37	3.42	4.19
28	123.1	376.8	0.69	0.53	3.06	3.80
29	12.4	25.6	0.07	0.04	2.06	2.44
30	0.0	0.0	0.0	0.0	0.0	0.0
31	105.9	297.3	0.59	0.42	2.81	3.50
32	28.7	92.8	0.16	0.13	3.23	3.99
33	0.0	0.0	0.0	0.0	0.0	0.0
34	0.0	0.0	0.0	0.0	0.0	0.0
35	0.0	0.0	0.0	0.0	0.0	0.0
36	391.4	887.6	2.19	1.25	2.27	2.77
37	8.6	76.4	0.05	0.11	8.88	7.55
38	78.5	170.5	0.44	0.24	2.17	2.62
39	0.0	0.0	0.0	0.0	0.0	0.0
40	0.0	0.0	0.0	0.0	0.0	0.0
41	140.0	299.6	0.78	0.42	2.14	2.57
42	33.0	72.5	0.18	0.10	2.20	2.66
43	529.1	7446.6	2.95	10.46	14.07	9.21
44	5.1	50.4	0.03	0.07	9.88	7.93
45	220.4	280.0	1.23	0.39	1.27	0.80
46	122.5	252.2	0.68	0.35	2.06	2.44
47	1422.0	5114.1	7.94	7.19	3.60	4.36
TOTAL	17911.9	71167.5	100.00	100.00	3.97	4.71

TABLE 18 TARIFF REVENUE VARIABLE (1970 PRICES) SCENARIO S

SECTOR	BASE 1970	PROJ. 2000	%SHARES 1970	%SHARES 2000	RATIO	%GROWTH RATES
1	0.8	2.5	0.10	0.07	3.15	3.90
2	0.0	0.0	0.00	0.00	1.58	1.53
3	0.8	1.8	0.10	0.05	2.14	2.57
4	2.4	6.0	0.30	0.17	2.52	3.13
5	52.1	122.1	6.49	3.50	2.35	2.88
6	16.9	66.3	2.11	1.90	3.92	4.66
7	16.1	59.2	2.01	1.70	3.68	4.44
8	163.5	878.1	20.38	25.14	5.37	5.76
9	4.4	12.9	0.54	0.37	2.96	3.69
10	7.5	57.3	0.94	1.64	7.60	7.00
11	10.9	50.6	1.36	1.45	4.63	5.24
12	16.2	63.1	2.02	1.81	3.89	4.63
13	21.8	132.1	2.72	3.78	6.06	6.19
14	30.6	89.3	3.81	2.56	2.92	3.63
15	0.1	0.2	0.01	0.00	1.97	2.28
16	31.7	164.8	3.95	4.72	5.20	5.65
17	0.1	0.2	0.01	0.00	1.75	1.88
18	20.5	39.8	2.56	1.14	1.94	2.23
19	64.8	247.6	8.07	7.09	3.82	4.57
20	8.1	35.6	1.01	1.02	4.38	5.04
21	4.1	13.0	0.52	0.37	3.13	3.88
22	64.3	187.4	8.02	5.36	2.91	3.63
23	100.9	327.3	12.58	9.37	3.24	4.00
24	107.9	664.3	13.45	19.02	6.16	6.25
25	22.2	90.5	2.77	2.59	4.07	4.79
26	31.7	177.6	3.96	5.09	5.60	5.91
27	0.0	0.0	0.0	0.0	0.0	0.0
28	0.0	0.0	0.0	0.0	0.0	0.0
29	0.0	0.0	0.0	0.0	0.0	0.0
30	0.0	0.0	0.0	0.0	0.0	0.0
31	0.0	0.0	0.0	0.0	0.0	0.0
32	0.0	0.0	0.0	0.0	0.0	0.0
33	0.0	0.0	0.0	0.0	0.0	0.0
34	0.0	0.0	0.0	0.0	0.0	0.0
35	0.0	0.0	0.0	0.0	0.0	0.0
36	0.0	0.0	0.0	0.0	0.0	0.0
37	0.0	0.0	0.00	0.00	3.29	4.05
38	0.0	0.0	0.00	0.00	0.93	-0.26
39	0.0	0.0	0.0	0.0	0.0	0.0
40	0.0	0.0	0.0	0.0	0.0	0.0
41	0.0	0.0	0.0	0.0	0.0	0.0
42	0.0	0.0	0.00	0.00	2.21	2.68
43	1.2	3.0	0.16	0.09	2.39	2.95
44	0.0	0.0	0.00	0.00	1.34	0.99
45	0.1	0.1	0.01	0.00	1.48	1.32
46	0.2	0.4	0.02	0.01	2.13	2.56
TOTAL	802.1	3493.1	100.00	100.00	4.36	5.03

TABLE 19 TARIFF REVENUE VARIABLE (2000 PRICES) SCENARIO S

SECTOR	BASE 1970	PROJ. 2000	%SHARES 1970	%SHARES 2000	RATIO	%GROWTH RATES
1	0.8	3.2	0.10	0.09	3.96	4.69
2	0.0	0.0	0.00	0.00	1.91	2.19
3	0.8	2.1	0.10	0.06	2.44	3.02
4	2.4	6.9	0.30	0.20	2.91	3.62
5	52.1	120.6	6.49	3.58	2.32	2.84
6	16.9	256.8	2.11	7.61	15.20	9.50
7	16.1	79.7	2.01	2.36	4.96	5.48
8	163.5	766.8	20.38	22.74	4.69	5.29
9	4.4	11.8	0.54	0.35	2.70	3.36
10	7.5	49.3	0.94	1.46	6.54	6.46
11	10.9	49.2	1.36	1.46	4.51	5.15
12	16.2	51.2	2.02	1.52	3.16	3.91
13	21.8	120.3	2.72	3.57	5.51	5.86
14	30.6	87.5	3.81	2.59	2.86	3.56
15	0.1	0.2	0.01	0.01	2.20	2.66
16	31.7	159.6	3.95	4.73	5.04	5.54
17	0.1	0.2	0.01	0.01	2.23	2.71
18	20.5	36.3	2.56	1.08	1.77	1.91
19	64.8	229.5	8.07	6.80	3.54	4.31
20	8.1	27.9	1.01	0.83	3.43	4.20
21	4.1	11.3	0.52	0.33	2.72	3.39
22	64.3	189.8	8.02	5.63	2.95	3.67
23	100.9	278.4	12.58	8.25	2.76	3.44
24	107.9	593.4	13.45	17.59	5.50	5.85
25	22.2	71.5	2.77	2.12	3.22	3.97
26	31.7	151.0	3.96	4.48	4.76	5.34
27	0.0	0.0	0.0	0.0	0.0	0.0
28	0.0	0.0	0.0	0.0	0.0	0.0
29	0.0	0.0	0.0	0.0	0.0	0.0
30	0.0	0.0	0.0	0.0	0.0	0.0
31	0.0	0.0	0.0	0.0	0.0	0.0
32	0.0	0.0	0.0	0.0	0.0	0.0
33	0.0	0.0	0.0	0.0	0.0	0.0
34	0.0	0.0	0.0	0.0	0.0	0.0
35	0.0	0.0	0.0	0.0	0.0	0.0
36	0.0	0.0	0.0	0.0	0.0	0.0
37	0.0	0.0	0.00	0.00	8.88	7.55
38	0.0	0.0	0.00	0.00	2.17	2.62
39	0.0	0.0	0.0	0.0	0.0	0.0
40	0.0	0.0	0.0	0.0	0.0	0.0
41	0.0	0.0	0.0	0.0	0.0	0.0
42	0.0	0.0	0.00	0.00	2.20	2.66
43	1.2	17.6	0.16	0.52	14.07	9.21
44	0.0	0.1	0.00	0.00	9.88	7.93
45	0.1	0.1	0.01	0.00	1.27	0.80
46	0.2	0.4	0.02	0.01	2.06	2.44
TOTAL	802.1	3372.6	100.00	100.00	4.20	4.90

TABLE 20 TOTAL CAPITAL FORMATION BY SECTOR OF ORIGIN SCENARIO S

SECTOR	BASE 1970	PROJ. 2000	%SHARES 1970	%SHARES 2000	RATIO	%GROWTH RATES
1	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0	0.0
8	4.3	12.6	0.04	0.04	2.94	3.66
9	13.6	34.6	0.13	0.11	2.54	3.16
10	153.5	477.4	1.41	1.49	3.11	3.85
11	0.0	0.0	0.0	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0
13	8.2	18.0	0.08	0.06	2.20	2.66
14	0.0	0.0	0.0	0.0	0.0	0.0
15	0.0	0.0	0.0	0.0	0.0	0.0
16	0.0	0.0	0.0	0.0	0.0	0.0
17	0.0	0.0	0.0	0.0	0.0	0.0
18	13.0	24.4	0.12	0.08	1.87	2.12
19	631.6	2165.2	5.81	6.76	3.43	4.19
20	248.3	638.2	2.28	1.99	2.57	3.20
21	208.8	650.9	1.92	2.03	3.12	3.86
22	156.0	449.1	1.43	1.40	2.88	3.59
23	2046.0	5727.6	18.81	17.87	2.80	3.49
24	860.0	2814.2	7.91	8.78	3.27	4.03
25	191.2	606.5	1.76	1.89	3.17	3.92
26	21.5	89.2	0.20	0.28	4.15	4.86
27	147.5	602.1	1.36	1.88	4.08	4.80
28	0.0	0.0	0.0	0.0	0.0	0.0
29	0.0	0.0	0.0	0.0	0.0	0.0
30	5181.2	15503.5	47.64	48.37	2.99	3.72
31	858.2	1953.0	7.89	6.09	2.28	2.78
32	0.0	0.0	0.0	0.0	0.0	0.0
33	132.3	284.6	1.22	0.89	2.15	2.59
34	0.0	0.0	0.0	0.0	0.0	0.0
35	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	10875.2	32051.3	100.00	100.00	2.95	3.67

TABLE 21 TOTAL CAPITAL STOCK BY SECTOR OF ORIGIN SCENARIO S

SECTOR	BASE 1970	PROJ. 2000	%SHARES 1970	%SHARES 2000	RATIO	%GROWTH RATES
1	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0	0.0
8	23.4	75.3	0.02	0.02	3.22	3.98
9	167.9	381.6	0.12	0.08	2.27	2.77
10	1739.9	5224.8	1.22	1.10	3.00	3.73
11	0.0	0.0	0.0	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0
13	18.5	53.7	0.01	0.01	2.90	3.62
14	0.0	0.0	0.0	0.0	0.0	0.0
15	0.0	0.0	0.0	0.0	0.0	0.0
16	0.0	0.0	0.0	0.0	0.0	0.0
17	0.0	0.0	0.0	0.0	0.0	0.0
18	90.8	205.0	0.06	0.04	2.26	2.75
19	5415.8	15271.0	3.79	3.22	2.82	3.52
20	3367.4	8962.9	2.35	1.89	2.66	3.32
21	1997.0	5204.5	1.40	1.10	2.61	3.24
22	1754.5	5072.3	1.23	1.07	2.89	3.60
23	22631.8	70535.1	15.83	14.85	3.12	3.86
24	8735.0	34967.2	6.11	7.36	4.00	4.73
25	1863.3	5940.1	1.30	1.25	3.19	3.94
26	218.7	760.5	0.15	0.16	3.48	4.24
27	979.1	4920.4	0.68	1.04	5.03	5.53
28	0.0	0.0	0.0	0.0	0.0	0.0
29	0.0	0.0	0.0	0.0	0.0	0.0
30	85217.9	290439.3	59.59	61.16	3.41	4.17
31	7705.2	23530.2	5.39	4.95	3.05	3.79
32	0.0	0.0	0.0	0.0	0.0	0.0
33	1079.4	3356.9	0.75	0.71	3.11	3.85
34	0.0	0.0	0.0	0.0	0.0	0.0
35	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	143005.8	474900.8	100.00	100.00	3.32	4.08

TABLE 22 TOTAL CAPITAL STOCK BY SECTOR OF DESTINATION SCENARIO S

SECTOR	BASE 1970	PROJ. 2000	%SHARES 1970	%SHARES 2000	RATIO	%GROWTH RATES
1	7278.9	18386.0	5.09	3.87	2.53	3.14
2	749.5	1938.6	0.52	0.41	2.59	3.22
3	3025.1	9651.1	2.12	2.03	3.19	3.94
4	2538.2	7904.3	1.77	1.66	3.11	3.86
5	5304.0	11308.6	3.71	2.38	2.13	2.56
6	2487.7	5985.5	1.74	1.26	2.41	2.97
7	5015.1	11793.1	3.51	2.48	2.35	2.89
8	2054.2	4764.5	1.44	1.00	2.32	2.84
9	1478.1	4670.7	1.03	0.98	3.16	3.91
10	236.1	617.4	0.17	0.13	2.62	3.26
11	6064.9	28262.9	4.24	5.95	4.66	5.26
12	1111.4	2793.7	0.78	0.59	2.51	3.12
13	363.3	683.6	0.25	0.14	1.88	2.13
14	2731.9	6626.3	1.91	1.40	2.43	3.00
15	269.0	967.8	0.19	0.20	3.60	4.36
16	720.9	2105.0	0.50	0 44	2.92	3.64
17	1696.6	4590.0	1.19	0.97	2.71	3.37
18	645.0	1949.6	0.45	0.41	3.02	3.76
19	1990.1	5627.3	1.39	1.18	2.83	3.53
20	239.3	643.4	0.17	0.14	2.69	3.35
21	353.5	1056.8	0.25	0.22	2.99	3.72
22	1681.4	4189.1	1.18	0.88	2.49	3.09
23	803.0	1916.4	0.56	0.40	2.39	2.94
24	1174.9	2860.1	0.82	0.60	2.43	3.01
25	152.9	498.2	0.11	0.10	3.26	4.02
26	284.6	667.3	0.20	0.14	2.34	2.88
27	14527.1	54200.3	10.16	11.41	3.73	4.49
28	25693.0	62817.4	17.97	13.23	2.44	3.02
29	20036.2	80573.0	14.01	16.97	4.02	4.75
30	2409.8	6759.1	1.69	1.42	2.80	3.50
31	9394.1	22507.1	6.57	4.74	2.40	2.96
32	9417.0	40996.3	6.59	8.63	4.35	5.03
33	0.0	0.0	0.0	0.0	0.0	0.0
34	0.0	0.0	0.0	0.0	0.0	0.0
35	0.0	0.0	0.0	0.0	0.0	0.0
36	0.0	0.0	0.0	0.0	0.0	0.0
37	804.8	6296.7	0.56	1.33	7.82	7.10
38	857.3	3143.5	0.60	0.66	3.67	4.43
39	411.8	2292.3	0.29	0.48	5.57	5.89
40	127.2	728.7	0.09	0.15	5.73	5.99
41	0.0	0.0	0.0	0.0	0.0	0.0
42	1477.8	5212.6	1.03	1.10	3.53	4.29
43	4391.3	19419.2	3.07	4.09	4.42	5.08
44	1015.2	19701.2	0.71	4.15	19.41	10.39
45	99.7	809.5	0.07	0.17	8.12	7.23
46	1894.6	6986.3	1.32	1.47	3.69	4.45
TOTAL	143006.5	474900.8	100.00	100.00	3.32	4.08

V LESS CONSTRAINED GROWTH FOR DEVELOPED REGIONS SCENARIO

This scenario offers a dramatic contrast with scenario S of the previous chapter. Nevertheless, the sectoral comparisons are all with the control scenario A described in Chapter III.

V.1 Canadian and U.N. Model Assumptions of Scenario T

To conform with the Carter-Petri nomenclature, this scenario is referred to as scenario T. Here the world model takes a more optimistic view of maintaining high labour productivity growth in developed regions (NAR, Western Europe, Japan, Oceania, Soviet Union, Eastern Europe). There is an across-the-board labour productivity increase of 20 per cent over and above scenario A in the year 2000. This relaxes the principal economic growth constraints for all developed regions with the result that GDP levels in 2000 are approximately 20 per cent higher in scenario T as compared to A. In particular, the GDP per capita growth rate for NAR becomes equal to 3.1 per cent in contrast to the 2.5 per cent growth in scenario A.

In order to link the Canadian model to the world model scenario T, it was decided to maintain population growth for Canada at 1.1 per cent over the period 1970 to 2000 (the same assumption made in Chapter III). This implies that a Canadian GDP annual growth rate of 4.2 per cent is required in scenario T. Such a projected growth rate is high compared to most other independent projections for the period 1970 to 2000. Indeed, the Canadian implied GDP per capita rate of growth, 3.1 per cent, is

reminiscent of the Canadian economic experience during the historical period 1955-75. The Canadian results of this high-growth scenario for the future, will be shown to be quite unrealistic (see, particularly, Chapter VII).

Before continuing it should be noted that raising GDP levels in developed regions has important impacts on resource-poor developing regions. The latters' balance-of-payments constraints on economic growth are partly relaxed through higher exports *to* and more foreign aid and capital flows *from* developed regions. Thus, in scenario T, Canada's exports to other developed regions are directly stimulated, but there is *also* some indirect export stimulation from exports to developing regions whose growth constraints are now partly relaxed. This topic is further analysed in the world model context in Carter and Petri [4].

V.2 Discussion of Results for Scenario T

Once again this chapter contains 10 tables, numbered Tables 23 to 32. Since the Canadian GDP growth is significantly higher as compared to scenario A, we would expect to find significantly higher sectoral growth rates for all variables. This is true, almost without exception. But the differential growth effects are not uniform, and it is interesting to point out some important examples.

Comparing Tables 1 and 23, it is seen that the largest output growth differentials occur with respect to the nontradable sectors (or almost nontradable): services, transport, utilities,

construction, wholesale-retail trade, and communications. This is not surprising because these sectors do not experience any significant import displacement at higher GDP levels. Comparing Tables 2 and 24, we see that increased Canadian export opportunities are particularly high for primary metal processing, nonmetallic mineral products, aircraft, and, perhaps, machinery.

Some Canadian manufacturing import coefficients are significantly raised when moving from scenario A to T. The arc elasticities,[1] used to project the coefficients, are especially high for such sectors as textiles, furniture, rubber products, electrical products, and miscellaneous manufactures (toys and sporting goods). For example, the import coefficient for textiles in the year 2000 changes from 0.41 in scenario A to 0.45 in scenario T; electrical products goes from 0.56 to 0.62. The differential results on Canadian import growth rates are clearly shown when comparing Tables 4 and 26. This also explains why some sectoral production growth rates are relatively unaffected by the new scenario T. For example, rubber products (sector 13) experiences extreme import displacement; the import coefficient rises from 0.56 in scenario A to 0.64 in T. The result is that rubber products output growth is very low in *both* scenarios, about 2.11 per cent for the period 1970-2000.

---

1 The elasticities act on the ratio of GDP in 2000 to base year GDP. Relatively high elasticities indicate accelerated import competition and the possibility of increased intrasectoral specialization at higher GDP levels.

Most Canadian resource outputs are considerably raised to parallel the higher GDP level in scenario T. In calculating the Canadian resource productions in the year 2000, the Canadian percentage *shares* of NAR resource outputs in that year are the same[1] in all scenarios. But the NAR output levels do change with alternative scenarios. The one exception is crude petroleum (sector 43) where NAR production is fixed, i.e., invariant with respect to scenarios, presumably at capacity expected for a given world price level[2] in the year 2000. Thus the Canadian crude petroleum production growth rate is the same in both scenarios A and T, namely 0.75 per cent. Then the net import requirements for petroleum become significantly larger in scenario T since the Canadian petroleum refining sectoral growth rate rises from 3.11 per cent in A to 3.66 per cent in T. All this is clearly shown in the various tables.

At this point it is instructive to note that both scenarios still permit a small trickle of crude petroleum exports even though crude petroleum imports become very large. In effect, the crude petroleum import coefficients are set at a sufficiently high level whereby exports are almost zero (if import coefficients were set at a lower level, then exports would become negative). Thus the crude petroleum import coefficient equals 0.47 in scenario A. However, in scenario T an import coefficient equal

---

1 The shares change over the period 1970 to 2000, but the change is invariant with respect to the particular scenario.

2 The normalized world relative price vector in 2000 is the same in all scenarios.

to 0.54 is required to satisfy the above requirement. This means that imports represent 54 per cent of total domestic needs for crude petroleum in the year 2000 under scenario T. Further consideration of this topic is given in the next chapter.

Canadian nickel output is significantly higher in scenario T. Presumably, lower quality Canadian (or NAR) nickel reserves are brought into production when world-wide GDP levels and corresponding mineral requirements are sufficiently raised. In scenario T it turns out that the Canadian net import of nickel, experienced in scenario A, is eliminated and nickel exports are virtually balanced by nickel imports in the year 2000. It might also be noted that all scenarios embody a nickel recycling mechanism -- the intermediate input coefficients for nickel are gradually reduced by a maximum of 7 per cent in the year 2000. Similar recycling assumptions are made for the other base metals and iron ore (scrap iron is a growing input of the primary metal processing sector). These assumptions have the indirect impact of raising the "effective" production growth rate of Canadian mineral resource sectors. However, no such assumptions are made for the Canadian energy resource sectors.

TABLE 23 OUTPUT VARIABLE SCENARIO T

SECTOR	BASE 1970	PROJ. 2000	%SHARES 1970	%SHARES 2000	RATIO	%GROWTH RATES
1	2544.3	6452.5	1.86	1.35	2.54	3.15
2	262.0	616.0	0.19	0.13	2.35	2.89
3	1057.4	3022.1	0.77	0.63	2.86	3.56
4	2509.8	7666.8	1.83	1.60	3.05	3.79
5	9516.4	24289.5	6.95	5.08	2.55	3.17
6	1908.0	5612.8	1.39	1.17	2.94	3.66
7	5129.6	14362.5	3.74	3.01	2.80	3.49
8	3809.3	10222.9	2.78	2.14	2.68	3.35
9	1987.6	8590.1	1.45	1.80	4.32	5.00
10	699.4	2588.6	0.51	0.54	3.70	4.46
11	4064.5	21663.6	2.97	4.53	5.33	5.74
12	1527.3	4545.7	1.11	0.95	2.98	3.70
13	549.1	1025.9	0.40	0.21	1.87	2.11
14	1456.1	4069.0	1.06	0.85	2.79	3.48
15	188.7	696.0	0.14	0.15	3.69	4.45
16	1518.1	5275.3	1.11	1.10	3.47	4.24
17	638.6	2589.5	0.47	0.54	4.06	4.78
18	642.9	2709.3	0.47	0.57	4.21	4.91
19	4644.3	16627.4	3.39	3.48	3.58	4.34
20	735.7	2846.3	0.54	0.60	3.87	4.61
21	496.9	1864.2	0.36	0.39	3.75	4.51
22	3201.1	11213.0	2.34	2.35	3.50	4.27
23	1966.7	6246.2	1.44	1.31	3.18	3.93
24	2787.9	8456.7	2.03	1.77	3.03	3.77
25	427.8	1636.0	0.31	0.34	3.82	4.57
26	685.1	1772.7	0.50	0.37	2.59	3.22
27	27400.7	94472.7	20.00	19.77	3.45	4.21
28	6774.6	25207.2	4.94	5.27	3.72	4.48
29	2198.7	9839.2	1.60	2.06	4.48	5.12
30	13698.7	52001.5	10.00	10.88	3.80	4.55
31	12719.7	48758.8	9.28	10.20	3.83	4.58
32	2358.6	11727.2	1.72	2.45	4.97	5.49
33	3061.9	11071.1	2.23	2.32	3.62	4.38
34	6140.2	23740.5	4.48	4.97	3.87	4.61
35	3120.4	11028.3	2.28	2.31	3.53	4.30
36	0.0	0.0	0.0	0.0	0.0	0.0
37	611.3	2061.7	0.45	0.43	3.37	4.14
38	651.2	1168.7	0.48	0.24	1.79	1.97
39	312.8	861.6	0.23	0.18	2.75	3.44
40	96.6	240.3	0.07	0.05	2.49	3.08
41	0.0	0.0	0.0	0.0	0.0	0.0
42	510.4	2236.9	0.37	0.47	4.38	5.05
43	1270.9	1592.1	0.93	0.33	1.25	0.75
44	293.8	813.9	0.21	0.17	2.77	3.45
45	89.3	846.4	0.07	0.18	9.48	7.78
46	760.0	3605.3	0.55	0.75	4.74	5.33
TOTAL	137024.4	477933.8	100.00	100.00	3.49	4.25

TABLE 24 EXPORT VARIABLE (1970 PRICES) SCENARIO T

SECTOR	BASE 1970	PROJ. 2000	%SHARES 1970	%SHARES 2000	RATIO	%GROWTH RATES
1	65.0	176.5	0.33	0.24	2.72	3.39
2	150.8	461.6	0.78	0.64	3.06	3.80
3	701.2	2094.9	3.61	2.89	2.99	3.72
4	177.1	402.0	0.91	0.55	2.27	2.77
5	918.4	2449.1	4.73	3.38	2.67	3.32
6	94.9	0.0	0.49	0.0	0.0	-100.00
7	2170.4	6105.1	11.18	8.42	2.81	3.51
8	184.9	752.2	0.95	1.04	4.07	4.79
9	852.3	3906.4	4.39	5.39	4.58	5.21
10	35.9	86.2	0.18	0.12	2.40	2.96
11	1897.7	11777.0	9.78	16.25	6.21	6.27
12	37.1	253.5	0.19	0.35	6.83	6.60
13	31.0	144.9	0.16	0.20	4.67	5.27
14	278.6	999.6	1.44	1.38	3.59	4.35
15	135.7	528.6	0.70	0.73	3.89	4.64
16	126.0	659.1	0.65	0.91	5.23	5.67
17	28.9	69.4	0.15	0.10	2.40	2.96
18	67.4	512.5	0.35	0.71	7.60	6.99
19	3480.2	12572.4	17.93	17.34	3.61	4.37
20	208.2	499.7	1.07	0.69	2.40	2.96
21	380.7	1707.2	1.96	2.36	4.48	5.13
22	249.8	671.3	1.29	0.93	2.69	3.35
23	667.6	2152.9	3.44	2.97	3.22	3.98
24	439.7	2567.4	2.27	3.54	5.84	6.06
25	143.2	604.7	0.74	0.83	4.22	4.92
26	84.2	317.9	0.43	0.44	3.78	4.53
27	228.5	835.5	1.18	1.15	3.66	4.42
28	589.2	2731.5	3.04	3.77	4.64	5.25
29	37.4	132.7	0.19	0.18	3.55	4.32
30	0.0	0.0	0.0	0.0	0.0	0.0
31	721.9	2685.4	3.72	3.70	3.72	4.48
32	29.3	85.5	0.15	0.12	2.92	3.64
33	868.3	3222.3	4.47	4.45	3.71	4.47
34	0.0	0.0	0.0	0.0	0.0	0.0
35	0.0	0.0	0.0	0.0	0.0	0.0
36	0.0	0.0	0.0	0.0	0.0	0.0
37	134.0	656.4	0.69	0.91	4.90	5.44
38	182.0	85.4	0.94	0.12	0.47	-2.49
39	78.0	398.2	0.40	0.55	5.10	5.58
40	29.0	100.9	0.15	0.14	3.48	4.24
41	0.0	0.0	0.0	0.0	0.0	0.0
42	386.2	1831.1	1.99	2.53	4.74	5.32
43	687.3	13.6	3.54	0.02	0.02	-12.26
44	126.3	156.6	0.65	0.22	1.24	0.72
45	52.8	255.0	0.27	0.35	4.83	5.39
46	446.2	2416.1	2.30	3.33	5.41	5.79
47	1206.0	4410.5	6.21	6.08	3.66	4.42
TOTAL	19409.4	72488.8	100.00	100.00	3.73	4.49

TABLE 25 EXPORT VARIABLE (2000 PRICES) SCENARIO T

SECTOR	BASE 1970	PROJ. 2000	%SHARES 1970	%SHARES 2000	RATIO	%GROWTH RATES
1	65.0	221.4	0.33	0.30	3.41	4.17
2	150.8	560.4	0.78	0.76	3.72	4.47
3	701.2	2391.7	3.61	3.22	3.41	4.17
4	177.1	463.0	0.91	0.62	2.61	3.26
5	918.4	2417.6	4.73	3.26	2.63	3.28
6	94.9	0.0	0.49	0.0	0.0	-100.00
7	2170.4	8220.8	11.18	11.08	3.79	4.54
8	184.9	656.8	0.95	0.89	3.55	4.32
9	852.3	3556.6	4.39	4.79	4.17	4.88
10	35.9	74.2	0.18	0.10	2.06	2.45
11	1897.7	11460.0	9.78	15.44	6.04	6.18
12	37.1	203.7	0.19	0.27	5.49	5.82
13	31.0	131.9	0.16	0.18	4.25	4.94
14	278.6	979.3	1.44	1.32	3.52	4.28
15	135.7	590.8	0.70	0.80	4.35	5.02
16	126.0	638.3	0.65	0.86	5.07	5.56
17	28.9	88.4	0.15	0.12	3.06	3.80
18	67.4	466.8	0.35	0.63	6.92	6.66
19	3480.2	11654.0	17.93	15.70	3.35	4.11
20	208.2	392.1	1.07	0.53	1.88	2.13
21	380.7	1483.0	1.96	2.00	3.90	4.64
22	249.8	680.1	1.29	0.92	2.72	3.40
23	667.6	1831.0	3.44	2.47	2.74	3.42
24	439.7	2293.3	2.27	3.09	5.22	5.66
25	143.2	477.7	0.74	0.64	3.34	4.10
26	84.2	270.3	0.43	0.36	3.21	3.97
27	228.5	812.5	1.18	1.09	3.56	4.32
28	589.2	2550.0	3.04	3.44	4.33	5.01
29	37.4	110.8	0.19	0.15	2.97	3.69
30	0.0	0.0	0.0	0.0	0.0	0.0
31	721.9	2519.9	3.72	3.40	3.49	4.26
32	29.3	72.8	0.15	0.10	2.48	3.08
33	868.3	3008.2	4.47	4.05	3.46	4.23
34	0.0	0.0	0.0	0.0	0.0	0.0
35	0.0	0.0	0.0	0.0	0.0	0.0
36	0.0	0.0	0.0	0.0	0.0	0.0
37	134.0	1770.6	0.69	2.39	13.22	8.99
38	182.0	200.3	0.94	0.27	1.10	0.32
39	78.0	905.9	0.40	1.22	11.61	8.52
40	29.0	246.0	0.15	0.33	8.49	7.39
41	0.0	0.0	0.0	0.0	0.0	0.0
42	386.2	1822.0	1.99	2.46	4.72	5.31
43	687.3	79.9	3.54	0.11	0.12	-6.92
44	126.3	1151.3	0.65	1.55	9.12	7.64
45	52.8	218.5	0.27	0.29	4.14	4.85
46	446.2	2332.6	2.30	3.14	5.23	5.67
47	1206.0	4201.1	6.21	5.66	3.48	4.25
TOTAL	19409.4	74205.8	100.00	100.00	3.82	4.57

TABLE 26 IMPORT VARIABLE (1970 PRICES) SCENARIO T

SECTOR	BASE 1970	PROJ. 2000	%SHARES 1970	%SHARES 2000	RATIO	%GROWTH RATES
1	33.2	138.6	0.19	0.16	4.17	4.88
2	54.0	104.5	0.30	0.12	1.93	2.22
3	46.1	118.3	0.26	0.13	2.57	3.19
4	343.4	1024.7	1.92	1.16	2.98	3.71
5	775.8	2274.6	4.33	2.57	2.93	3.65
6	253.5	1347.6	1.42	1.52	5.32	5.73
7	671.5	3220.6	3.75	3.64	4.80	5.36
8	1001.2	7672.2	5.59	8.67	7.66	7.02
9	112.7	421.9	0.63	0.48	3.74	4.50
10	57.5	682.1	0.32	0.77	11.86	8.59
11	212.6	1221.8	1.19	1.38	5.75	6.00
12	281.2	1458.9	1.57	1.65	5.19	5.64
13	180.1	1580.1	1.01	1.78	8.77	7.51
14	558.0	2031.6	3.12	2.29	3.64	4.40
15	20.3	43.8	0.11	0.05	2.16	2.60
16	369.0	2717.6	2.06	3.07	7.36	6.88
17	4.8	11.4	0.03	0.01	2.37	2.91
18	229.5	517.6	1.28	0.58	2.26	2.75
19	3353.8	16561.6	18.72	18.71	4.94	5.47
20	109.5	672.4	0.61	0.76	6.14	6.24
21	427.3	1698.3	2.39	1.92	3.97	4.71
22	677.0	2533.2	3.78	2.86	3.74	4.50
23	2232.8	9344.7	12.47	10.55	4.19	4.89
24	1036.9	9511.9	5.79	10.74	9.17	7.67
25	599.2	3195.1	3.35	3.61	5.33	5.74
26	349.7	2801.1	1.95	3.16	8.01	7.18
27	700.6	3262.8	3.91	3.69	4.66	5.26
28	123.1	496.3	0.69	0.56	4.03	4.76
29	12.4	39.2	0.07	0.04	3.16	3.91
30	0.0	0.0	0.0	0.0	0.0	0.0
31	105.9	408.9	0.59	0.46	3.86	4.61
32	28.7	143.4	0.16	0.16	5.00	5.51
33	0.0	0.0	0.0	0.0	0.0	0.0
34	0.0	0.0	0.0	0.0	0.0	0.0
35	0.0	0.0	0.0	0.0	0.0	0.0
36	391.4	927.4	2.19	1.05	2.37	2.92
37	8.6	33.8	0.05	0.04	3.93	4.67
38	78.5	86.8	0.44	0.10	1.11	0.34
39	0.0	0.0	0.0	0.0	0.0	0.0
40	0.0	0.0	0.0	0.0	0.0	0.0
41	140.0	314.8	0.78	0.36	2.25	2.74
42	33.0	87.2	0.18	0.10	2.64	3.29
43	529.1	1860.5	2.95	2.10	3.52	4.28
44	5.1	8.5	0.03	0.01	1.67	1.73
45	220.4	404.7	1.23	0.46	1.84	2.05
46	122.5	331.5	0.68	0.37	2.71	3.37
47	1422.0	7226.7	7.94	8.16	5.08	5.57
TOTAL	17911.9	88538.7	100.00	100.00	4.94	5.47

TABLE 27 IMPORT VARIABLE (2000 PRICES) SCENARIO T

SECTOR	BASE 1970	PROJ. 2000	%SHARES 1970	%SHARES 2000	RATIO	%GROWTH RATES
1	33.2	173.8	0.19	0.18	5.24	5.67
2	54.0	126.8	0.30	0.13	2.35	2.89
3	46.1	135.1	0.26	0.14	2.93	3.65
4	343.4	1180.1	1.92	1.23	3.44	4.20
5	775.8	2245.3	4.33	2.34	2.89	3.61
6	253.5	5221.3	1.42	5.45	20.60	10.61
7	671.5	4336.6	3.75	4.52	6.46	6.42
8	1001.2	6699.6	5.59	6.99	6.69	6.54
9	112.7	384.2	0.63	0.40	3.41	4.17
10	57.5	587.1	0.32	0.61	10.21	8.05
11	212.6	1188.9	1.19	1.24	5.59	5.91
12	281.2	1184.5	1.57	1.24	4.21	4.91
13	180.1	1438.8	1.01	1.50	7.99	7.17
14	558.0	1990.4	3.12	2.08	3.57	4.33
15	20.3	49.0	0.11	0.05	2.41	2.98
16	369.0	2631.7	2.06	2.75	7.13	6.77
17	4.8	14.5	0.03	0.02	3.02	3.75
18	229.5	471.4	1.28	0.49	2.05	2.43
19	3353.8	15351.8	18.72	16.02	4.58	5.20
20	109.5	527.7	0.61	0.55	4.82	5.38
21	427.3	1475.3	2.39	1.54	3.45	4.22
22	677.0	2566.4	3.78	2.68	3.79	4.54
23	2232.8	7947.4	12.47	8.29	3.56	4.32
24	1036.9	8496.4	5.79	8.86	8.19	7.26
25	599.2	2523.8	3.35	2.63	4.21	4.91
26	349.7	2381.6	1.95	2.48	6.81	6.60
27	700.6	3173.2	3.91	3.31	4.53	5.16
28	123.1	463.3	0.69	0.48	3.76	4.52
29	12.4	32.8	0.07	0.03	2.64	3.29
30	0.0	0.0	0.0	0.0	0.0	0.0
31	105.9	383.7	0.59	0.40	3.62	4.38
32	28.7	122.1	0.16	0.13	4.25	4.94
33	0.0	0.0	0.0	0.0	0.0	0.0
34	0.0	0.0	0.0	0.0	0.0	0.0
35	0.0	0.0	0.0	0.0	0.0	0.0
36	391.4	1034.0	2.19	1.08	2.64	3.29
37	8.6	91.2	0.05	0.10	10.61	8.19
38	78.5	203.6	0.44	0.21	2.59	3.23
39	0.0	0.0	0.0	0.0	0.0	0.0
40	0.0	0.0	0.0	0.0	0.0	0.0
41	140.0	361.0	0.78	0.38	2.58	3.21
42	33.0	86.7	0.18	0.09	2.63	3.27
43	529.1	10952.4	2.95	11.43	20.70	10.63
44	5.1	62.6	0.03	0.07	12.28	8.72
45	220.4	346.8	1.23	0.36	1.57	1.52
46	122.5	320.0	0.68	0.33	2.61	3.25
47	1422.0	6883.6	7.94	7.18	4.84	5.40
TOTAL	17911.9	95846.5	100.00	100.00	5.35	5.75

TABLE 28 TARIFF REVENUE VARIABLE (1970 PRICES) SCENARIO T

SECTOR	BASE 1970	PROJ. 2000	%SHARES 1970	%SHARES 2000	RATIO	%GROWTH RATES
1	0.8	3.4	0.10	0.07	4.17	4.88
2	0.0	0.0	0.00	0.00	1.93	2.22
3	0.8	2.2	0.10	0.04	2.57	3.19
4	2.4	7.1	0.30	0.15	2.98	3.71
5	52.1	152.7	6.49	3.16	2.93	3.65
6	16.9	89.8	2.11	1.86	5.32	5.73
7	16.1	77.1	2.01	1.59	4.80	5.36
8	163.5	1252.6	20.38	25.89	7.66	7.02
9	4.4	16.3	0.54	0.34	3.74	4.50
10	7.5	89.4	0.94	1.85	11.86	8.59
11	10.9	62.8	1.36	1.30	5.75	6.00
12	16.2	84.2	2.02	1.74	5.19	5.64
13	21.8	191.4	2.72	3.96	8.77	7.51
14	30.6	111.4	3.81	2.30	3.64	4.40
15	0.1	0.2	0.01	0.00	2.16	2.60
16	31.7	233.3	3.95	4.82	7.36	6.88
17	0.1	0.2	0.01	0.00	2.37	2.91
18	20.5	46.3	2.56	0.96	2.26	2.75
19	64.8	319.8	8.07	6.61	4.94	5.47
20	8.1	50.0	1.01	1.03	6.14	6.24
21	4.1	16.5	0.52	0.34	3.97	4.71
22	64.3	240.8	8.02	4.98	3.74	4.50
23	100.9	422.4	12.58	8.73	4.19	4.89
24	107.9	989.9	13.45	20.46	9.17	7.67
25	22.2	118.6	2.77	2.45	5.33	5.74
26	31.7	254.2	3.96	5.25	8.01	7.18
27	0.0	0.0	0.0	0.0	0.0	0.0
28	0.0	0.0	0.0	0.0	0.0	0.0
29	0.0	0.0	0.0	0.0	0.0	0.0
30	0.0	0.0	0.0	0.0	0.0	0.0
31	0.0	0.0	0.0	0.0	0.0	0.0
32	0.0	0.0	0.0	0.0	0.0	0.0
33	0.0	0.0	0.0	0.0	0.0	0.0
34	0.0	0.0	0.0	0.0	0.0	0.0
35	0.0	0.0	0.0	0.0	0.0	0.0
36	0.0	0.0	0.0	0.0	0.0	0.0
37	0.0	0.0	0.00	0.00	3.93	4.67
38	0.0	0.0	0.00	0.00	1.11	0.34
39	0.0	0.0	0.0	0.0	0.0	0.0
40	0.0	0.0	0.0	0.0	0.0	0.0
41	0.0	0.0	0.0	0.0	0.0	0.0
42	0.0	0.0	0.00	0.00	2.64	3.29
43	1.2	4.4	0.16	0.09	3.52	4.28
44	0.0	0.0	0.00	0.00	1.67	1.73
45	0.1	0.1	0.01	0.00	1.84	2.05
46	0.2	0.5	0.02	0.01	2.71	3.37
TOTAL	802.1	4837.3	100.00	100.00	6.03	6.17

TABLE 29 TARIFF REVENUE VARIABLE (2000 PRICES) SCENARIO T

SECTOR	BASE 1970	PROJ. 2000	%SHARES 1970	%SHARES 2000	RATIO	%GROWTH RATES
1	0.8	4.2	0.10	0.09	5.24	5.67
2	0.0	0.0	0.00	0.00	2.35	2.89
3	0.8	2.5	0.10	0.05	2.93	3.65
4	2.4	8.2	0.30	0.18	3.44	4.20
5	52.1	150.7	6.49	3.24	2.89	3.61
6	16.9	347.9	2.11	7.47	20.60	10.61
7	16.1	103.9	2.01	2.23	6.46	6.42
8	163.5	1093.8	20.38	23.48	6.69	6.54
9	4.4	14.9	0.54	0.32	3.41	4.17
10	7.5	76.9	0.94	1.65	10.21	8.05
11	10.9	61.1	1.36	1.31	5.59	5.91
12	16.2	68.3	2.02	1.47	4.21	4.91
13	21.8	174.2	2.72	3.74	7.99	7.17
14	30.6	109.1	3.81	2.34	3.57	4.33
15	0.1	0.2	0.01	0.00	2.41	2.98
16	31.7	225.9	3.95	4.85	7.13	6.77
17	0.1	0.3	0.01	.01	3.02	3.75
18	20.5	42.2	2.56	0.91	2.05	2.43
19	64.8	296.5	8.07	6.36	4.58	5.20
20	8.1	39.2	1.01	0.84	4.82	5.38
21	4.1	14.3	0.52	0.31	3.45	4.22
22	64.3	243.9	8.02	5.24	3.79	4.54
23	100.9	359.2	12.58	7.71	3.56	4.32
24	107.9	884.2	13.45	18.98	8.19	7.26
25	22.2	93.6	2.77	2.01	4.21	4.91
26	31.7	216.1	3.96	4.64	6.81	6.60
27	0.0	0.0	0.0	0.0	0.0	0.0
28	0.0	0.0	0.0	0.0	0.0	0.0
29	0.0	0.0	0.0	0.0	0.0	0.0
30	0.0	0.0	0.0	0.0	0.0	0.0
31	0.0	0.0	0.0	0.0	0.0	0.0
32	0.0	0.0	0.0	0.0	0.0	0.0
33	0.0	0.0	0.0	0.0	0.0	0.0
34	0.0	0.0	0.0	0.0	0.0	0.0
35	0.0	0.0	0.0	0.0	0.0	0.0
36	0.0	0.0	0.0	0.0	0.0	0.0
37	0.0	0.0	0.00	0.00	10.61	8.19
38	0.0	0.0	0.00	0.00	2.59	3.23
39	0.0	0.0	0.0	0.0	0.0	0.0
40	0.0	0.0	0.0	0.0	0.0	0.0
41	0.0	0.0	0.0	0.0	0.0	0.0
42	0.0	0.0	0.00	0.00	2.63	3.27
43	1.2	25.9	0.16	0.56	20.70	10.63
44	0.0	0.1	0.00	0.00	12.28	8.72
45	0.1	0.1	0.01	0.00	1.57	1.52
46	0.2	0.5	0.02	0.01	2.61	3.25
TOTAL	802.1	4658.0	100.00	100.00	5.81	6.04

TABLE 30 TOTAL CAPITAL FORMATION BY SECTOR OF ORIGIN SCENARIO T

SECTOR	BASE 1970	PROJ. 2000	%SHARES 1970	%SHARES 2000	RATIO	%GROWTH RATES
1	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0	0.0
8	4.3	16.0	0.04	0.04	3.73	4.48
9	13.6	46.1	0.13	0.11	3.39	4.15
10	153.5	637.8	1.41	1.47	4.15	4.86
11	0.0	0.0	0.0	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0
13	8.2	23.3	0.08	0.05	2.84	3.55
14	0.0	0.0	0.0	0.0	0.0	0.0
15	0.0	0.0	0.0	0.0	0.0	0.0
16	0.0	0.0	0.0	0.0	0.0	0.0
17	0.0	0.0	0.0	0.0	0.0	0.0
18	13.0	31.3	0.12	0.07	2.40	2.97
19	631.6	2772.1	5.81	6.40	4.39	5.05
20	248.3	852.6	2.28	1.97	3.43	4.20
21	208.8	830.3	1.92	1.92	3.98	4.71
22	156.0	594.9	1.43	1.37	3.81	4.56
23	2046.0	7445.2	18.81	17.18	3.64	4.40
24	860.0	3975.3	7.91	9.17	4.62	5.24
25	191.2	778.5	1.76	1.80	4.07	4.79
26	21.5	114.7	0.20	0.26	5.33	5.74
27	147.5	754.0	1.36	1.74	5.11	5.59
28	0.0	0.0	0.0	0.0	0.0	0.0
29	0.0	0.0	0.0	0.0	0.0	0.0
30	5181.2	21474.5	47.64	49.56	4.14	4.85
31	858.2	2598.5	7.89	6.00	3.03	3.76
32	0.0	0.0	0.0	0.0	0.0	0.0
33	132.3	384.8	1.22	0.89	2.91	3.62
34	0.0	0.0	0.0	0.0	0.0	0.0
35	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	10875.2	43329.8	100.00	100.00	3.98	4.72

TABLE 31 TOTAL CAPITAL STOCK BY SECTOR OF ORIGIN SCENARIO T

SECTOR	BASE 1970	PROJ. 2000	%SHARES 1970	%SHARES 2000	RATIO	%GROWTH RATES
1	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0	0.0
8	23.4	91.8	0.02	0.02	3.93	4.66
9	167.9	469.2	0.12	0.08	2.79	3.48
10	1739.9	6486.8	1.22	1.12	3.73	4.48
11	0.0	0.0	0.0	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0
13	18.5	66.8	0.01	0.01	3.61	4.37
14	0.0	0.0	0.0	0.0	0.0	0.0
15	0.0	0.0	0.0	0.0	0.0	0.0
16	0.0	0.0	0.0	0.0	0.0	0.0
17	0.0	0.0	0.0	0.0	0.0	0.0
18	90.8	245.1	0.06	0.04	2.70	3.36
19	5415.8	18756.6	3.79	3.23	3.46	4.23
20	3367.4	10846.3	2.35	1.87	3.22	3.98
21	1997.0	6315.4	1.40	1.09	3.16	3.91
22	1754.5	6217.9	1.23	1.07	3.54	4.31
23	22631.8	84656.0	15.83	14.58	3.74	4.50
24	8735.0	45013.3	6.11	7.75	5.15	5.62
25	1863.3	7171.7	1.30	1.24	3.85	4.60
26	218.7	936.6	0.15	0.16	4.28	4.97
27	979.1	5858.0	0.68	1.01	5.98	6.14
28	0.0	0.0	0.0	0.0	0.0	0.0
29	0.0	0.0	0.0	0.0	0.0	0.0
30	85217.9	354855.1	59.59	61.12	4.16	4.87
31	7705.2	28527.3	5.39	4.91	3.70	4.46
32	0.0	0.0	0.0	0.0	0.0	0.0
33	1079.4	4112.8	0.75	0.71	3.81	4.56
34	0.0	0.0	0.0	0.0	0.0	0.0
35	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	143005.8	580626.4	100.00	100.00	4.06	4.78

TABLE 32 TOTAL CAPITAL STOCK BY SECTOR OF DESTINATION SCENARIO T

SECTOR	BASE 1970	PROJ. 2000	%SHARES 1970	%SHARES 2000	RATIO	%GROWTH RATES
1	7278.9	22151.6	5.09	3.82	3.04	3.78
2	749.5	2114.8	0.52	0.36	2.82	3.52
3	3025.1	10374.9	2.12	1.79	3.43	4.19
4	2538.2	9304.2	1.77	1.60	3.67	4.43
5	5304.0	13537.8	3.71	2.33	2.55	3.17
6	2487.7	7318.1	1.74	1.26	2.94	3.66
7	5015.1	14041.9	3.51	2.42	2.80	3.49
8	2054.2	5512.8	1.44	0.95	2.68	3.35
9	1478.1	5749.3	1.03	0.99	3.89	4.63
10	236.1	786.4	0.17	0.14	3.33	4.09
11	6064.9	32325.8	4.24	5.57	5.33	5.74
12	1111.4	3307.8	0.78	0.57	2.98	3.70
13	363.3	678.8	0.25	0.12	1.87	2.11
14	2731.9	7634.2	1.91	1.31	2.79	3.48
15	269.0	992.1	0.19	0.17	3.69	4.45
16	720.9	2505.0	0.50	0.43	3.47	4.24
17	1696.6	6191.9	1.19	1.07	3.65	4.41
18	645.0	2446.5	0.45	0.42	3.79	4.54
19	1990.1	6412.3	1.39	1.10	3.22	3.98
20	239.3	833.3	0.17	0.14	3.48	4.25
21	353.5	1193.5	0.25	0.21	3.38	4.14
22	1681.4	5300.8	1.18	0.91	3.15	3.90
23	803.0	2295.4	0.56	0.40	2.86	3.56
24	1174.9	3207.5	0.82	0.55	2.73	3.40
25	152.9	584.8	0.11	0.10	3.82	4.57
26	284.6	736.5	0.20	0.13	2.59	3.22
27	14527.1	67617.3	10.16	11.65	4.65	5.26
28	25693.0	76479.5	17.97	13.17	2.98	3.70
29	20036.2	103111.8	14.01	17.76	5.15	5.61
30	2409.8	9147.8	1.69	1.58	3.80	4.55
31	9394.1	28808.5	6.57	4.96	3.07	3.81
32	9417.0	53845.6	6.59	9.27	5.72	5.98
33	0.0	0.0	0.0	0.0	0.0	0.0
34	0.0	0.0	0.0	0.0	0.0	0.0
35	0.0	0.0	0.0	0.0	0.0	0.0
36	0.0	0.0	0.0	0.0	0.0	0.0
37	804.8	7599.8	0.56	1.31	9.44	7.77
38	857.3	3846.5	0.60	0.66	4.49	5.13
39	411.8	2835.7	0.29	0.49	6.89	6.64
40	127.2	822.5	0.09	0.14	6.47	6.42
41	0.0	0.0	0.0	0.0	0.0	0.0
42	1477.8	6476.8	1.03	1.12	4.38	5.05
43	4391.3	19419.2	3.07	3.34	4.42	5.08
44	1015.2	23144.9	0.71	3.99	22.80	10.98
45	99.7	945.1	0.07	0.16	9.48	7.78
46	1894.6	8987.6	1.32	1.55	4.74	5.33
TOTAL	143006.5	580626.4	100.00	100.00	4.06	4.78

VI THE WORLDWIDE ENERGY CONSERVATION SCENARIO

In terms of potential policy implications (see Chapter VII) this is the most important scenario of the study. However, the methodology is relatively incomplete and so the results must be regarded as exploratory and suggestive. Here it is necessary to distinguish the United Nations from the Canadian assumptions of the energy conservation scenario.

VI.1 U.N. Model Assumptions of Scenario SB

All three scenarios so far discussed have one major weakness: the market-type developed regions (NAR, Western Europe, Japan) experience sizeable balance-of-payments deficits by the year 2000 clearly due to petroleum and other fossil-fuel[1] energy import requirements. The deficits are implicitly made feasible by assuming that Middle East surplus oil-revenues are "recycled" to the advanced developed regions (see Carter and Petri [4] and Economic Council [10] for further discussion). This leads to consideration of an alternative scenario featuring fossil-fuel energy conservation and substitution measures in all energy-importing regions, and particularly in the three major developed regions.

These measures do not come "free of charge". The substitution of renewable energy (e.g., solar and wood waste energy) and nuclear energy for fossil-fuels inevitably involves additional labour and particularly fixed capital requirements. Similarly, energy conservation measures such as increased insulation for

---

1 In the model there are three fossil-fuels: petroleum, natural gas and coal.

residential construction and energy saving modifications of industrial machinery may indirectly have the same effects. In any event, the U.N. energy conservation scenario does *not* spell out these measures in terms of specific changes in structural coefficients. Instead, a *short-cut* procedure is employed whereby regional fossil-fuel requirements (for regional use) are cut by certain proportions in the year 2000, the proportions coming from the latest research on energy savings opportunities.[1] The savings due to fossil-fuel energy conservation and substitution are charged to increased labour and capital costs (about 70 per cent is charged to capital). For the NAR this implies a slightly lower GDP growth rate reflecting the labour force constraint; the major impact is on lower consumption levels since capital investment requirements are significantly raised (see, again, Carter and Petri [4]). For most of the resource-poor developing regions, energy savings implies moderately higher GDP growth rates since their balance-of-payments constraints are partly relaxed by cutting fossil-fuel imports, but the effects are relatively small since fixed capital import requirements are now higher.

The energy conservation scenario SB examined in this chapter is actually combined with the main feature of scenario S. The reader should recall that scenario S permitted a 20 per cent increase in resource-poor developing regions' GDP financed by foreign aid and capital flows from developed regions. This increase is now

---

1 The estimates were prepared by the Cavendish Laboratories of Cambridge University for the World Energy Conference held in October 1977. See Economic Council [10] for some more details.

additional to any GDP stimulation these regions gain from fossil-fuel energy conservation. It might be noted that augmented foreign aid and capital flows from the major advanced developed regions could be regarded as "more likely" if these regions also practise energy conservation since their own payments-deficits are significantly cut in this case.

VI.2 Canadian Model Assumptions of Scenario SB

As usual the Canadian model was linked to the U.N. model scenario SB. It was decided that the Canadian average annual 1970-2000 population growth rate of 1.1 per cent (used in scenarios A and T) was most appropriate for this case. This implies a Canadian GDP growth rate of approximately 3.6 per cent since the corresponding NAR growth rate is only marginally lower in scenario SB than A. To reflect the additional labour costs of Canadian energy savings (explained below), the Canadian GDP rate of growth was in fact also marginally lowered to 3.58 per cent. Thus, for example, the Canadian manufacturing import coefficients in scenario SB are just about the same as those in A. We shall also see that linking Canadian nonresource exports to those of NAR by means of export shares yields interesting changes in future Canadian exports.

However, there are some critical differences in the treatment of energy savings in the Canadian model as compared to the U.N. model. In all three scenarios so far examined, Canada remains a net exporter of natural gas and becomes virtually self-sufficient in coal by the year 2000. Thus it was decided to exclude these two fossil-fuels from the Canadian energy savings

program and apply the latter only to petroleum. It is easily checked that Canada is a major net importer of crude petroleum in the three scenarios A, S and T.[1]

The Cavendish energy savings opportunities research shows that NAR total petroleum consumption could be cut by a maximum of one-third in the year 2000 compared to a non-energy savings scenario. The Canadian petroleum energy savings program *also* cuts Canadian petroleum consumption by this proportion. The program, in the Canadian model, is achieved by lowering the Canadian petroleum import coefficient from 0.47 in scenario A (which still permitted a small trickle of petroleum exports) to about 0.20 in scenario SB. If this alone is done, then Canadian (gross) exports of petroleum become negative! In fact, Canadian exports of petroleum were artificially set at zero, and the negative magnitude of petroleum exports which would "normally" occur was charged to additional capital and labour requirements at year 2000 prices for crude petroleum.

The split into capital and labour was taken from the capital and labour proportions of real value added in the Canadian utilities sector; 0.72 and 0.28 respectively. Thus 72 per cent of petroleum energy savings is charged to capital. The commodity or sectoral composition of the capital is also taken from the utilities sector column of a capital investment distribution

---

1 In fact, the Canadian net import of petroleum is the main contributor to the Canadian balance-of-trade deficits in the three scenarios. This is further discussed in the next chapter.

matrix projected[1] to the year 2000. This requires a suitable modification of the Canadian business total capital investment equation explained in Chapter II. Part of total capital investment, *additional to* business expansion and replacement investment, depends on the petroleum negative export magnitude (artificially set at zero) in the Canadian export equation. Thus the stepwise solution procedure used for all other scenarios is no longer valid. A more complicated *simultaneous* solution procedure, mentioned in Appendix A, is now required. The procedure yields the *net* energy savings affected, *after* taking account of the petroleum energy directly and indirectly required to produce the additional capital investment. All this is illustrated in the next section.

VI.3 Discussion of Results for Scenario SB

The principal macrocomparisons between scenario SB and the other scenarios are in the next chapter. There is also a comparative international trade analysis. Here we provide some discussion that could serve as an introduction.

First note that the Canadian scenario SB is accompanied by eight tables, Tables numbers 33 to 40. Two of the tables shown in previous chapters, namely those analysing business capital stock by sectors of origin and destination, are omitted in this chapter because of computational difficulties.[2] Also, the final

---

1 The construction component of utilities capital investment (sector of destination) is lowered by 20 per cent and the remaining capital components are raised accordingly -- as compared to the base year 1970.

2 A methodology for performing these calculations has been worked out, but not yet implemented.

Table 40 (business total capital formation by sector of origin) is conceptually different from the corresponding tables for other scenarios. This table is now formed from the summation of three components (not two): (1) business expansion investment, (2) business replacement investment, and (3) business petroleum energy-savings investment (as explained in the previous section).

Some of the main sectoral differences between scenarios A and SB are revealed by comparing the gross production growth rates in Tables 1 and 33. Since overall GDP growth is about the same in the two scenarios, the main differences stem from a significant fall in personal consumption expenditures and a corresponding rise in business capital formation (see next chapter). Thus the production growth rates of consumer-orientated sectors such as food processing, textiles, furniture and services are all lower in scenario SB than in scenario A. On the other hand, the growth rates of primary metal processing, electrical products, machinery and construction are now higher. The movement from scenario A to SB also has important impacts on Canadian nonresource exports. The latter are affected for two reasons: (1) the substitution of fixed capital for fossil-fuel energy in the major energy-importing regions, and (2) increased GDP levels in resource-poor developing regions. This is reflected in new Canadian export opportunities for motor vehicles (probably trucks), aircraft, electrical and industrial machinery, and scientific instruments. It is interesting to observe that the Canadian machinery sector (23) changes from one of relatively slow production growth in scenario A, 3.31 per cent, to average growth, 3.58 per cent, in scenario SB.

The most important impact of Canadian energy conservation is, of course, on crude petroleum imports. The full weight of Canadian petroleum savings falls on petroleum imports since Canadian petroleum production is assumed unchanged, while Canadian total domestic requirements (or total consumption for domestic use) is cut by about one-third. Measured in year 2000 prices, petroleum imports fall from 8,192 million dollars in scenario A to 2,220 million in scenario SB. Alternatively, Canadian petroleum imports change from absorbing 10.90 per cent of total Canadian requirements for all commodity imports,[1] to only 3.25 per cent in scenario SB. The latter share is only slightly higher than the Canadian petroleum import share of total import requirements in the base year 1970, namely 2.95 per cent.

It turns out that when the petroleum import coefficient is lowered to about 0.20,[2] the total net petroleum import savings equals 5,226 million dollars (in year 2000 prices). In fact, the latter is the negative petroleum exports set equal to zero and simultaneously charged to additional capital investment. There are four interesting features to be understood here. First, the figure 5,226 million is *not* the same as the simple difference between 8,192 million (scenario A petroleum imports) and 2,220 million (scenario SB petroleum imports). This is because other aspects of the Canadian and worldwide economic environments change when

---

1 This is for the year 2000 during scenario A.

2 This guarantees that Canadian total domestic requirements for crude petroleum are cut by one-third.

shifting from scenario A to SB. Second, since 72 per cent of petroleum savings is charged to capital, then 3,747 million of Canadian business total capital formation in year 2000 (i.e., of 36,820 million shown in Table 40) is the additional capital investment serving to "replace" petroleum energy. Third, the petroleum import savings is a *net* savings, taking into account the petroleum "cost" of the additional capital investment. The latter cost actually amounts to 106 million dollars in the year 2000. Fourth, one would normally expect increased Canadian imports of capital sectoral items such as machinery, electrical products and scientific instruments,[1] when comparing scenario SB with A. This does not directly materialize because of the altered economic environment (e.g., capital import coefficients are slightly lower in SB than A). However, these sectors do significantly raise their *shares* of total Canadian import requirements in year 2000 when moving to the petroleum energy conservation scenario.

Before closing this chapter it should be noted that Canadian energy outputs for coal and natural gas in scenario SB are not estimated in the usual manner since the corresponding NAR energy outputs are directly altered to reflect fossil-fuel energy conservation. (The NAR petroleum output in year 2000 is not altered and conservation applies strictly to imports.) Thus the Canadian

---

1 These are the most important nonconstruction capital components of the utilities sector capital requirements vector used to form the capital commodity pattern in the petroleum savings exercise.

coal and natural gas outputs in scenario SB were set equal to their respective productions in the earlier scenario S (in both scenarios the two fossil-fuels are not subject to special conservation measures). However, the Canadian mineral resource outputs in year 2000 were linked to the NAR scenario SB by the modified share coefficient method outlined in Chapter II.

TABLE 33 OUTPUT VARIABLE SCENARIO 8

SECTOR	BASE 1970	PROJ. 2000	%SHARES 1970	%SHARES 2000	RATIO	%GROWTH RATES
1	2544.3	5425.7	1.86	1.36	2.13	2.56
2	262.0	559.9	0.19	0.14	2.14	2.56
3	1057.4	2809.0	0.77	0.70	2.66	3.31
4	2509.8	6617.7	1.83	1.66	2.64	3.28
5	9516.4	20519.6	6.95	5.13	2.16	2.59
6	1908.0	4672.5	1.39	1.17	2.45	3.03
7	5129.6	12804.1	3.74	3.20	2.50	3.10
8	3809.3	8773.0	2.78	2.19	2.30	2.82
9	1987.6	7244.7	1.45	1.81	3.64	4.41
10	699.4	2068.9	0.51	0.52	2.96	3.68
11	4064.5	18908.9	2.97	4.73	4.65	5.26
12	1527.3	3894.5	1.11	0.97	2.55	3.17
13	549.1	1031.9	0.40	0.26	1.88	2.13
14	1456.1	3556.5	1.06	0.89	2.44	3.02
15	188.7	695.0	0.14	0.17	3.68	4.44
16	1518.1	4454.5	1.11	1.11	2.93	3.65
17	638.6	2086.6	0.47	0.52	3.27	4.03
18	642.9	2241.4	0.47	0.56	3.49	4.25
19	4644.3	15389.5	3.39	3.85	3.31	4.07
20	735.7	2230.8	0.54	0.56	3.03	3.77
21	496.9	1873.7	0.36	0.47	3.77	4.52
22	3201.1	9383.2	2.34	2.35	2.93	3.65
23	1966.7	5653.6	1.44	1.41	2.87	3.58
24	2787.9	7986.5	2.03	2.00	2.86	3.57
25	427.8	1474.2	0.31	0.37	3.45	4.21
26	685.1	1597.1	0.50	0.40	2.33	2.86
27	27400.7	77132.6	20.00	19.29	2.81	3.51
28	6774.6	21151.2	4.94	5.29	3.12	3.87
29	2198.7	7798.6	1.60	1.95	3.55	4.31
30	13698.7	41952.5	10.00	10.49	3.06	3.80
31	12719.7	39022.3	9.28	9.76	3.07	3.81
32	2358.6	9071.6	1.72	2.27	3.85	4.59
33	3061.9	9516.4	2.23	2.38	3.11	3.85
34	6140.2	19651.8	4.48	4.92	3.20	3.95
35	3120.4	9137.7	2.28	2.29	2.93	3.65
36	0.0	0.0	0.0	0.0	0.0	0.0
37	611.3	1796.5	0.45	0.45	2.94	3.66
38	651.2	1006.6	0.48	0.25	1.55	1.46
39	312.8	724.4	0.23	0.18	2.32	2.84
40	96.6	221.4	0.07	0.06	2.29	2.80
41	0.0	0.0	0.0	0.0	0.0	0.0
42	510.4	1876.8	0.37	0.47	3.68	4.44
43	1270.9	1592.1	0.93	0.40	1.25	0.75
44	293.8	692.8	0.21	0.17	2.36	2.90
45	89.3	725.0	0.07	0.18	8.12	7.23
46	760.0	2802.5	0.55	0.70	3.69	4.45
TOTAL	137024.4	399826.0	100.00	100.00	2.92	3.63

TABLE 34 EXPORT VARIABLE (1970 PRICES) SCENARIO B

SECTOR	BASE 1970	PROJ. 2000	%SHARES 1970	%SHARES 2000	RATIO	%GROWTH RATES
1	65.0	168.9	0.33	0.26	2.60	3.23
2	150.8	432.5	0.78	0.66	2.87	3.57
3	701.2	2027.3	3.61	3.10	2.89	3.60
4	177.1	365.9	0.91	0.56	2.07	2.45
5	918.4	2361.7	4.73	3.61	2.57	3.20
6	94.9	0.0	0.49	0.0	0.0	-100.00
7	2170.4	5516.9	11.18	8.42	2.54	3.16
8	184.9	633.4	0.95	0.97	3.43	4.19
9	852.3	3371.5	4.39	5.15	3.96	4.69
10	35.9	77.4	0.18	0.12	2.16	2.60
11	1897.7	10548.9	9.78	16.11	5.56	5.88
12	37.1	220.8	0.19	0.34	5.95	6.12
13	31.0	125.4	0.16	0.19	4.04	4.76
14	278.6	893.0	1.44	1.36	3.21	3.96
15	135.7	542.9	0.70	0.83	4.00	4.73
16	126.0	600.9	0.65	0.92	4.77	5.35
17	28.9	58.4	0.15	0.09	2.02	2.37
18	67.4	418.1	0.35	0.64	6.20	6.27
19	3480.2	11703.0	17.93	17.87	3.36	4.13
20	208.2	420.6	1.07	0.64	2.02	2.37
21	380.7	1707.1	1.96	2.61	4.48	5.13
22	249.8	593.2	1.29	0.91	2.37	2.93
23	667.6	2077.7	3.44	3.17	3.11	3.86
24	439.7	2411.4	2.27	3.68	5.48	5.84
25	143.2	580.1	0.74	0.89	4.05	4.77
26	84.2	280.9	0.43	0.43	3.34	4.10
27	228.5	737.6	1.18	1.13	3.23	3.98
28	589.2	2383.4	3.04	3.64	4.05	4.77
29	37.4	115.3	0.19	0.18	3.09	3.83
30	0.0	0.0	0.0	0.0	0.0	0.0
31	721.9	2455.5	3.72	3.75	3.40	4.17
32	29.3	74.1	0.15	0.11	2.53	3.14
33	868.3	2945.5	4.47	4.50	3.39	4.16
34	0.0	0.0	0.0	0.0	0.0	0.0
35	0.0	0.0	0.0	0.0	0.0	0.0
36	0.0	0.0	0.0	0.0	0.0	0.0
37	134.0	548.7	0.69	0.84	4.09	4.81
38	182.0	44.6	0.94	0.07	0.24	-4.58
39	78.0	313.1	0.40	0.48	4.01	4.74
40	29.0	97.5	0.15	0.15	3.36	4.12
41	0.0	0.0	0.0	0.0	0.0	0.0
42	386.2	1517.5	1.99	2.32	3.93	4.67
43	687.3	0.0	3.54	0.0	0.0	-100.00
44	126.3	153.9	0.65	0.24	1.22	0.66
45	52.8	233.0	0.27	0.36	4.41	5.07
46	446.2	1830.9	2.30	2.80	4.10	4.82
47	1206.0	3894.0	6.21	5.95	3.23	3.98
TOTAL	19409.4	65482.5	100.00	100.00	3.37	4.14

TABLE 35 EXPORT VARIABLE (2000 PRICES) SCENARIO B

SECTOR	BASE 1970	PROJ. 2000	%SHARES 1970	%SHARES 2000	RATIO	%GROWTH RATES
1	65.0	211.9	0.33	0.32	3.26	4.02
2	150.8	525.1	0.78	0.79	3.48	4.25
3	701.2	2314.5	3.61	3.46	3.30	4.06
4	177.1	421.4	0.91	0.63	2.38	2.93
5	918.4	2331.3	4.73	3.49	2.54	3.15
6	94.9	0.0	0.49	0.0	0.0	-100.00
7	2170.4	7428.8	11.18	11.11	3.42	4.19
8	184.9	553.1	0.95	0.83	2.99	3.72
9	852.3	3069.6	4.39	4.59	3.60	4.36
10	35.9	66.6	0.18	0.10	1.86	2.10
11	1897.7	10264.9	9.78	15.35	5.41	5.79
12	37.1	177.4	0.19	0.27	4.78	5.35
13	31.0	114.2	0.16	0.17	3.68	4.44
14	278.6	874.9	1.44	1.31	3.14	3.89
15	135.7	606.8	0.70	0.91	4.47	5.12
16	126.0	581.9	0.65	0.87	4.62	5.23
17	28.9	74.4	0.15	0.11	2.58	3.20
18	67.4	380.8	0.35	0.57	5.65	5.94
19	3480.2	10848.1	17.93	16.22	3.12	3.86
20	208.2	330.1	1.07	0.49	1.59	1.55
21	380.7	1482.9	1.96	2.22	3.89	4.64
22	249.8	601.0	1.29	0.90	2.41	2.97
23	667.6	1767.0	3.44	2.64	2.65	3.30
24	439.7	2154.0	2.27	3.22	4.90	5.44
25	143.2	458.2	0.74	0.69	3.20	3.95
26	84.2	238.8	0.43	0.36	2.84	3.54
27	228.5	717.3	1.18	1.07	3.14	3.89
28	589.2	2225.0	3.04	3.33	3.78	4.53
29	37.4	96.3	0.19	0.14	2.58	3.21
30	0.0	0.0	0.0	0.0	0.0	0.0
31	721.9	2304.2	3.72	3.44	3.19	3.94
32	29.3	63.1	0.15	0.09	2.15	2.59
33	868.3	2749.8	4.47	4.11	3.17	3.92
34	0.0	0.0	0.0	0.0	0.0	0.0
35	0.0	0.0	0.0	0.0	0.0	0.0
36	0.0	0.0	0.0	0.0	0.0	0.0
37	134.0	1479.9	0.69	2.21	11.05	8.34
38	182.0	104.5	0.94	0.16	0.57	-1.83
39	78.0	712.3	0.40	1.06	9.13	7.65
40	29.0	237.8	0.15	0.36	8.20	7.27
41	0.0	0.0	0.0	0.0	0.0	0.0
42	386.2	1509.9	1.99	2.26	3.91	4.65
43	687.3	0.0	3.54	0.0	0.0	-100.00
44	126.3	1131.5	0.65	1.69	8.96	7.58
45	52.8	199.7	0.27	0.30	3.78	4.53
46	446.2	1767.7	2.30	2.64	3.96	4.70
47	1206.0	3709.1	6.21	5.55	3.08	3.82
TOTAL	19409.4	66885.8	100.00	100.00	3.45	4.21

TABLE 36 IMPORT VARIABLE (1970 PRICES) SCENARIO B

SECTOR	BASE 1970	PROJ. 2000	%SHARES 1970	%SHARES 2000	RATIO	%GROWTH RATES
1	33.2	107.7	0.19	0.16	3.24	4.00
2	54.0	86.2	0.30	0.13	1.60	1.57
3	46.1	99.8	0.26	0.15	2.16	2.61
4	343.4	881.8	1.92	1.30	2.57	3.19
5	775.8	1850.6	4.33	2.73	2.39	2.94
6	253.5	1029.4	1.42	1.52	4.06	4.78
7	671.5	2650.0	3.75	3.91	3.95	4.68
8	1001.2	5530.7	5.59	8.15	5.52	5.86
9	112.7	351.1	0.63	0.52	3.12	3.86
10	57.5	456.7	0.32	0.67	7.94	7.15
11	212.6	1000.1	1.19	1.47	4.70	5.30
12	281.2	1134.0	1.57	1.67	4.03	4.76
13	180.1	1155.3	1.01	1.70	6.41	6.39
14	558.0	1671.1	3.12	2.46	2.99	3.72
15	20.3	40.4	0.11	0.06	1.99	2.32
16	369.0	1989.0	2.06	2.93	5.39	5.78
17	4.8	9.1	0.03	0.01	1.90	2.17
18	229.5	463.0	1.28	0.68	2.02	2.37
19	3353.8	13285.5	18.72	19.59	3.96	4.70
20	109.5	493.0	0.61	0.73	4.50	5.14
21	427.3	1412.3	2.39	2.08	3.31	4.07
22	677.0	2092.7	3.78	3.09	3.09	3.83
23	2232.8	7540.6	12.47	11.12	3.38	4.14
24	1036.9	6731.0	5.79	9.92	6.49	6.43
25	599.2	2522.9	3.35	3.72	4.21	4.91
26	349.7	2023.9	1.95	2.98	5.79	6.03
27	700.6	2535.4	3.91	3.74	3.62	4.38
28	123.1	414.4	0.69	0.61	3.37	4.13
29	12.4	31.1	0.07	0.05	2.50	3.11
30	0.0	0.0	0.0	0.0	0.0	0.0
31	105.9	323.2	0.59	0.48	3.05	3.79
32	28.7	110.8	0.16	0.16	3.86	4.61
33	0.0	0.0	0.0	0.0	0.0	0.0
34	0.0	0.0	0.0	0.0	0.0	0.0
35	0.0	0.0	0.0	0.0	0.0	0.0
36	391.4	803.9	2.19	1.19	2.05	2.43
37	8.6	30.0	0.05	0.04	3.49	4.26
38	78.5	77.1	0.44	0.11	0.98	-0.06
39	0.0	0.0	0.0	0.0	0.0	0.0
40	0.0	0.0	0.0	0.0	0.0	0.0
41	140.0	277.4	0.78	0.41	1.98	2.31
42	33.0	77.2	0.18	0.11	2.34	2.87
43	529.1	377.1	2.95	0.56	0.71	-1.12
44	5.1	7.0	0.03	0.01	1.37	1.05
45	220.4	336.6	1.23	0.50	1.53	1.42
46	122.5	270.8	0.68	0.40	2.21	2.68
47	1422.0	5553.0	7.94	8.19	3.91	4.65
TOTAL	17911.9	67833.0	100.00	100.00	3.79	4.54

TABLE 37 IMPORT VARIABLE (2000 PRICES) SCENARIO B

SECTOR	BASE 1970	PROJ. 2000	%SHARES 1970	%SHARES 2000	RATIO	%GROWTH RATES
1	33.2	135.1	0.19	0.20	4.07	4.79
2	54.0	104.7	0.30	0.15	1.94	2.23
3	46.1	113.9	0.26	0.17	2.47	3.06
4	343.4	1015.6	1.92	1.48	2.96	3.68
5	775.8	1826.8	4.33	2.67	2.35	2.90
6	253.5	3988.4	1.42	5.83	15.73	9.62
7	671.5	3568.4	3.75	5.22	5.31	5.73
8	1001.2	4829.6	5.59	7.06	4.82	5.39
9	112.7	319.7	0.63	0.47	2.84	3.54
10	57.5	393.1	0.32	0.57	6.84	6.62
11	212.6	973.2	1.19	1.42	4.58	5.20
12	281.2	920.8	1.57	1.35	3.27	4.03
13	180.1	1052.0	1.01	1.54	5.84	6.06
14	558.0	1637.2	3.12	2.39	2.93	3.65
15	20.3	45.1	0.11	0.07	2.22	2.70
16	369.0	1926.2	2.06	2.82	5.22	5.66
17	4.8	11.7	0.03	0.02	2.43	3.00
18	229.5	421.7	1.28	0.62	1.84	2.05
19	3353.8	12315.0	18.72	18.00	3.67	4.43
20	109.5	386.9	0.61	0.57	3.53	4.30
21	427.3	1226.8	2.39	1.79	2.87	3.58
22	677.0	2120.1	3.78	3.10	3.13	3.88
23	2232.8	6413.0	12.47	9.37	2.87	3.58
24	1036.9	6012.4	5.79	8.79	5.80	6.03
25	599.2	1992.9	3.35	2.91	3.33	4.09
26	349.7	1720.8	1.95	2.52	4.92	5.46
27	700.6	2465.7	3.91	3.60	3.52	4.28
28	123.1	386.9	0.69	0.57	3.14	3.89
29	12.4	25.9	0.07	0.04	2.09	2.49
30	0.0	0.0	0.0	0.0	0.0	0.0
31	105.9	303.3	0.59	0.44	2.86	3.57
32	28.7	94.3	0.16	0.14	3.29	4.05
33	0.0	0.0	0.0	0.0	0.0	0.0
34	0.0	0.0	0.0	0.0	0.0	0.0
35	0.0	0.0	0.0	0.0	0.0	0.0
36	391.4	896.4	2.19	1.31	2.29	2.80
37	8.6	81.0	0.05	0.12	9.42	7.76
38	78.5	180.8	0.44	0.26	2.30	2.82
39	0.0	0.0	0.0	0.0	0.0	0.0
40	0.0	0.0	0.0	0.0	0.0	0.0
41	140.0	318.0	0.78	0.46	2.27	2.77
42	33.0	76.8	0.18	0.11	2.33	2.86
43	529.1	2220.0	2.95	3.25	4.20	4.90
44	5.1	51.4	0.03	0.08	10.07	8.00
45	220.4	288.5	1.23	0.42	1.31	0.90
46	122.5	261.5	0.68	0.38	2.13	2.56
47	1422.0	5289.3	7.94	7.73	3.72	4.48
TOTAL	17911.9	68410.6	100.00	100.00	3.82	4.57

TABLE 38 TARIFF REVENUE VARIABLE (1970 PRICES) SCENARIO B

SECTOR	BASE 1970	PROJ. 2000	%SHARES 1970	%SHARES 2000	RATIO	%GROWTH RATES
1	0.8	2.6	0.10	0.07	3.24	4.00
2	0.0	0.0	0.00	0.00	1.60	1.57
3	0.8	1.8	0.10	0.05	2.16	2.61
4	2.4	6.1	0.30	0.17	2.57	3.19
5	52.1	124.2	6.49	3.42	2.39	2.94
6	16.9	68.6	2.11	1.89	4.06	4.78
7	16.1	63.5	2.01	1.75	3.95	4.68
8	163.5	903.0	20.38	24.88	5.52	5.86
9	4.4	13.6	0.54	0.37	3.12	3.86
10	7.5	59.9	0.94	1.65	7.94	7.15
11	10.9	51.4	1.36	1.42	4.70	5.30
12	16.2	65.4	2.02	1.80	4.03	4.76
13	21.8	139.9	2.72	3.85	6.41	6.39
14	30.6	91.6	3.81	2.52	2.99	3.72
15	0.1	0.2	0.01	0.00	1.99	2.32
16	31.7	170.8	3.95	4.70	5.39	5.78
17	0.1	0.2	0.01	0.00	1.90	2.17
18	20.5	41.4	2.56	1.14	2.02	2.37
19	64.8	256.6	8.07	7.07	3.96	4.70
20	8.1	36.6	1.01	1.01	4.50	5.14
21	4.1	13.7	0.52	0.38	3.31	4.07
22	64.3	198.9	8.02	5.48	3.09	3.83
23	100.9	340.8	12.58	9.39	3.38	4.14
24	107.9	700.5	13.45	19.30	6.49	6.43
25	22.2	93.6	2.77	2.58	4.21	4.91
26	31.7	183.7	3.96	5.06	5.79	6.03
27	0.0	0.0	0.0	0.0	0.0	0.0
28	0.0	0.0	0.0	0.0	0.0	0.0
29	0.0	0.0	0.0	0.0	0.0	0.0
30	0.0	0.0	0.0	0.0	0.0	0.0
31	0.0	0.0	0.0	0.0	0.0	0.0
32	0.0	0.0	0.0	0.0	0.0	0.0
33	0.0	0.0	0.0	0.0	0.0	0.0
34	0.0	0.0	0.0	0.0	0.0	0.0
35	0.0	0.0	0.0	0.0	0.0	0.0
36	0.0	0.0	0.0	0.0	0.0	0.0
37	0.0	0.0	0.00	0.00	3.49	4.26
38	0.0	0.0	0.00	0.00	0.98	-0.06
39	0.0	0.0	0.0	0.0	0.0	0.0
40	0.0	0.0	0.0	0.0	0.0	0.0
41	0.0	0.0	0.0	0.0	0.0	0.0
42	0.0	0.0	0.00	0.00	2.34	2.87
43	1.2	0.9	0.16	0.02	0.71	-1.12
44	0.0	0.0	0.00	0.00	1.37	1.05
45	0.1	0.1	0.01	0.00	1.53	1.42
46	0.2	0.4	0.02	0.01	2.21	2.68
TOTAL	802.1	3629.9	100.00	100.00	4.53	5.16

TABLE 39 TARIFF REVENUE VARIABLE (2000 PRICES) SCENARIO B

SECTOR	BASE 1970	PROJ. 2000	%SHARES 1970	%SHARES 2000	RATIO	%GROWTH RATES
1	0.8	3.3	0.10	0.09	4.07	4.79
2	0.0	0.0	0.00	0.00	1.94	2.23
3	0.8	2.1	0.10	0.06	2.47	3.06
4	2.4	7.0	0.30	0.20	2.96	3.68
5	52.1	122.6	6.49	3.51	2.35	2.90
6	16.9	265.7	2.11	7.61	15.73	9.62
7	16.1	85.5	2.01	2.45	5.31	5.73
8	163.5	788.5	20.38	22.57	4.82	5.39
9	4.4	12.4	0.54	0.35	2.84	3.54
10	7.5	51.5	0.94	1.47	6.84	6.62
11	10.9	50.0	1.36	1.43	4.58	5.20
12	16.2	53.1	2.02	1.52	3.27	4.03
13	21.8	127.4	2.72	3.65	5.84	6.06
14	30.6	89.7	3.81	2.57	2.93	3.65
15	0.1	0.2	0.01	0.00	2.22	2.70
16	31.7	165.4	3.95	4.73	5.22	5.66
17	0.1	0.2	0.01	0.01	2.43	3.00
18	20.5	37.7	2.56	1.08	1.84	2.05
19	64.8	237.8	8.07	6.81	3.67	4.43
20	8.1	28.7	1.01	0.82	3.53	4.30
21	4.1	11.9	0.52	0.34	2.87	3.58
22	64.3	201.5	8.02	5.77	3.13	3.88
23	100.9	289.9	12.58	8.30	2.87	3.58
24	107.9	625.7	13.45	17.91	5.80	6.03
25	22.2	73.9	2.77	2.12	3.33	4.09
26	31.7	156.1	3.96	4.47	4.92	5.46
27	0.0	0.0	0.0	0.0	0.0	0.0
28	0.0	0.0	0.0	0.0	0.0	0.0
29	0.0	0.0	0.0	0.0	0.0	0.0
30	0.0	0.0	0.0	0.0	0.0	0.0
31	0.0	0.0	0.0	0.0	0.0	0.0
32	0.0	0.0	0.0	0.0	0.0	0.0
33	0.0	0.0	0.0	0.0	0.0	0.0
34	0.0	0.0	0.0	0.0	0.0	0.0
35	0.0	0.0	0.0	0.0	0.0	0.0
36	0.0	0.0	0.0	0.0	0.0	0.0
37	0.0	0.0	0.00	0.00	9.42	7.76
38	0.0	0.0	0.00	0.00	2.30	2.82
39	0.0	0.0	0.0	0.0	0.0	0.0
40	0.0	0.0	0.0	0.0	0.0	0.0
41	0.0	0.0	0.0	0.0	0.0	0.0
42	0.0	0.0	0.00	0.00	2.33	2.86
43	1.2	5.2	0.16	0.15	4.20	4.90
44	0.0	0.1	0.00	0.00	10.07	8.00
45	0.1	0.1	0.01	0.00	1.31	0.90
46	0.2	0.4	0.02	0.01	2.13	2.56
TOTAL	802.1	3493.9	100.00	100.00	4.36	5.03

TABLE 40 TOTAL CAPITAL FORMATION BY SECTOR OF ORIGIN SCENARIO B

SECTOR	BASE 1970	PROJ. 2000	%SHARES 1970	%SHARES 2000	RATIO	%GRUWTH RATES
1	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0	0.0
8	4.3	13.0	0.04	0.04	3.03	3.76
9	13.6	35.6	0.13	0.10	2.62	3.26
10	153.5	507.2	1.41	1.38	3.30	4.06
11	0.0	0.0	0.0	0.0	0.0	0.0
12	0.0	0.0	0.0	0.0	0.0	0.0
13	8.2	18.9	0.08	0.05	2.30	2.82
14	0.0	0.0	0.0	0.0	0.0	0.0
15	0.0	0.0	0.0	0.0	0.0	0.0
16	0.0	0.0	0.0	0.0	0.0	0.0
17	0.0	0.0	0.0	0.0	0.0	0.0
18	13.0	24.8	0.12	0.07	1.91	2.18
19	631.6	2277.5	5.81	6.19	3.61	4.37
20	248.3	660.0	2.28	1.79	2.66	3.31
21	208.8	668.7	1.92	1.82	3.20	3.96
22	156.0	498.0	1.43	1.35	3.19	3.94
23	2046.0	6435.4	18.81	17.48	3.15	3.89
24	860.0	3516.0	7.91	9.55	4.09	4.81
25	191.2	715.3	1.76	1.94	3.74	4.50
26	21.5	91.4	0.20	0.25	4.25	4.94
27	147.5	618.4	1.36	1.68	4.19	4.89
28	0.0	0.0	0.0	0.0	0.0	0.0
29	0.0	0.0	0.0	0.0	0.0	0.0
30	5181.2	18255.1	47.64	49.58	3.52	4.29
31	858.2	2165.5	7.89	5.88	2.52	3.13
32	0.0	0.0	0.0	0.0	0.0	0.0
33	132.3	319.7	1.22	0.87	2.42	2.98
34	0.0	0.0	0.0	0.0	0.0	0.0
35	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	10875.2	36820.5	100.00	100.00	3.39	4.15

VII COMPARATIVE ANALYSIS OF ALTERNATIVE SCENARIOS

So far the analysis has focused directly on the sectoral results of the various scenarios. In this Chapter we first summarize the 1970 data base and the four scenarios in terms of the major macrovariable components of GDP. The macrocomparisons are quite revealing for policy purposes. There is particular analysis of balance-of-trade and terms-of-trade in the four scenarios. This is followed by the results of special calculations designed to analyse Canadian sectoral international trade in the year 2000. These calculations are performed only for scenarios A and SB. Some further policy implications then follow.

VII.1 Macrocomparisons of Four Scenarios

The principal results of this section are found in Tables 41 and 42. Again, the results should speak for themselves, but some explanation is also necessary.

The 1970 data are not solely based on 1970 observations; some modifications are required to conform with the Canadian projection model. For example, inventory change in 1970, 580 million dollars, is essentially estimated from an inventory change equation 1961-1971 which abstracts from cyclical influences. Also, as explained in Chapter III, exports and imports omit certain inter-government service transactions. Thus, the grand total of items 3, 4, 5, 6, 7 plus 8 minus 9 does not quite yield the GDP data base for 1970[1] (though

---

1 GDP is by definition equal to this grand total. The definition is exact for the four scenarios in the year 2000.

the statistical error is relatively small; less than 1 per cent). Some of the data shown in Table 41 comes from the sectoral (total) tables of previous chapters. Total exports in 1970, i.e., 19,409 million, is the same as that given in Table 2. Total imports, 17,110 million according to GDP accounts, equals total imports including total tariff revenue from Table 4 (17,912 million) minus total tariff revenue from Table 6 (802 million). Business total capital formation in 1970 comes directly from Table 8 (10,875 million) *after* multiplication by a constant scalar (1.044) to account for the indirect taxes on business investment in GDP. In fact, the total commodity spending levels of personal consumption expenditures and government total net expenditures have also been adjusted by appropriate scalar multipliers[1] to conform with the GDP notion in market prices. Similar remarks apply to the macrodata shown for the year 2000 in scenarios A, S, T and SB.

Before continuing it might be noted that choosing 1970 as the base year for comparisons has the disadvantage that total imports are relatively depressed in that year (i.e., relative to the situation in 1969 and 1971). However, this fact will not affect the *differential impact* analysis of the four scenarios stressed below. At the same time, since imports are generally depressed in 1970, the import coefficients in that year are also generally below trend values. For this reason, the base year import coefficients used for projecting these coefficients

---

1 These scalars account for primary factor final demand as well as indirect taxes.

to year 2000 (see Chapter II) are not the actual 1970 observations, but the 1970 trend values obtained from linear time series regressions 1961-1974.

With this background Tables 41 and 42 yield some interesting results. In all scenarios, the growth rates for both exports and imports are significantly greater than the GDP rate of growth. Thus Canadian international trade involves a larger proportion of GDP in the year 2000 than 1970. Actually this result is common to all regions in the U.N. world model -- the phenomenon of growing global interdependence -- and Canada is no exception. (The mechanism by which this occurs is the rising shares of imports in regional requirements for most manufacturing production coupled with more specialized resource production and trade as higher quality reserves are used up in different regions.) Canadian personal consumption more than matches GDP growth in most scenarios and this will be further explained below. Business total capital formation growth is also significantly greater than GDP since capital-output ratios (sector of destination) typically[1] rise and particular sectors with relatively high capital-intensity (utilities, communications and transportation) have relatively high sectoral output growth rates. Residential construction investment experiences slow growth 1970-2000, indirectly reflecting the low rate of new household formation. Inventory change is also slow because

---

1 Except in most manufacturing sectors.

most inventories involve agricultural and food processing sectoral commodities which, as we have seen, experience below-average growth rates. Finally, the reader will recall that in the Canadian model, government expenditures are strictly exogenous and tied to GDP growth.

Thus, the four scenarios, even though based on different domestic and external environments, appear to have a great deal in common insofar as Canadian macroimplications are concerned. However, there are also some critical differences discussed next.

VII.2 Balance-of-Trade Analysis

Reference is now made to Table 43. The balance-of-trade data, expressed as a proportion of GDP in 1970 prices, comes directly from the previous Table 41. For example, in the year 1970, the balance-of-trade is positive (surplus) and equal to 19,409 minus 17,110, or 2,299 million which as a proportion of GDP (87,026) yields +2.64 per cent. It should again be noted that the balance-of-trade concept used in the Canadian model is not comprehensive (see Chapter III) and should certainly not be confused with balance-of-payments (which includes private capital flows, public aid transfers and foreign interest payments).[1] The important point is that the balance-of-trade concept is the same in 1970 and the four scenarios, so permitting a comparative differential impact analysis.

---

1 The world model does have a reasonably comprehensive balance-of-payments coverage which was not followed in the case of the Canadian model.

Table 43 reveals that the four scenarios produce different balance-of-trade results ranging from positive to negative (deficit). Even though the growth rate of imports is greater than the corresponding export growth in all four scenarios (see Table 42), there is a small surplus balance in two scenarios, S and SB (all measured in 1970 prices). The reason for this is obvious -- the relatively large surplus balance in the base year. Also, the fact that the surplus balance diminishes or disappears 1970-2000 is primarily responsible for total personal consumption growth in excess of GDP growth in scenarios A, S and T. (It is shown in Appendix A, and stated in Chapter II, that the Canadian model treats personal consumption, in part, as a residual required to guarantee a fixed GDP target.) However, in scenario SB, total consumption merely keeps pace with GDP growth because of the extra business investment required to "replace" petroleum energy savings.

It is more useful for policy purposes to analyse balance-of-trade in current prices. This is also shown in Table 43 where the base year results remain in 1970 prices and all projected scenarios are in relative (normalized) prices for the year 2000.[1] The growth rates for both total exports and total imports measured in current prices are invariably greater than the corresponding rates expressed in 1970 prices. This is because Canada becomes both an important exporter and

---

1 The derivation of the current prices for 2000 is given in Chapter III and Appendix B.

importer of resource-intensive products while relative prices for the latter generally tend to increase over the period 1970 to 2000. In fact, the relative price changes for all tradable commodities can be obtained by merely taking the ratios of sectoral exports (or imports) in current prices to the corresponding exports (or imports) in 1970 prices directly from tables of previous chapters. Thus, relative prices increase for important Canadian exports such as grain, copper and primary metal processing; relative prices also increase (dramatically) for important imports of crude and refined petroleum.

The balance-of-trade results for the year 2000, expressed in current prices, are probably the most significant results yielded by this study. Moreover, these results are not sensitive to reasonable changes in the theoretical assumptions (including the linkage mechanism) of the Canadian model. The difference between balance-of-trade in 1970 prices and that in current prices is determined by changes in the Canadian terms-of-trade 1970 to 2000.[1] It is seen that for scenarios A, S and T, the Canadian terms-of-trade deteriorate slightly. This means that Canadian imports in current prices relative to the same imports in constant 1970 prices grow at a higher rate than Canadian exports in current prices relative to exports in 1970 prices. The terms-of-trade ratios in scenarios A, S and T are, therefore, less than unity. On the other hand, Canadian terms-of-trade for scenario SB is marginally greater than unity.

---

1 The formula used to measure terms-of-trade is given in Appendix A.

It is not difficult to identify some of the main components contributing to the sign and magnitude of the Canadian balance-of-trade (current prices). For example, in scenario A the trade deficit (71,576 minus 63,571) equals 8,005 million or 3.18 per cent of GDP.[1] The service trade deficit (sectors 27 plus 47) is 3,619 million; the crude petroleum trade deficit (sector 43) equals 7,874 million. An overall balance-of-trade deficit of this magnitude experienced in scenario A, is rather high when it is realized that the measure does not account for probable additional international payments deficits such as net foreign interest and dividend payments as well as Canadian net foreign aid commitments in the year 2000. Thus, the Canadian GDP growth rate of 3.6 per cent, with personal consumption growing at an even higher rate, may not be sustainable in business-as-usual conditions.[2] In scenario S the situation is more hopeful mainly because of slower growth in endogenous imports. But this result is mainly dependent on a cut in Canadian exogenous population growth. In scenario T Canada enjoys increased export opportunities, but at the expense of significantly higher imports -- the balance-of-trade deficit is worsened. Once more it is easy to check that the Canadian crude petroleum trade deficit is primarily responsible for the

---

1 It might be noted that Canadian GDP has not been translated into current (relative) prices from constant prices, but there is a strong reason to assume that GDP will change only slightly if this is done.

2 Note that the Canadian balance-of-trade situation is considerably better than that of the United States (the "residual" of NAR after removing Canada). The latter's trade deficit as a proportion of GDP in year 2000 is estimated as 4.78 per cent in scenario A.

overall balance-of-trade deficits in scenarios S and T. Hence, the case for a petroleum energy conservation scenario.

We have already seen (Chapter VI) that in scenario SB the Canadian petroleum trade deficit is cut drastically to 2,220 million (current prices) in the year 2000. The result is a small balance-of-trade surplus. The terms-of-trade move marginally in favour of Canada in this scenario because crude petroleum, with a very high relative price change 1970 to 2000, receives much less weight on the import side. The growth rate of personal consumption expenditures in SB is down as compared to scenario A, but the overall growth situation appears sustainable. Thus, the implications of worldwide (including Canada) energy conservation have some attractive features for Canada and they provide a sense of direction for future policy research.

VII.3 Intersectoral Trade Analysis

This section contains the results of special calculations designed to reveal the sectoral sources of Canadian comparative advantage and disadvantage in international trade,[1] 1970 and 2000. The base year results are, of course, derived from actual observations. The projection results for the year 2000 come from two alternative scenarios, A and SB. The calculations were not performed for scenarios S and T since there is strong reason to suppose that the results would be very similar to those of scenario A.

---

1 The notion of *revealed* comparative advantage has primarily a pragmatic rather than a theoretical orientation; see Postner [28].

To understand the results, some background is necessary. Each of the calculations shown in Tables 44 to 47 yields the *change* in Canadian sectoral gross output, expressed as a proportion of Canadian total sectoral output, that follows from existing Canadian international trade. The sectoral changes could be either positive or negative depending on whether international trade ultimately stimulates domestic output or displaces domestic output (respectively). The calculations account not only for the direct impacts of Canadian trade (i.e., impacts on exporting or import-displacing sectors), but also for the indirect impacts on all sectors ultimately supplying raw materials and intermediate inputs to the sectors directly affected by international trade. The precise mathematical formula used in these calculations is given in Appendix A, together with some alternative formulae.[1] Under certain assumptions it can be shown that the calculations yield a rank-ordering of Canadian sectors, from high to low, that corresponds with the notion of sectors ranked from "best source of comparative advantage" to "least source of comparative advantage". Those sectors which are most positively affected (relative to output) by international trade, are revealed as the ones with best comparative advantage; those sectors most negatively affected (relative to output) by trade have the least comparative advantage (or the most comparative disadvantage).

---

1 If one is interested only in the direct impacts of trade, then the appropriate formula is simply: exports minus imports divided by total output, for each sector. This simple formula yields results that are generally and nonuniformly smaller (in absolute value) than the formula actually used. The reader could calculate the simple formula directly from tabular data of previous Chapters.

It should be clear that the calculations are only performed for Canadian sectors producing output capable of being displaced by tradable commodities. In fact, the calculations were also omitted for sectors where trade (exports or imports) is a negligible proportion of domestic output. Thus, no results are recorded for sectors numbers 17, 27 to 36, 41 and 47. Also some sectors were combined in the calculations because of statistical data limitations -- oilcrops was combined with grains, the latter having about three-quarters of the total weight; copper, zinc and lead were combined, copper having about two-thirds of the weight (the latter combination is called base metals in the tables). Finally, since all calculations involve proportional changes in sectoral outputs (expressed as a percentage), the results do not essentially depend on whether 1970 constant prices or current prices are used. It was most convenient to carry out the calculations in 1970 prices.

Table 44 gives the results for the 13 highest ranking sectors in 1970 and the scenario A year 2000. Both the ranks and the actual calculations are presented. Thus, e.g., Canadian international trade in 1970 results in a *positive* impact on the fertilizer sector equal to 83.5 per cent of Canadian total fertilizer production in that year. It is most interesting to compare the calculations in 1970 and 2000 (scenario A). Generally speaking, the ranking of the sectors are quite similar, but there are some important exceptions. By the year 2000, nickel and petroleum are no longer ranked among the top 13 sectors

(and, in fact, are negatively affected by international trade). Natural gas, base metals and primary metal processing are still ranked high, but clearly lose some of their comparative advantage. On the other hand, Canada's comparative advantage in grains, wood and paper products and residual agriculture are at least as strong in the year 2000 as in 1970. Thus, we could say that Canada experiences a distinct, but subtle, shift away from *nonrenewable* or resource-based sectors towards *renewable* resource-based sectors as the prime sources of comparative advantage in international trade. However, it should be recalled that scenario A embodies a considerable balance-of-trade deficit[1] and might not be a realistic scenario.

Table 45 compares scenario SB with 1970 in terms of the top 13 ranking sectors. The results are very similar to those in the previous table. We may claim that the prime sectoral sources of Canadian comparative advantage in year 2000 are largely invariant to the particular scenario analysed. Some minor differences do occur (e.g., aircraft and metal processing rank and value higher in scenario SB than A), but the main conclusion stated in the previous paragraph[2] continues to hold. This conclusion has important policy implications and again provides guidelines for future policy research concerning Canadian international trade.

---

1 This explains why the calculated values of Table 44 for scenario A are, on-the-average, lower than the base year.

2 That is, the shift towards renewable resource-based comparative advantage.

Tables 46 and 47 contain the analysis of Canadian comparative *disadvantage* in international trade -- the 13 lowest ranking sectors (ranked, in terms of value, from low to high). Thus, in 1970 Canadian trade had a *negative* impact on the coal production sector equal to 160.3 per cent of Canadian total coal production.[1] Here the effect of moving from 1970 to the year 2000 is somewhat greater than in the two previous tables. Coal is no longer a prime source of comparative disadvantage in 2000. On the other hand, the petroleum sector becomes an important source of comparative disadvantage, especially in scenario A, but the situation is considerably mitigated by energy conservation in scenario SB. The labour-intensive sectors: textiles, rubber products, miscellaneous manufactures, electrical products and furniture, are all either ranked "higher" or dramatically valued "higher" (absolute terms) in the year 2000 compared to 1970. This latter result is quite invariant with respect to scenarios -- Canada's basic comparative disadvantage in labour-intensive production continues to grow undiminished 1970 to 2000. (It should be noted that the developing regions in the world model, particularly Asia low, possess a growing comparative advantage in labour-intensive production during the period analysed.) At the same time, though, some other manufacturing sectors (nonmetallic mineral products, aircraft) drop out as sources of Canadian comparative disadvantage.

---

1 Alternatively, Canadian trade results in a displacement of coal production equal to 160.3 per cent of domestic output.

Further light is thrown on Canadian international trade in the next section.

VII.4 Intrasectoral Trade Analysis

So far the analysis has focused on Canadian intersectoral trade -- sectoral imports are subtracted from the corresponding sectoral exports and the calculations are essentially based on the resulting net exports (positive or negative). A glance at the tables of previous chapters shows that a good deal of Canada's international trade, especially secondary manufacturing trade, is characterized by high levels of exports and imports simultaneously for the same sectors. This phenomenon is know as intrasectoral international trade. The phenomenon is partly a result of sectoral aggregation,[1] but is also due to the high level of product differentiation among traded manufactured commodities. An explicit recognition of intrasectoral trade is essential for the purpose of interpreting Canadian international trade patterns. For example, it is seen (Tables 2 and 34) that some of the best Canadian future export opportunities occur in the manufacturing sectors: wood and paper products, fertilizers, nonindustrial chemicals, nonmetallic mineral products, aircraft and parts and electrical products. The export growth rates for these sectors are significantly greater than average in both scenarios A and SB. Nevertheless, only some of these sectors rank high in terms of comparative advantage

---

1 The aggregation classification problem in the Canadian model has been mentioned before and is further discussed in the next chapter.

(Tables 44 and 45) mainly because the corresponding sectoral import growth rates may or may not also be high. The following analysis focuses on Canadian sectoral export levels relative to import levels and their changes, 1970 to 2000.

Table 48 presents a ranking and measure of Canadian intrasectoral trade for the manufacturing sectors of the model (numbers 5 to 26 inclusive). Only the 10 highest ranking sectors are shown. The specific measure used is gauged to range between 100 per cent and 0 per cent. If exports equal imports of a sector, then the measure equals 100; when there are exports and no imports or vice versa, the measure yields 0; if exports equal one-half of imports or vice versa, the measure is 66.6 per cent; and so on.[1] Thus, the particular measure (and ranking) of Canadian intrasectoral trade has some desirable properties.

What do we find? There are some critical changes in Canadian intrasectoral trade, 1970 to 2000. Furniture and petroleum refining completely drop out of the picture by the year 2000 as exports fall dramatically relative to imports. Intrasectoral trade improves for transportation equipment and primary metal processing because imports catch up with exports as compared to 1970. Intrasectoral trade also shoots up for nonmetallic mineral products where, now, Canadian exports virtually catch up with corresponding imports. It is also seen that the high level of Canadian intrasectoral motor vehicle trade, largely reflecting the Auto Pact Agreement, is not such a dominant factor in the

---

1 A complete exposition of this measure is given in Grubel [16] and the explicit calculation is shown in Appendix A.

year 2000 as in 1970. By the year 2000, there are four other sectors experiencing intrasectoral trade at about the same level as the motor vehicle sector. This result is also quite invariant with respect to the particular scenario analysed.

Finally, it might be noted that the measurement results in Table 48 are affected by the unbalanced (deficit) nature of Canadian trade in manufactures. The overall deficit in this trade is considerably larger in scenario A than 1970; the deficit for scenario SB is smaller than A, but also larger than 1970.[1] This has the effect of producing, on-the-average, somewhat lower intrasectoral trade results in 2000 than in base year 1970, but the rank-orderings are certainly not affected. Thus one should be appropriately cautious about stating whether Canadian manufacturing intrasectoral trade as a whole has increased or decreased over the time period 1970 to 2000.

---

1 The deficits as a proportion of total manufacturing trade (exports plus imports) in 1970, 2000A and 2000SB are: 3.8 per cent, 13.9 per cent and 10.2 per cent, respectively.

Table 41

Macrovariable Comparisons, 1970 and 2000
(1970 prices in millions of dollars)

	1970	2000A	2000S	2000T	2000SB
1. Gross domestic product	87,026	251,477	241,183	301,196	250,167
2. Population (in thousands)	21,297	29,258	28,065	29,258	29,258
3. Personal consumption	50,152	152,727	142,403	184,510	143,874
4. Government expenditures	19,766	57,108	54,779	68,404	56,793
5. Business total investment	11,356	35,114	33,468	45,246	38,448
6. Residential construction	3,557	9,127	8,190	12,500	8,523
7. Inventory change	580	1,252	1,181	1,750	1,249
8. Total exports	19,409	62,104	63,887	72,488	65,483
9. Total imports	17,110	65,955	62,725	83,702	64,203
		Percentage Shares of Gross Domestic Product			
Personal consumption	57.63	60.73	59.04	61.26	57.51
Government expenditures	22.71	22.71	22.71	22.71	22.70
Business total investment	13.05	13.96	13.88	15.02	15.37
Residential construction	4.09	3.63	3.39	4.15	3.41
Inventory change	0.67	0.50	0.49	0.58	0.50
Total exports	22.30	24.70	26.49	24.07	26.18
Total imports (negative)	-19.67	-26.23	-26.01	-27.79	-25.66

Table 42

Macrovariable Growth Rates, 1970 to 2000

(Percentage rates of growth)[1]

	A	S	T	SB
Gross domestic product	3.60	3.46	4.23	3.58
Population	1.06	0.92	1.06	1.06
Personal consumption	3.78	3.54	4.44	3.57
Government expenditures	3.60	3.46	4.23	3.58
Business total investment	3.83	3.67	4.72	4.15
Residential construction	3.19	2.82	4.28	2.96
Inventory change	2.60	2.40	3.75	2.59
Total exports	3.95	4.05	4.49	4.14
Total imports	4.60	4.43	5.43	4.51

1 Based on 1970 prices.

Table 43

Balance of Trade and Terms of Trade Analysis, 1970 and 2000

(Based on relative prices for the year 2000)

	1970[1]	2000 A	2000 S	2000 T	2000 SB
Total exports	19,409	63,571	65,560	74,206	66,886
Total imports	17,110	71,576	67,795	91,189	64,917
		Growth rates, 1970 to 2000			
Total exports		4.03	4.14	4.57	4.21
Total imports		4.89	4.70	5.74	4.55
		Percentage of gross domestic product			
Balance-of-trade (1970 prices)	+2.64	-1.53	+0.48	-3.72	+0.51
Balance-of-trade (current prices)	+2.64	-3.18	-0.93	-5.64	+0.79
		Ratio estimate			
Terms-of-trade	1.000	0.943	0.949	0.939	1.010

1 1970 data are in 1970 prices.

Table 44

Comparative Advantage Ranks and Values, 1970 and Scenario A (2000)

	1970		2000 A	
Rank	Sector Name	Value	Sector Name	Value
1.	Fertilizers	83.5	Fertilizers	84.1
2.	Iron ore	74.7	Iron ore	75.2
3.	Grains, oil crops	56.0	Grains, oil crops	65.7
4.	Paper products	45.6	Residual mining	52.1
5.	Wood products	43.9	Wood products	47.8
6.	Natural gas	42.6	Paper products	44.3
7.	Residual mining	42.1	Base metals	26.6
8.	Base metals	39.1	Natural gas	18.5
9.	Nickel ore	27.9	Residual agriculture	18.4
10.	Primary metal processing	24.3	Livestock	1.3
11.	Residual agriculture	13.0	Food processing	0.6
12.	Other transportation equipment	12.9	Primary metal processing	-1.6
13.	Petroleum	9.6	Aircraft	-2.4

Table 45

Comparative Advantage Ranks and Values, 1970 and Scenario SB (2000)

Rank	1970 Sector Name	1970 Value	2000 SB Sector Name	2000 SB Value
1.	Fertilizers	83.5	Fertilizers	85.7
2.	Iron ore	74.7	Iron ore	76.3
3.	Grains, oil crops	56.0	Grains, oil crops	67.3
4.	Paper products	45.6	Residual mining	52.9
5.	Wood products	43.9	Wood products	48.7
6.	Natural gas	42.6	Paper products	46.7
7.	Residual mining	42.1	Base metals	30.2
8.	Base metals	39.1	Natural gas	22.4
9.	Nickel ore	27.9	Residual agriculture	20.8
10.	Primary metal processing	24.3	Aircraft	10.4
11.	Residual agriculture	13.0	Primary metal processing	4.5
12.	Other transportation equipment	12.9	Livestock	2.7
13.	Petroleum	9.6	Food processing	2.0

Table 46

Comparative Disadvantage Ranks and Values, 1970 and Scenario A (2000)

	1970		2000 A	
Rank	Sector Name	Value	Sector Name	Value
1.	Coal	-160.3	Scientific instruments	-161.8
2.	Scientific instruments	-114.9	Other manufacturing	-132.9
3.	Machinery	-89.0	Rubber products	-127.7
4.	Other manufacturing	-45.2	Machinery	-122.1
5.	Textiles	-33.5	Petroleum	-118.6
6.	Electrical products	-30.2	Textiles	-92.7
7.	Rubber products	-30.1	Electrical products	-81.3
8.	Non-metallic mineral products	-28.1	Industrial chemicals	-43.2
9.	Industrial chemicals	-25.7	Other chemicals	-35.9
10.	Metal products	-21.4	Metal products	-32.6
11.	Aircraft	-19.3	Publishing	-31.2
12.	Publishing	-18.0	Motor vehicles	-31.1
13.	Other chemicals	-15.5	Furniture	-20.9

Table 47

Comparative Disadvantage Ranks and Values, 1970 and Scenario SB (2000)

Rank	1970 Sector Name	1970 Value	2000 SB Sector Name	2000 SB Value
1.	Coal	-160.3	Scientific instruments	-143.5
2.	Scientific instruments	-114.9	Other manufacturing	-127.6
3.	Machinery	-89.0	Rubber products	-119.8
4.	Other manufacturing	-45.2	Machinery	-108.4
5.	Textiles	-33.5	Textiles	-90.5
6.	Electrical products	-30.2	Electrical products	-71.3
7.	Rubber products	-30.1	Petroleum	-53.5
8.	Non-metallic mineral products	-28.1	Industrial chemicals	-37.9
9.	Industrial chemicals	-25.7	Other chemicals	-33.4
10.	Metal products	-21.4	Metal products	-29.9
11.	Aircraft	-19.3	Publishing	-28.5
12.	Publishing	-18.0	Furniture	-20.6
13.	Other chemicals	-15.5	Motor vehicles	-17.5

Table 48

Intrasectoral Trade Ranks and Values, 1970 and 2000

	1970		2000 A		2000 SB	
Rank	Sector Name	Value	Sector Name	Value	Sector Name	Value
1.	Motor vehicles	98.1	Aircraft	98.0	Non-metallic mineral products	94.9
2.	Aircraft	94.2	Non-metallic mineral products	95.8	Transportation equipment	92.8
3.	Food processing	91.6	Food processing	91.7	Motor vehicles	92.7
4.	Furniture	76.9	Transportation equipment	90.0	Aircraft	91.5
5.	Transportation equipment	68.9	Motor vehicles	88.9	Food processing	89.8
6.	Industrial chemicals	66.6	Industrial chemicals	68.6	Industrial chemicals	69.7
7.	Electrical products	59.6	Primary metal processing	66.9	Primary metal processing	64.9
8.	Petroleum refining	54.5	Electrical products	48.6	Electrical products	53.8
9.	Metal products	53.9	Other chemicals	45.3	Other chemicals	47.4
10.	Other chemicals	50.9	Metal products	43.9	Metal products	45.2

VIII SUGGESTIONS FOR FUTURE RESEARCH

The methodology and results of this study have been described in a simple and straight-forward manner. In particular, we have not considered alternative methodologies and possible extensions of results. The emphasis is on explaining what *has* been done rather than justifying what has not been done. Nevertheless, due to the simple nature of the Canadian projection model, there certainly are opportunities to modify and extend the model in various directions. These directions, in some cases, take us outside the limitations of the U.N. world model to which Canada is linked. But in all cases described below, substantive links remain with the world model. We do *not* consider a Canadian long-term model which is essentially independent of the global interdependence phenomenon featured by the world model.

VIII.1 Short-Term Research Suggestions

First it is clear that all results of the Canadian model can be improved by more careful and more sophisticated projection of coefficients. This is especially true for: input-output current account coefficients and the personal consumption expenditures pattern[1] projected to the year 2000. The results could also benefit from the availability of updated input-output structural accounts data 1961-1974 expected to be released in a few months after this writing.[2] However, it is believed that

---

1 There is a technical problem of consumer demand complementarity neglected by our methods.

2 See Appendix B for more complete discussion.

such improvements would be mainly marginal (assuming that the overall structure of the Canadian model and links to the world model remain the same). For example, the macroresults of the last chapter would probably be very little affected, but the sectoral international trade calculations may change in some cases (although the rankings would probably be essentially invariant). Also, some important conclusions of the study could change if implicit assumptions are not realized. The projected Canadian grain exports and paper products exports, which play a large role in maintaining Canadian balance-of-trade viability, may not be forthcoming if domestic transportation bottlenecks are not removed or if domestic plant and equipment are not modernized (respectively). So the results of the study provide material for a policy-orientated analysis. All this is by way of introduction to some concrete suggestions for future research.

One outstanding problem that permeates the study is the question of sectoral aggregation. We have seen that results are sometimes ambiguous or difficult to interpret because of this problem. The aggregation level for the Canadian model was, in effect, chosen to match the world model and thus maximize the use of the world model in the Canadian projections (this was discussed at length in Chapter II). Nevertheless it is not essential to limit the Canadian model to the world model aggregation. Suppose we desire a finer disaggregation of the nonresource tradable sectors. Then to project Canadian nonresource exports to the year 2000, some assumptions and analysis would be needed *additional to* the Canadian export shares of NAR exports methodology

explained in Chapter II. The former could be based on extrapolation of observed historical trends of Canadian disaggregated exports,[1] with the aggregation projection constrained to satisfy the standard Canadian export methodology link to the world model. Similarly, Canadian resource productions to the year 2000 could be projected at an alternative disaggregation level using additional data sources[2] and constraining to the world model NAR linkage guidelines. Again some appropriate assumptions would be required. Note that the Canadian model import (coefficients) projections are not dependent on the world model aggregation level and neither are most other elements of the Canadian model. Thus a model, paralleling the one built for this study, can be constructed and essentially linked to the world model, at an appropriately finer level of sectoral disaggregation.

It is believed that the payoff on further disaggregation would be particularly high for a study of this nature. Table 49 provides some guidelines for this task. The suggested sectoral disaggregations are mainly motivated towards clarifying the Canadian sectoral sources of comparative advantage and disadvantage in the projection year 2000. Some sectors (e.g., food processing and primary metal processing) which do not reveal prime sources of comparative advantage or disadvantage at the present model aggregation level, may do so with further disaggregation. It

---

1 See Appendix B for potential data sources.

2 See Appendix B for potential data sources.

would be particularly interesting to know the future international trade status of the Canadian electrical industrial equipment subsector. However, it should be realized that disaggregation cannot be pushed "too far" since the role of required assumptions becomes more critical while the world model aggregation projections become less useful.[1] At the same time, an alternative disaggregation structure (such as the one in Table 49) could make the Canadian model results more comparable to those of another long-term model built by the Canadian Department of Industry, Trade and Commerce.[2] Right now it is difficult to perform sectoral comparisons between different models because of conflicting aggregation.

One other outstanding limitation of the present model framework is the exclusion of labour. In principle, labour can be brought into the Canadian model by introducing sectoral labour productivity projections to the year 2000 coupled with a total labour force estimate constraint on Canadian economic growth. The latter would probably conflict with the present model's treatment of Canadian GDP growth as exogenous (and tied

---

1 Even the problem of newly arising industries (or sectors) could be handled by sufficient disaggregation if the empirical analysis, combined with some heroic assumptions, is carried far enough.

2 Reference is made to the Canadian Explor Model [8]. The task of comparing our results with those of other investigators is one for future research. Very few sectoral projections to the year 2000, based on other Canadian modeling, are available at this time.

to NAR economic growth).[1] To reconcile the two approaches, it is suggested that sectoral labour productivity projections be uniformly scaled up or down so that the total labour force constraint is satisfied even though Canadian economic growth remains exogenous. In effect, it is assumed that future sectoral labour productivities are estimated only up to a constant factor of proportionality. (Actually, this assumption is already made in the world model when moving from scenario A to scenario T.) The extended Canadian model would then yield labour employed projections for each sector (and primary final demand for labour)[2] in the year 2000 for alternative scenarios which could be compared with the base year 1970. These estimates could be useful in tracing the redeployment of Canadian labour, 1970 to 2000. At the same time the results would not explicitly depend on a fixed total labour force constraint which is a difficult aspect to project in a future economy featuring increased leisure and changing social values.

Finally it should be noted that *combining* further sectoral disaggregation with labour productivity estimates could yield especially useful results. In both cases this could be done within the scope of the present Canadian model.

---

1 See, again, Chapters II and III. The exogeneity assumption was very useful to justify the Canadian export projection methodology and the GDP growth rates fell in a range similar to that of other independent macroprojections.

2 From the nonbusiness sector, mostly government public administration.

VIII.2 Long-Term Research Suggestions

The future research suggestions outlined in this section are more long-term orientated since they require alterations of the Canadian model or new world model scenarios. We will not discuss recommendations for drastically changing the nature of the U.N. world model itself. Such suggestions have already been made by other sources[1] and additional discussion would fall outside the "spirit" of the present study (see Chapter I). In particular we do not speculate on the possible impacts of a revised world model on the Canadian results obtained in previous chapters.

The projected Canadian international trade results of this study are all with respect to total trade. There is no breakdown of Canadian future trade with the individual regions of the world model (or with the "residual" of NAR after removing Canada, i.e., United States). The methodology reflects the current limitations of the world model where all regional trade projections are of the "total" variety.[2] However, once more it

---

1 See, e.g., Klein [21] and O.E.C.D. [26]. The suggestions mostly involve incorporation of a sectoral price formation scheme in full feedback mode with the macromodel and input-output system of the present framework. Other suggestions require an explicit foreign exchange rate equilibrium mechanism in the international trade aspects of the model.

2 Regional import requirements are all totalled to form a "world pool" of imports which are then satisfied according to regional export share allocations. See U.N. [22].

is feasible to estimate Canadian future bilateral export and import flows with individual world model regions. This can be done using: (a) the 1970 base year Canadian sectoral bilateral trade, (b) extrapolation of observed trends in such bilateral trade 1966 to 1976, (c) the total trade projections in year 2000 for Canada *and* all fifteen regions of the world model, and (d) some assumptions,[1] subject to appropriate total trade constraints, concerning the application of historical bilateral trends towards the year 2000. Clearly such a procedure involves considerable effort, but the results could be valuable for policy purposes. In particular, it would be interesting to estimate the proportion of Canadian total trade with the United States in year 2000 as compared to 1970. We have already seen that Canada becomes increasingly import-dependent on petroleum and labour-intensive commodities while also attaining near self-sufficiency in coal requirements. So there is a strong presumption that the proportion of Canadian total imports coming from the United States may fall significantly 1970 to 2000. There may also be a similar change in the direction of Canadian exports because of the shift towards renewable resource-based comparative advantage (regions, other than the United States, may offer the best markets for Canadian grain, wood and paper products).

Events of the past few years show that the world model scenarios to which Canada is linked in this study might be

---

1 A feasible theoretical framework can be found in Economic Bulletin for Europe [9]. For our purposes we need *regionally disaggregated* Canadian sectoral import coefficients projections and sectoral export share coefficients. (See also Marwah [25].)

modified.[1] For example, all scenarios employ the U.N. medium-population growth 1970-2000 variant. There is now reason to believe that a lower population growth variant would be more appropriate for some resource-poor developing regions, including Asia. This would probably have a negative impact on Canadian grain exports, but a positive impact on other exports because of relaxed balance-of-payments constraints in these developing regions.[2] Indeed, the latest evidence points to considerable progress in per capita GDP growth of (non-oil) developing regions as the latter obtain a higher proportion of the world's private capital flows and public aid transfers.[3] Therefore, it might be useful to extend scenarios which favour resource-poor developing regions' growth (scenarios S and SB) to *also* include favoured treatment of two other world model regions: Latin America low and tropical Africa. These regions are classified as (non-oil) resource-rich developing regions in the U.N. model, with economic growth essentially constrained by domestic savings available for investment. The two regions are now earning a higher proportion of foreign investment, including OPEC surplus funds, than is evident from the world model assumptions.

Finally, it is already recognized in this study that the developed regions' future economic growth (and, indirectly, Canadian growth) cannot be simply limited by conventional labour force constraints. This leads to balance-of-trade deficits of

---

1 Recall that the world model scenarios come from Carter and Petri [4].

2 See Keyfitz [20].

3 See World Bank [38].

a magnitude which are probably unsustainable. Hence, the introduction of an energy conservation scenario. This scenario SB is certainly incomplete because of the drastic short-cut procedure used to implement the required energy savings (see, again, Chapter VI).[1] In particular, there is evidence that energy conservation, brought about by high energy prices, stimulates the substitution of more labour-intensive industrial processes than would occur without conservation (capital-intensive processes are typically also energy-intensive).[2] Thus labour productivity growth slows down and economic growth, especially in developed regions, would be lower than otherwise. This in itself further diminishes energy import requirements. Thus it would be interesting to modify scenario SB to incorporate more labour costs of energy savings rather than capital costs which receive most of the weight in the current treatment. In this suggested modified scenario, the GDP growth rates 1970 to 2000 of the major energy-importing regions (NAR, Western Europe and Japan) might be significantly lower than shown in scenario SB. So might the Canadian economic growth rate, but the *net* impact on Canadian balance-of-trade would probably be small (both Canadian exports and imports would diminish).

---

1 Clearly a better procedure is to modify all important energy structural coefficients to reflect energy savings and appropriately rectify other coefficients to reflect the costs of conservation. This has not been done in a world model context.

2 See Jorgenson [18].

Table 49

Suggested Structure for Further Disaggregation

Model Sector	Suggested Subsectors
(4) Residual Agriculture	(4a) Forestry Products
	(4b) Fish Landings
	(4c) Other Residual Agriculture
(5) Food Processing	(5a) Meat Products
	(5b) Fish Products
	(5c) Fruit & Vegetable Preparations
	(5d) Alcoholic Beverages
	(5e) Other Food Processing
(7) Primary Metal Processing	(7a) Iron and Steel Products
	(7b) Aluminum Products
	(7c) Copper & Alloy Products
	(7d) Nickel Products
	(7e) Other Nonferrous Metal Products
(8) Textiles, Clothing	(8a) Leather & Leather Products
	(8b) Yarns and Fabrics
	(8c) Synthetic Fibres
	(8d) Other Textile Products
	(8e) Hosiery, Knitted Wear & Clothing
(11) Paper Products	(11a) Pulp and Newsprint
	(11b) Other Paper Products
(18) Nonmetallic Mineral Products	(18a) Glass Products
	(18b) Asbestos Products
	(18c) Other Nonmetallic Mineral Products
(19) Motor Vehicles & Parts	(19a) Motor Vehicles
	(19b) Motor Vehicle Parts
(23) Machinery	(23a) Agricultural Machinery
	(23b) Other Industrial Machinery
(24) Electrical Products	(24a) Small Electrical Appliances and Receivers, Household
	(24b) Large Electrical Appliances, Household
	(24c) Communications Equipment
	(24d) Electrical Industrial Equipment
	(24e) Other Electrical Products

Table 49 (cont'd.)

Model Sector	Suggested Subsectors
(46) Residual Mining	(46a) Radioactive Ores & Concentrates
	(46b) Asbestos, Unmanufactured, Crude & Fibrous
	(46c) Other Residual Mining

Note: The additional disaggregation would provide a Canadian model with a total of about 70 sectors.

APPENDIX A: MATHEMATICAL MODEL AND SOLUTION PROCEDURE

This Appendix contains a mathematical outline of the Canadian model, the solution procedure, and links to the U.N. global model. Many of these aspects were already described in nontechnical terms in Chapter III. The Appendix concentrates on the essential features of the Canadian model (the *basic* model). Some complications arising in the complete model and problems concerning statistical data are discussed in Appendix B and other references. It might be noted that the methodology which follows is *also* applicable to other nations using U.N. world model printouts and national input-output tables with complementary data. The Canadian model uses input-output conventions; all sectoral variables are measured in Canadian 1970 producers' prices (unless specified otherwise).

A.1 Definitions and Notation

The Canadian model is disaggregated into 46 commodity sectors. Therefore all vectors contain 46 elements and the matrices are square and of order 46. It is convenient to partition the vectors (or sectors) into two subvectors of order 35 and 11, respectively. The first 35 elements are supposed to correspond to sectors 1-3, 5, 16-43 of the U.N. model plus three Canadian dummy sectors (sectors 4 and 5 of the U.N. model are aggregated).[1] The second set of 11 elements correspond to sectors

1 See Appendix C for complete details.

6-15 of the U.N. model (i.e., the nonrenewable resource sectors) plus a Canadian noncompetitive import sector. Thus, e.g., the 46 order column vector

$$q = \begin{pmatrix} q_1 \\ q_2 \end{pmatrix}$$

where q_1 is a 35-element subvector and q_2 is an 11-element subvector. Similarly the 46 order square matrix

$$A = \begin{pmatrix} A_{11} & A_{12} \\ A_{21} & A_{22} \end{pmatrix}$$

where the dimensions of the partitioned submatrices are indicated as $A_{11}(35, 35)$, $A_{12}(35, 11)$, $A_{21}(11, 35)$ and $A_{22}(11, 11)$.

All the matrices, including diagonal matrices, listed below are determined outside the basic Canadian model. All vectors with an explicit (70) subscript are already known from 1970 data. Of the remaining vectors listed below, some are also estimated outside the basic model[1] and these will be indicated by a bar. Thus $\bar{q}_2$ is already known, but q_1 is unknown.

The following is a list of the basic vectors and matrices included in the Canadian model. All symbols without a (70) subscript refer to the year 2000 and all variables are measured in 1970 prices. First the vectors with elements corresponding to the producing sector of origin:

---

1 See Section A.5 for further explanation.

$(q_{1(70)}, q_{2(70)})$ is domestic output[1] in year 1970

$(q_1, \bar{q}_2)$ is domestic output in year 2000

$(\bar{x}_1, x_2)$ is total exports in 2000

$(m_{1(70)}, m_{2(70)})$ is total imports in 1970

(m_1, m_2) is total imports in 2000

$(v_1, 0)$ is business total capital investment in 2000

with $\bar{v}_2 \equiv 0$

$(r_1, 0)$ is business replacement capital investment in 2000

with $\bar{r}_2 \equiv 0$

$(n_{1(70)}, 0)$ is business expansion capital investment in 1970

$(n_1, 0)$ is business expansion capital investment in 2000

with $\bar{n}_2 \equiv 0$

$(s_{1(70)}, s_{2(70)})$ is inventory change in 1970

(s_1, s_2) is inventory change in 2000

$(\bar{e}_1, \bar{e}_2)$ is "all other" final demand in 2000.

There are three diagonal matrices with diagonal vectors:

(μ_1, μ_2) is commodity import coefficients

(d_1, d_2) is "first set" inventory change coefficients

(d_1^*, d_2^*) is "second set" inventory change coefficients.

The nondiagonal coefficient matrices are:

A is current account intermediate input-output coefficient matrix

---

1 To save space, the two-column subvectors $q_{1(70)}$ and $q_{2(70)}$ are written in a row rather than in a column. The latter arrangement is understood.

R is the capital replacement coefficient flow matrix

K* is incremental capital account coefficient matrix (used for time period 1970 to 2000).

The derivations of all matrices are explained in Section A.5.

A.2 Basic Model Equations[1]

The basic equations of the Canadian model are now listed. Some of these equations are clarified in Section A.5.

(1) total commodity supply equals total commodity demand:

$$q + m = Aq + v + s + \bar{e} + x$$

or equivalently

$$\begin{pmatrix} q_1 \\ \bar{q}_2 \end{pmatrix} + \begin{pmatrix} m_1 \\ m_2 \end{pmatrix} = \begin{pmatrix} A_{11} & A_{12} \\ A_{21} & A_{22} \end{pmatrix} \begin{pmatrix} q_1 \\ \bar{q}_2 \end{pmatrix} + \begin{pmatrix} v_1 \\ 0 \end{pmatrix} + \begin{pmatrix} s_1 \\ s_2 \end{pmatrix} + \begin{pmatrix} \bar{e}_1 \\ \bar{e}_2 \end{pmatrix} + \begin{pmatrix} \bar{x}_1 \\ x_2 \end{pmatrix}$$

(2) imports determination equation:

$$m = \hat{\mu}(q + m - x)$$

or equivalently

$$\begin{pmatrix} m_1 \\ m_2 \end{pmatrix} = \begin{pmatrix} \hat{\mu}_1 & 0 \\ 0 & \hat{\mu}_2 \end{pmatrix} \begin{pmatrix} q_1 + m_1 - \bar{x}_1 \\ \bar{q}_2 + m_2 - x_2 \end{pmatrix}$$

(3) business replacement capital investment, by sector of origin, equation:

$$r = Rq$$

or equivalently

$$\begin{pmatrix} r_1 \\ 0 \end{pmatrix} = \begin{pmatrix} R_{11} & R_{12} \\ 0 & 0 \end{pmatrix} \begin{pmatrix} q_1 \\ \bar{q}_2 \end{pmatrix}$$

---

1 This section and the next outline the model and solution procedure used for the standard Canadian scenarios (Chapters III, IV and V). Modifications required for an energy-conservation scenario are described in Chapter VI.

(4) business expansion capital investment equation:

$$n = (2/29)K^*(q - q_{(70)}) - (31/29)n_{(70)}$$

or equivalently

$$\begin{pmatrix} n_1 \\ 0 \end{pmatrix} = (2/29)\begin{pmatrix} K^*_{11} & K^*_{12} \\ 0 & 0 \end{pmatrix}\begin{pmatrix} q_1 - q_{1(70)} \\ \bar{q}_2 - q_{2(70)} \end{pmatrix} - (31/29)\begin{pmatrix} n_{1(70)} \\ 0 \end{pmatrix}$$

(5) business total capital investment identity:

$$v_1 = r_1 + n_1$$

(6) economy-wide inventory change, by sector of origin, equation:

$$s = \hat{d}(q + m - q_{(70)} - m_{(70)}) - \hat{d}^* s_{(70)}$$

or equivalently

$$\begin{pmatrix} s_1 \\ s_2 \end{pmatrix} = \begin{pmatrix} \hat{d}_1 & 0 \\ 0 & \hat{d}_2 \end{pmatrix}\begin{pmatrix} q_1 + m_1 - q_{1(70)} - m_{1(70)} \\ \bar{q}_2 + m_2 - q_{2(70)} - m_{2(70)} \end{pmatrix} - \begin{pmatrix} \hat{d}^*_1 & 0 \\ 0 & \hat{d}^*_2 \end{pmatrix}\begin{pmatrix} s_{1(70)} \\ s_{2(70)} \end{pmatrix}$$

The problem then is to determine q_1, m_1, m_2, x_2, v_1, s_1 and s_2, given $\bar{q}_2$, $\bar{x}_1$, $\bar{e}_1$, $\bar{e}_2$ and all coefficient matrices.

A.3 Stepwise Solution Procedure

This section provides the stepwise procedure actually used in the determination of unknown vectors. The computer program is written in MATSYS language. In the following, when a required calculation yields the solution of an unknown vector, then the particular solution vector is designated with a bar.

First a number of preliminary calculations are needed:

$$(1)\quad \begin{pmatrix} B_{11} & B_{12} \\ B_{21} & B_{22} \end{pmatrix} = \begin{pmatrix} A_{11} & A_{12} \\ A_{21} & A_{22} \end{pmatrix} + \begin{pmatrix} R_{11} & R_{12} \\ 0 & 0 \end{pmatrix} + (2/29)\begin{pmatrix} K^*_{11} & K^*_{12} \\ 0 & 0 \end{pmatrix} + \begin{pmatrix} \hat{d}_1 & 0 \\ 0 & \hat{d}_2 \end{pmatrix}$$

$$(2)\quad \begin{pmatrix} b_{1(70)} \\ b_{2(70)} \end{pmatrix} = (2/29)\begin{pmatrix} K^*_{11} & K^*_{12} \\ 0 & 0 \end{pmatrix}\begin{pmatrix} q_{1(70)} \\ q_{2(70)} \end{pmatrix} + (31/29)\begin{pmatrix} n_{1(70)} \\ 0 \end{pmatrix}$$

$$+ \begin{pmatrix} \hat{d}_1 & 0 \\ 0 & \hat{d}_2 \end{pmatrix}\begin{pmatrix} q_{1(70)} + m_{1(70)} \\ q_{2(70)} + m_{2(70)} \end{pmatrix} + \begin{pmatrix} \hat{d}^*_1 & 0 \\ 0 & \hat{d}^*_2 \end{pmatrix}\begin{pmatrix} s_{1(70)} \\ s_{2(70)} \end{pmatrix}$$

$$(3)\quad \hat{\mu}^*_1 = (I - \hat{\mu}_1\hat{d}_1)^{-1}\hat{\mu}_1$$

$$(4)\quad \hat{\mu}^{**}_1 = (I - \hat{d}_1)\hat{\mu}^*_1$$

$$(5)\quad \hat{\mu}^*_2 = (I - \hat{\mu}_2\hat{d}_2)^{-1}\hat{\mu}_2$$

Then the unknown vectors are obtained:

$$(6)\quad \bar{q}_1 = [I - (I - \hat{\mu}^{**}_1)B_{11}]^{-1}[(I - \hat{\mu}^{**}_1)(B_{12}\bar{q}_2 + \bar{e}_1 - b_{1(70)}) + \bar{x}_1]$$

$$(7)\quad \bar{m}_1 = \hat{\mu}^*_1(B_{11}\bar{q}_1 + B_{12}\bar{q}_2 + \bar{e}_1 - b_{1(70)})$$

$$(8)\quad \bar{m}_2 = \hat{\mu}^*_2(B_{21}\bar{q}_1 + B_{22}\bar{q}_2 + \bar{e}_2 - b_{2(70)})$$

$$(9)\quad \bar{x}_2 = (I - B_{22})\bar{q}_2 - B_{21}\bar{q}_1 - \bar{e}_2 + (I - \hat{d}_2)\bar{m}_2 + b_{2(70)}$$

$$(10)\quad \bar{r}_1 = R_{11}\bar{q}_1 + R_{12}\bar{q}_2$$

$$(11)\quad \bar{n}_1 = (2/29)[K^*_{11}(\bar{q}_1 - q_{1(70)}) + K^*_{12}(\bar{q}_2 - q_{2(70)})] - (31/29)n_{1(70)}$$

$$(12)\quad \bar{v}_1 = \bar{r}_1 + \bar{n}_1$$

$$(13)\quad \bar{s}_1 = \hat{d}_1(\bar{q}_1 + \bar{m}_1 - q_{1(70)} - m_{1(70)}) - \hat{d}^*_1 s_{1(70)}$$

$$(14)\quad \bar{s}_2 = \hat{d}_2(\bar{q}_2 + \bar{m}_2 - q_{2(70)} - m_{2(70)}) - \hat{d}^*_2 s_{2(70)}$$

Finally, a preliminary estimate of gross domestic product in the year 2000 can be obtained as the scalar

$$(15) \quad {}_1\lambda = i'(\bar{e} + \bar{v} + \bar{s} + \bar{x} - \bar{m})$$

where, for simplicity in this presentation, we neglect complications[1] due to (a) final demands for primary factors, (b) indirect taxes, subsidies and tariff revenue, and (c) unallocated exports and imports such as travel receipts and expenditures. Clearly there is nothing in the basic model or solution procedure introduced so far which guarantees that ${}_1\lambda$ in (15) equals a fixed GDP target for the year 2000. This topic is discussed in the next section.

A.4 Short-Circuited Iteration

Suppose a fixed GDP target is chosen for Canada. The Canadian GDP target and exogenous population level in 2000, as compared to 1970, determine the initial "all other" final demand vector $\bar{e}$ (further explained in Section A.5). The nonresource import coefficient vector μ_1 also depends on the GDP target in the light of an historical time series analysis. Each target corresponds to a particular world model scenario such that the growth rate of Canadian GDP per capita (1970-2000) is approximately equal to the corresponding NAR[2] growth rate. We then use the appropriate world model printouts for NAR to estimate, with no further change, the vectors $\bar{q}_2$ and $\bar{x}_1$ by methods fully explained in Section A.5. (This

1 These complications were certainly accounted for in the complete model by appropriate adjustment ratios, explicit use of tariff rates and separate estimation of tourist trade in the year 2000. See the text, particularly Chapter VII, and Appendix B.

2 NAR denotes North American Region in the world model.

constitutes the most explicit links of the Canadian model to the world model.) All coefficient matrices, aside from $\hat{\mu}$, are essentially independent of the particular GDP target.

Now suppose the target is represented by the scalar ${}_*\lambda$. It should then be evident from the model so far described that[1]

(1) ${}_*\lambda \neq {}_1\lambda = i'(e + v + s + x - m)$.

One method of resolving this problem is to add or subtract marginal increments to the "all other" final demand vector e in an iterative fashion until ${}_*\lambda$ is obtained with satisfactory precision. For example, suppose $|{}_*\lambda - {}_1\lambda| \neq 0$. Consider the "all other" final demand pattern vector

(2) $f = (i'e)^{-1}e$

and an adjustment scalar

(3) ${}_1\gamma = (i'e){}_1\lambda^{-1}$ $\quad ({}_1\gamma \simeq 0.6$ in most cases).

Then we could rerun the basic model solution procedure a second time with

(4) $e + {}_1\gamma({}_*\lambda - {}_1\lambda)f$

substituted for the original e. Clearly this would lead to revised solution vectors v, s, x_2 and m, and a second-round GDP level of ${}_2\lambda$ such that

$$|{}_*\lambda - {}_2\lambda| < |{}_*\lambda - {}_1\lambda|.$$

The process would continue until $\lim_n {}_n\lambda = {}_*\lambda$.

---

1 To simplify the notation, we omit the bars on the GDP component vectors.

The above iteration procedure was actually tried for the Canadian model. It was found that because of the nature of the model, convergence to ${}_*\lambda$ was "slow"; in effect the scalar adjustment factor (3) is "too conservative". The reason for this is not difficult to see. If ${}_*\lambda > {}_1\lambda$, then the second-round (solution) vectors e, v and s would all be larger than their first-round counterparts (see (4) above and Equations (6) - (14) in Section A.3). This is "good"! However, the solution import vector m also rises and the export subvector x_2 falls (recall that $\bar{x}_1$ and $\bar{q}_2$ are unchanged). This is "bad" because it leads us away from ${}_*\lambda$. Indeed, it turns out that the Canadian nonresource import coefficients μ_1 are sufficiently high so that a much larger adjustment factor than (3) is required for satisfactory convergence. After observing the impact of one iteration on GDP, it became clear that an adjustment factor equal to 0.97 was required to yield ${}_2\lambda \simeq {}_*\lambda$. Thus, in effect, the Canadian GDP targets were obtained almost directly by using as the "all other" final demand vector

$$e + 0.97({}_*\lambda - {}_1\lambda)f$$

in the second-round of the stepwise solution procedure. However, it must be noted that the adjustment factor 0.97 reflects distinct Canadian structural characteristics and should not be used in all applications.

A.5 Notes on Technical Derivations

This section contains brief notes on various technical derivations relating to the basic Canadian model. The problems are numbered.

1. Derivation of business expansion capital investment

Equation (4) in Section A.2. Business expansion investment by sector of origin in year t, n_t, is related to the increment in domestic output, $(q_{t+1} - q_t)$, by

$$(1) \quad n_t = K_{(70)}(q_{t+1} - q_t)$$

where $K_{(70)}$ is a matrix of incremental capital coefficients in 1970. For the moment we assume $K_{(70)}$ is constant through time. Then total expansion investment over the time period beginning in 1970 (t = 0) until and including 1999 (t = 29) is

$$(2) \quad \sum_{t=0}^{29} n_t = K_{(70)}(q - q_{(70)})$$

where q is domestic output in year 2000 (t = 30). It is assumed that each nonzero element of the vector n_t rises linearly during the time period 1970 to 2000 from the 1970 data base $n_{(70)}$

$$(3) \quad n_t = n_{(70)} + (t/30)(n - n_{(70)}) \qquad (t = 0, 1, \ldots, 30)$$

where n is business expansion investment in year 2000. Using (3) to evaluate (2) we find

$$(4) \quad \sum_{t=0}^{29} n_t = (1/2)(31n_{(70)} + 29n).$$

Comparing (2) and (4), we end up with

$$(5) \quad n = (2/29)K_{(70)}(q - q_{(70)}) - (31/29)n_{(70)}.$$

In the Canadian model the incremental capital coefficient matrix is not constant but changes linearly from $K_{(70)}$ to K in the year 2000. Then relation (2) does not follow. Instead we have

$$(2a) \quad \sum_{t=0}^{29} n_t = K^*(q - q_{(70)})$$

where

$K^* \simeq (1/2)(K_{(70)} + K)$ and (5) becomes

$$(5a) \quad n = (2/29)K^*(q - q_{(70)}) - (31/29)n_{(70)}$$

which is identical to Equation (4) in Section A.2. This makes business expansion investment endogenous in the Canadian model.[1]

2. Derivation of inventory change Equation (6) in Section A.2. Let us introduce

s_t is the inventory (or stock) change in year t as compared to year t-1 (also known as inventory investment in year t)

q_t^* is total product sales in year t, so that[2]

$$q_t^* = q_t + m_t - s_t$$

α is a vector of inventory stock-sales ratios by commodity sector of origin (assumed constant over time in the model).

Then inventory change is related to incremental product sales by

$$(6) \quad s_t = \hat{\alpha}(q_t^* - q_{t-1}^*).$$

---

1 Actually a more complex equation than (5a) was used in the Canadian model reflecting multi-year gestation lags in various sectors (described in Chapter III). See Postner [27] for the technical derivation of the complete equation.

2 Note that a negative inventory change is indicative of additional sales and that imports must be added to domestic output for total product sales.

Total inventory change from 1971 (t = 1) to year 2000 (t = 30) is

$$(7) \quad \sum_{t=1}^{30} s_t = \hat{\alpha}(q^* - q^*_{(70)}).$$

Suppose s_t follows a linear growth path

$$(8) \quad s_t = s_{(70)} + (t/30)(s - s_{(70)}) \qquad (t = 0, 1, \ldots, 30)$$

where $s_{(70)}$ is base year inventory change and s is inventory change in year 2000 (t = 30). Then by manipulations similar to those already outlined

$$(9) \quad s = (2/31)\hat{\alpha}(q^* - q^*_{(70)}) - (29/31)s_{(70)}.$$

However

$$(10) \quad q^* = q + m - s, \text{ and } q^*_{(70)} = q_{(70)} + m_{(70)} - s_{(70)}.$$

Substituting (10) in (9) we finally derive

$$(11) \quad s = \hat{d}(q + m - q_{(70)} - m_{(70)}) - \hat{d}^* s_{(70)}$$

where $\hat{d} = (2\hat{\alpha})(31I + 2\hat{\alpha})^{-1}$

and $\hat{d}^* = (29I - 2\hat{\alpha})(31I + 2\hat{\alpha})^{-1}$.

This is Equation (6) in Section A.2. The correct specification of the above relation (11) is important for Canadian agricultural production where the stock-sales ratios α are greatest and, for the grain sector, actually larger than unity. A vector of inventory stock in the year 2000 by sector of origin can now be estimated as

$$\hat{\alpha}(q + m - s)$$

and total inventory stock is simply

$$i'\hat{\alpha}(q + m - s).$$

3. Derivation of current account input-output coefficient matrix A. A square 46 order commodity sector input-output matrix for 1970, $A_{(70)}$, was formed by multiplying two rectangular (industry by commodity) matrices obtained from official Canadian sources. One is a commodity into industry input-output coefficient matrix, and the other is an industry into commodity market-share coefficient matrix. Then the matrix A in the model is obtained as

$$A = A_{(70)} \otimes M$$

where $\otimes$ represents element by element multiplication and M is a square modifier matrix which is supposed to update the 1970 input-output coefficients to the year 2000. The modifier elements come from world model (NAR) documentation and analysis of Canadian input-output coefficient change 1961-1971 (see Appendix B).

4. Derivations of incremental capital coefficient matrix K and capital replacement coefficient flow matrix R. First a matrix $K_{(70)}$ was constructed by

$$K_{(70)} = C\hat{k}_{(70)}$$

where C is a sectoral distribution matrix[1] for capital investment demands and $k_{(70)}$ is a vector of capital-output ratios by sector of destination for 1970 adjusted for capacity utilization. The latter is modified to permit a normal margin of spare capacity (as explained in Appendix B). Then $k_{(70)}$ serves as our estimate

---

1 That is, i'C = i'. The matrix C is mostly constant over time. In effect, C transforms investment demand by sector of destination into investment demand by sector of origin. See Appendix B.

of incremental capital-output ratios in 1970. Similarly

$$K = C\hat{k}$$

where k is a vector of capital-output ratios by sector of destination for the year 2000 (built upon $k_{(70)}$, observed trends and world model documentation). Then the capital replacement coefficient matrix R in the year 2000 is estimated as

$$R = K \ominus L$$

where L is a matrix of expected life spans for all nonzero capital items (it is implicitly assumed that life spans exhibit an exponential probability distribution -- then replacement investment equals depreciation) and the symbol $\ominus$ designates element-wise division. Finally a vector of capital stock by sector of origin in the year 2000 is

$$Kq.$$

A row vector of capital stock by sector of destination in 2000 is

$$i'K\hat{q}.$$

The scalar of total business capital stock is

$$i'Kq \equiv i'K\hat{q}i.$$

5. Derivation of commodity import coefficient vector μ (used in imports determination Equation (2) of Section A.2). Here we must distinguish between μ_1 and μ_2. The import coefficients of the 4 agricultural sectors in μ_1 were held constant at 1970 data base levels. The remaining tradable commodity

coefficients in μ_1, represent manufacturing sectors and one service sector. Here the individual j^{th} coefficients for the year 2000 are mostly estimated as

$$\mu_{1j} = \mu_{1j(70)}\lambda^{\varepsilon_j}$$

where $\mu_{1j(70)}$ is the corresponding 1970 coefficient, λ is the ratio of the GDP target in 2000 to the base year GDP, and ε_j is the calculated arc elasticity of the j^{th} import coefficient with respect to real GDP over the time period 1961-1974. Note that μ_{1j} varies depending on the Canadian GDP targets in different scenarios. Most, but not all, ε_j are such that

$$0<\varepsilon_j<0.5$$

indicating accelerated import competition and the possibility of increased manufacturing intrasectoral specialization at higher GDP levels. (See Barker [3] for further discussion).

The second set of import coefficients μ_2 (nonrenewable resource sectors) are estimated using judgment, observed trends and prior knowledge. Two of the coefficients, noncompetitive imports and bauxite, are equal to unity; their domestic outputs and exports are zero. Indeed, it is easily verified that in the model

$$(u_{2j} = 1 \text{ and } q_{2j} = 0) \Rightarrow x_{2j} = 0.$$

For the remaining resource sectors it can be shown that if the reader is only interested in Canadian net resource exports,

$(x_2 - m_2)$, then the model's estimates of net exports are essentially independent of the import coefficients μ_2. This is mainly because Canadian resource outputs, $\bar{q}_2$, are obtained outside the Canadian model (as shown below).[1]

6. Derivation of (initial) "all other" final demand vector e. This vector is the summation of three final demand vectors: (i) personal consumption expenditures, e*, (ii) residential construction investment, e**, and (iii) total government net expenditures, e***.

First, the vector e* in the year 2000 is estimated as

$$e^* = (\lambda - \eta)\hat{\xi}e^*_{(70)} + \eta e^*_{(70)}$$

where λ (as before) is the ratio of GDP target in 2000 to base year GDP, η is the ratio of total population in 2000 to 1970 population, ξ is a vector of arc elasticities of real sectoral consumption expenditures per capita with respect to total real consumption expenditures per capita (estimated from Canadian data as in Appendix B), and $e^*_{(70)}$ represents the observed consumption vector in base year 1970. Note that the row vector of arc elasticities

$$i'\hat{\xi} = \xi'$$

are Engel elasticities constrained so that a weighted average

$$[\xi' e^*_{(70)}]\ [i' e^*_{(70)}]^{-1} = \text{unity}.$$

---

1 Nevertheless it is still of interest to obtain x_2 and m_2 separately since Canada is both an exporter and importer of some resource sectoral commodities.

Then the summation of all elements in e* equals

$$i'e^* = (\lambda - \eta)i'\hat{\xi}e^*_{(70)} + \eta i'e^*_{(70)}$$

$$= (\lambda - \eta)\ (i'e^*_{(70)}) + \eta i'e^*_{(70)}$$

$$= \lambda i'e^*_{(70)}$$

at least initially (see below).

Second, the vector e** in 2000 is obtained by a procedure similar to that used for business expansion investment. Total residential construction stock is related to total personal consumption expenditures with an average 4-year negative lag (see Postner [77]) and residential construction investment is assumed to grow linearly over the period 1970 to 2000. This leads to

$$e^{**} = (2/39)\rho(\lambda-1)(i'e^*_{(70)})(i'e^{**}_{(70)})^{-1}e^{**}_{(70)}$$

$$-(21/39)e^{**}_{(70)}$$

where ρ is an estimated scalar representing the "desired" ratio of total residential construction stock to total personal consumption expenditures, $e^{**}_{(70)}$ is the residential construction gross investment vector in 1970, and where use was made of the relation

$$i'e^* - i'e^*_{(70)} = (\lambda-1)i'e^*_{(70)}.$$

Note that e** is a vector composed of residential construction and real estate services. The residential construction investment

pattern in 2000 is assumed the same as in 1970.[1] The linear growth of residential construction investment reflects the declining growth rate of new household or family formation expected during the 1970-2000 period.

Third, the total (current plus capital) government net expenditures vector e*** in 2000 comes from

$$e^{***} = \lambda e^{***}_{(70)}$$

where $e^{***}_{(70)}$ denotes the total government net expenditures vector in base year 1970 (actually the 1971 pattern vector was used here and adjusted to the 1970 total).

Note that the above estimate of the "all other" final demand vector e, namely

$$e = e^{*} + e^{**} + e^{***}$$

represents the initial vector in the short-circuited iteration procedure outlined in Section A.4. In effect, total consumption expenditures and residential construction investment are partly determined as a residual to meet a fixed GDP target, and the summation of the first two terms in the above, namely

$$e^{*} + e^{**}$$

are used to develop the pattern vector f in (2) of Section A.4. The government expenditures term e*** remains constant (exogenous) and is not part of the marginal increments used to adjust the model.

---

1 To be clear it is readily seen that

$$i'e^{**} = (2/39)\rho(\lambda-1)(i'e^{*}_{(70)}) - (21/39)(i'e^{**}_{(70)}).$$

7. Determination of nonresource exports vector $\bar{x}_1$. Almost all elements of this vector were obtained from

$$\bar{x}_1 = \hat{g}_1 x_{1(70)}$$

where $x_{1(70)}$ represents the base year Canadian export vector and the j^{th} element of the vector g_1 comes from

$$g_{1j} = x^*_{1j}(x^*_{1j(70)})^{-1}$$

where x^*_{1j} is the NAR export element in 2000 and $x^*_{1j(70)}$ is the corresponding NAR value in 1970. In effect it is assumed that each Canadian nonresource export item will maintain the same share of NAR exports in the year 2000 as observed in 1970. In the context of the world model this assumption seems reasonable since Canada's exogenous GDP per capita growth rate (1970-2000) is approximately equal to the NAR growth rate in all scenarios. The assumption was not followed for textiles (Canada's share drops by 30 per cent) and primary metal processing (Canada's share increases by 15 per cent). There are also some complications regarding Canadian trade and transportation export margins, not discussed in this Appendix.

8. Determination of Canadian resource output vector $\bar{q}_2$. Two elements of this vector equal zero; noncompetitive imported commodities and bauxite. All other elements were estimated as

$$\bar{q}_2 = \hat{h}\hat{g}_2 q_{2(70)}$$

where $q_{2(70)}$ is the base year Canadian resource output vector, the j^{th} element of vector g_2 comes from

$$g_{2j} = q^*_{2j}(q^*_{2j(70)})^{-1}$$

where q^*_{2j} is the NAR j^{th} resource output in 2000 and $q^*_{2j(70)}$ the value in 1970, and the j^{th} element of vector h is an estimate of the ratio of Canada's share of NAR j^{th} resource output in the year 2000 as compared to 1970. The statistical sources for estimating vector h include 1966-1976 trend analysis and most recent projections by Department of Energy, Mines and Resources.

A.6 Some International Trade Calculations

The Canadian model gives particular emphasis to projections and analysis of Canadian international trade in the year 2000. Some of the relevant calculations are now listed. The following notation is used:

$x = (x_1, x_2)$ is the estimated export vector for the year 2000 expressed in 1970 producers' prices

$m = (m_1, m_2)$ is the estimated import vector for the year 2000 expressed in 1970 producers' prices

$p = (p_1, p_2)$ is the projected price vector of normalized relative price ratios in the year 2000 as compared to 1970, adjusted to conform with the Canadian model

$t = (t_1, t_2)$ is the adjusted vector of implicit ad valorem tariff rates in year 2000 (assumed approximately the same as in 1970).

Then, for balance-of-trade purposes, the total value of Canadian exports in year 2000 equals

$$\beta_x = p_1'x_1 + p_2'x_2 \ .$$

The total value of Canadian imports in year 2000 equals

$$\beta_m = p_1'(I-\hat{t}_1)m_1 + p_2'(I-\hat{t}_2)m_2.$$

The balance-of-trade in year 2000 is

$$\beta = \beta_x - \beta_m$$

The Canadian terms-of-trade in year 2000 as compared to 1970 is calculated as

$$\{p'[x(i'x)^{-1}]\}\{p'[m(i'm)^{-1}]\}^{-1}.$$

(Note that the Canadian terms-of-trade will vary slightly with different scenarios since the vectors x and m change in alternative scenarios. The vector p is invariant.)

Net exports as a proportion of Canadian domestic sectoral outputs in year 2000 equal

$$\hat{q}^{-1}(x - m). \qquad \text{(with } q>0\text{).}$$

The relative changes in Canadian sectoral outputs resulting from international trade in year 2000 for the "static" case is

$$\hat{q}^{-1}(I-A-R)^{-1}(x-m).$$

(This formula is used in Chapter VII.)

The relative changes in Canadian sectoral outputs resulting from international trade in year 2000 for the "quasi-dynamic" case is

$$\hat{q}^{-1}(I-A-R-K\hat{\gamma}-\hat{d})^{-1}(x-m).$$

(See Postner [28] for further explanation.)

A vector measure of Canadian intrasectoral international trade in year 2000 (Grubel [16]) is

$$\kappa(\widehat{x + m})^{-1}[(x + m) - |x - m|]$$

where κ is an adjustment scalar factor for imbalanced international trade

$$\kappa = i'(x + m)[i'(x + m) - |i'(x - m)|]^{-1}.$$

(This measure is used, without the adjustment factor, to analyse Canadian intrasectoral manufacturing trade in Chapter VII.)

It is instructive to compare all these calculations with those for the observed base year data 1970.

APPENDIX B: STATISTICAL DATA SOURCES

This appendix provides an outline of the most important data sources and projection methods used in the study. The appendix is partly based on notes written by a research assistant, Dennis Nerland, to summarize his work at the Economic Council during the summer of 1977. It should be emphasized that it is not possible to give here a complete detailed account of all data sources and manipulations -- this would require a statistical appendix much longer than one appropriate for a study of this nature. The reader interested in further detail is encouraged to contact the author. All basic and projected data, including matrix coefficients, are available on computer printouts.

B.1 Canadian Base Year Data, 1970[1]

The commodity classification used in this study has already been explained in Chapter II and is explicitly given in Appendix C. All variables listed below are categorized according to the Canadian (input-output) commodity classification system and are measured in 1970 producers' prices. Unless otherwise specified, all base year data were kindly provided by the Input-Output Division and Structural Analysis Division of Statistics Canada. These are the *basic sources* referred to below. The role of Statistics Canada was to realign their work-sheet commodity classification data to the

1 In some cases the base year data is "centered around" 1970.

particular commodity aggregation level required for this study. The basic published data sources to which the reader should turn for a complete exposition and understanding of the following notes are:

The Input-Output Structure of the Canadian Economy, 1961-71, Catalogue 15-506, Ottawa (March 1977)

and

The Input-Output Structure of the Canadian Economy in Constant 1961 Prices, Catalogue 15-507, Ottawa (December 1977).

The base year variables used in this study together with their composition and data sources (other than basic sources) are now listed.

(i) Exports: domestic exports plus re-exports of goods and services.

(ii) Imports: imports of goods and services.

(iii) Domestic Gross Output: the vector of total commodity outputs.

(iv) Personal Consumption Expenditures: summation of consumer durable, semi-durable, nondurable and services expenditures.

(v) Government Total Net Expenditures: summation of government construction, machinery and equipment investment; plus government gross current expenditures; minus government revenue from sales of goods and services.

(vi) Business (Nonresidential) Total Investment: the summation of business construction, machinery

and equipment gross fixed capital formation. This variable could be represented by the symbol $v_{(70)}$, analogous to notation of Appendix A.

(vii) Business Replacement Investment: this variable, represented by $r_{(70)}$, is estimated as

$R_{(70)}q_{(70)}$ where $R_{(70)} = K_{(70)} \textcircled{\div} L$

using notation analogous to Appendix A. Then

$K_{(70)} = C_{(70)}\hat{k}_{(70)}$.

The main statistical sources are the following. For L, the matrix of expected life spans for all capital items (the matrix is assumed constant 1970-2000), adapted from Statistics Canada, *Fixed Capital Flows and Stocks*, Catalogue 13-211. For $C_{(70)}$, the sectoral distribution matrix of capital investment demands,[1] the basic sources mentioned above combined with methodology explained in Grosse [15] and previously used in Postner [28]. For $k_{(70)}$, the vector of total fixed capital-output ratios by sector of destination, adapted from Postner [28] with allowance for a normal margin of space capacity as in Clark [6] using Department of Industry, Trade and Commerce, *Rates of Capacity Utilization, Canada*.[2]

---

1 This matrix is essentially constant over time, except for adjustments in the transportation and utilities sectors columns.

2 Observed capital-output ratios in 1970 were adjusted downwards to reflect degree of capacity utilization. Then these ratios were adjusted upwards by one-third the *ratio* of capital-output *to* capital-capacity with a maximum upward adjustment of 10 per cent. The latter is supposed to reflect normal spare capacity margins evident from capacity utilization data 1966-1976. The normal margin is assumed constant 1970-2000.

(viii) Business Expansion Investment: representing this variable by $n_{(70)}$, then

$$n_{(70)} = v_{(70)} - r_{(70)}$$

(ix) Business Total Capital Stock (by sector of origin): estimated as

$$K_{(70)}q_{(70)}$$

(x) Business Total Capital Stock (by sector of destination): estimated as

$$i'K_{(70)}\hat{q}_{(70)}$$

(xi) Residential Construction Gross Investment: the vector of residential construction and real estate services (relevant to nongovernment construction investment). The ratio coefficient of total residential construction stock to total personal consumption expenditures comes from various Canadian unpublished sources (after adjustment to our concept of total consumption expenditures) using guidelines from Almon [2].

(xii) Inventory Investment: value of physical changes in inventories.

Agricultural inventory stock coefficients estimated using 1966-1976 average from Statistics Canada, *Quarterly Bulletin of Agricultural Statistics*, Catalogue 21-003 and *Canada Yearbook*. Remaining coefficients estimated using basic sources and definition of coefficient (see Appendix A).

(xiii) Tariff Rates: ad valorem tariff rates adapted from Wilkinson [37] and adjusted to conform with total tariff revenue in 1970 from basic sources.

(xiv) Tourist Trade: travel receipts and expenditures from Statistics Canada, *The Canadian Balance of International Payments*, Catalogue 67-201.

B.2 Canadian Projection Year Data, 2000

The Canadian model and related procedures yield the data results for the projection year 2000. The most important data results are shown in the tables of Chapters III, IV, V and VI, together with the 1970 base year comparisons. Nevertheless, some aspects of the projections, especially data sources, have not yet been explained and this is now done. The following aspects appear to be the most significant.

(i) Import Coefficients: for the nonresource tradable sectors (mostly manufacturing), import coefficients were obtained from basic sources 1961-1971 and updated to 1974 using Statistics Canada, *Manufacturing Industries of Canada*, Catalogue 31-203 and *Merchandise Trade*, Catalogues 65-202 and 65-203. A linear trend was fitted to the observations (some nonlinear trends were also tried) yielding 1961 and 1974 trend values for import coefficients (to abstract from cyclical influences). Then the jth arc elasticity used in the import coefficient projection formula given in Appendix A is calculated as

$$\varepsilon_j = \frac{\log[\mu_{j(74)}/\mu_{j(61)}]}{\log[GDP_{(74)}/GDP_{(61)}]}$$

where $\mu_{j(74)}$ and $\mu_{j(61)}$ are the jth import coefficient trend values for 1974 and 1961, and $GDP_{(74)}$ and $GDP_{(61)}$ are gross domestic products for the two years in constant dollars. In some cases the projection exercise was performed on the basis of 1965-1974 trend values (rather than 1961-1974). A more judgmental method was used to project resource sectoral import coefficients to the year 2000 (as noted in the text). Here the references are Statistics Canada, *General Review of the Mineral Industries*, Catalogue 26-601 and *Trade of Canada Statistics*, Catalogues 65-004 and 65-007.

(ii) Nonresource Exports: the checks required for the Canadian shares of NAR exports 1966-1976 were done with United Nations, *Commodity Trade Statistics*, *World Trade Annual*, and *Yearbook of International Trade Statistics*.

(iii) Resource Outputs: the analysis of Canadian shares of NAR resource outputs 1966-1976 was performed using *General Review of the Mineral Industries*; U.S. Bureau of Mines, *Minerals Yearbook*; United Nations, *World Energy Supplies*, *Statistical Yearbook* and *Monthly Bulletin of Statistics*. The Canadian resource output constraints in year 2000, relative to NAR and world resource output constraints, were taken from the following listed sources --

(iiia) Copper: Energy, Mines and Resources, *MR149*.

(iiib) Nickel: Energy, Mines and Resources, *MR157*.

(iiic) Zinc: Energy, Mines and Resources, *MR159*.

(iiid) Lead: Energy, Mines and Resources, *MR167*.

(iiie) Iron: Energy, Mines and Resources, *MR148*.

(iiif) Petroleum: National Energy Board, *Canadian Oil Supply and Requirements* and Energy, Mines and Resources, *An Energy Strategy for Canada* (using high-price scenario including oil sands and frontier supplies).

(iiig) Natural Gas: National Energy Board, *Canadian Natural Gas Supply and Requirements* and Energy, Mines and Resources, *An Energy Strategy for Canada* (using high-price scenario including frontier supplies).

(iiih) Coal: Energy, Mines and Resources, *An Energy Strategy for Canada* (with high-price scenario).

(iiii) Residual Mining: Energy, Mines and Resources, *MR155, 156, 160, 167*.

Share trends, constraints and world model NAR scenario projections were then combined in a judgmental manner to yield Canadian resource outputs in 2000 as seen in Appendix A formula.

(iv) Personal Consumption Expenditures: the consumption pattern was obtained from basic sources 1961-1971 and updated to 1976 using a 1971 link converter coefficient matrix applied to national accounts consumption categories from Statistics Canada, *National Income and Expenditure Accounts 1962-1976*, Catalogue 13-201. The Engel arc elasticities ξ used to project the consumption pattern (see Appendix A) were essentially calculated from 1961 and 1976 data somewhat analogous to

calculation of ε_j above. Thus the jth element is[1]

$$\xi_j = \frac{\log[e^*_{j(76)}/N_{(76)}] - \log[e^*_{j(61)}/N_{(61)}]}{\log[i'e^*_{(76)}/N_{(76)}] - \log[i'e^*_{(61)}/N_{(61)}]}$$

where $e^*_{j(76)}$ and $e^*_{j(61)}$ are the jth sectoral consumptions in 1976 and 1961, $N_{(76)}$ and $N_{(61)}$ are total population in the two years, and $i'e^*_{(76)}$ and $i'e^*_{(61)}$ are total sectoral consumption in the two years, with consumption always measured in constant dollars.

(v) Travel Expenditures (Abroad): this is classified as an import item for the special sector number 47 (see Chapter III). Representing the item by m^*_j for the year 2000 then

$$m^*_j = m^*_{j(70)} \lambda^{\varepsilon^*_j} \eta^{1-\varepsilon^*_j}$$

where $m^*_{j(70)}$ is travel expenditures in base year 1970, λ is the ratio of GDP in 2000 to 1970 GDP, η is the ratio of total population in 2000 to population in 1970, and ε^*_j is an historically calculated arc elasticity

$$\varepsilon^*_j = \frac{\log[m^*_{j(76)}/N_{(76)}] - \log[m^*_{j(64)}/N_{(64)}]}{\log[GDP_{(76)}/N_{(76)}] - \log[GDP_{(64)}/N_{(64)}]}$$

where $m^*_{j(76)}$ and $m^*_{j(64)}$ are real (constant dollar) travel expenditures in 1976 and 1964, and $GDP_{(76)}$, $GDP_{(64)}$, $N_{(76)}$ and $N_{(64)}$ are analogous to previous notation. Travel expenditures data come from Statistics Canada, *Travel Between Canada and Other Countries*, Catalogue 66-201 and consumption service deflators were used from *National Income and Expenditures Accounts*, Catalogue 13-533.

---

1 Prior to adjustment to guarantee "adding-up" (see Appendix A).

(vi) Capital-Output Ratios: projected from $k_{(70)}$ using judgmental methods for nonresource sectors and U.N. model documentation (see next section) for resource sectors. Ratio trends were adapted from Postner [28] (with modifications using *Fixed Capital Flows and Stocks*) and Department of Finance, *Canada's Economy: Medium-term Projections and Targets* (1978). The reader could trace implied changes in sectoral capital-output ratios 1970-2000 by comparing sectoral output growth rates with sectoral fixed capital stock requirements growth rates (sector of destination) in the tables of Chapter III.

(vii) Trade and Transportation Export Margins: these margins for all Canadian exports (sectors number 31 and 33) were projected by special methods requiring iteration on "advance" estimates of resource exports (in effect, using notation of Appendix A, x_1 is not quite independent of solution vector x_2). Margin coefficient data come from basic sources and Statistics Canada, *The Input-Output Structure of the Canadian Economy*, Catalogue 15-502.

B.3 United Nations Model Documentation

Some important aspects of the Canadian projections 2000 come from U.N. model documentation generously provided by Brandeis University. In most cases the documentation has not been published and in some cases the documentation is not explicitly authored. However, in all cases described below (where relevant), the NAR documentation was applied to Canada.

(i) Input-Output Matrix: the base year matrix $A_{(70)}$ was formed as the product of distinct input and output coefficient matrices from basic sources (see also previous Appendix). Some additional adjustments were also required to conform with particular sectoral alignment of this study.[1] Then the modifier matrix, M, which updates $A_{(70)}$ to year 2000, comes *mainly* from U.N. sources, implying that NAR future technological trends can be applied to Canada. Some key papers used for U.N. study are: A. Shapanka, R. Ayres and S. Noble, "The Use of Explicit Technological Forecasts in Long-Range Input-Output Models"; R. Whorf, "Transportation Technology Forecast for the United Nations Input-Output Model"; and P. Cline, "Emerging Technologies in Agriculture and their Impacts on Input-Output Coefficients". Using these papers, important intermediate input coefficient changes occur for the following sectoral technologies: textiles, motor vehicles, aircraft and construction.[2] The key paper used to update NAR resource sectoral technology, featuring increasing scarcity of some high quality fossil fuel and mineral reserves,[3] is not explicitly authored: "Inputs into Extraction from Manufacturing and Services". Another paper was also used: G. Weisbrod, "Oil and Natural Gas Production Costs". In

---

1 It was not practical to retain the industry technology format of Canadian I-O accounts for this study since *both* part of Canadian final demand (x_1) and part of Canadian domestic output (q_2) are derived from NAR world model data which are all on a sectoral commodity basis. Our model implies the commodity technology format discussed in *The Input-Output Structure of the Canadian Economy*.

2 Also, scientific instruments becomes a more important intermediate input for some sectors, while industrial chemicals declines in importance.

3 Recall that the Canadian "weight" in NAR for most resource sectors is quite high as seen in Chapter II.

addition, some particular Canadian coefficients were updated on the basis of special analysis for this study of 1961-1971 coefficient changes using basic data sources. This was done for: service inputs into agriculture, agricultural inputs into food processing, crude petroleum input into petroleum refining, residual agriculture inputs (mostly forestry) into wood products. The coal and residual mining (uranium) inputs into utilities were also analysed 1961-1971 and updated to 2000 using expected changes in Canadian electrical power mix from *An Energy Strategy for Canada* (average of low-growth and high-growth cases). Most mineral coefficients, especially mineral inputs into primary metal processing, were scaled downwards 1970-2000 to reflect increased recycling of various metals.[1] The scaling coefficients were borrowed from U.N. documentation. The lead and zinc coefficients were further reduced to reflect hypothetical effects of possible conservation and substitution measures by the year 2000. (Canadian shares of NAR resource outputs for the latter two minerals imply such measures; see Carter and Petri [4].) Note that recycling multipliers are not relevant for the energy sectors. Finally, substitution and complementarities among various intermediate and primary inputs imply that only a unified approach to projection of different input coefficients can produce fully consistent results. The present, essentially trend-based projections of individual inputs, represent only a first approximation.

---

1 The general idea, e.g., is that scrap iron metal is an increasing substitute for iron ore.

(ii) Capital-Output Ratios and Related Matrix: the ratio trends for resource sectors come from "Inputs into Extraction from Manufacturing and Services" where the fundamental references are given. The step multipliers use an average of the low and high resource endowment assumptions. (Again, the impact can be observed by comparing resource output growth rates with required fixed capital stock growth rates by resource sector of destination.) The utilities sector distribution vector of capital investment demands was modified 1970-2000 using expected changes in Canadian electrical power mix from *An Energy Strategy for Canada* combined with R. Tessmer, *Input-Output Capital Coefficients for Energy Technologies*, Brookhaven National Laboratory (1976). The modified vector plays an important role in the energy conservation scenario explained in Chapter VI.

(iii) Relative Price Changes: described in U.N. documentation paper "Prices in the World Model". The projected world price vector 2000 is essentially estimated as the solution of the NAR input-output dual problem with (a) updated I-O structure, particularly costs of resource extraction, (b) expected changes in sectoral labour productivities and required capital stocks, and (c) normalized so that average price of final demand pattern, NAR, remains the same as in 1970. To adapt the world model prices to the Canadian model methodology, some adjustments were required for the following sector price changes: food processing, petroleum refining,

primary metal processing.[1] Note that price changes are used exclusively to value international trade composition and balance-of-trade in current prices and do not directly interact with other aspects of the model. On the other hand, balance-of-trade "problems" (see Chapter VII) stimulate search for alternative and sustainable scenarios and thus, price changes, indirectly act on the real (quantity) side of the model.

---

1 The U.N. model regards the output of these sectors to be equivalent to their "processing margins". The Canadian model works with the gross output concept for these sectors.

APPENDIX C: SECTORAL ALIGNMENT TABLE

The following table shows the relationship between the Canadian model sectoral alignment and the Statistics Canada input-output commodity classification system. The latter is fully explained in Statistics Canada *The Input-Output Structure of the Canadian Economy, 1961-1971*, Catalogue 15-506, Occasional, Ottawa, March 1977. Sometimes the model sectors are directly related to the medium ("M") commodity classification and other times the more detailed large ("L") classification is required to show the meaning of the alignment. Thus the Canadian model sectors are merely an aggregation of the medium or large (or mixture of medium and large) commodity classification system employed by Statistics Canada. A knowledge of the precise commodity contents of the Canadian model sectors is useful in interpreting the results of this study (see also Chapter VIII).

The Canadian model sectors are very closely related to those used by the U.N. global model. Indeed the sectoral alignment was chosen to maximize the use of NAR scenario printouts in Canadian nonresource exports and resource outputs projections. The U.N. model deploys 43 sectors listed in Leontief *et al.*[22], p. 73. The commodity contents of these sectors were obtained from U.N. documentation and served as the guidelines in relating the Canadian sectors to the Statistics Canada commodity system. In almost all cases there is a direct one-to-one correspondence between U.N. model sectors and Canadian model sectors. The exceptions are as

follows: (a) sector numbers 4 and 5 of the U.N. model (root-crops and residual agriculture) are aggregated into one sector for the Canadian model; (b) there is a distinct noncompetitive agricultural import sector for the Canadian model with commodity content probably included in sector 5 of the U.N. model; (c) the Canadian model deploys three dummy sectors (indicated in the following table); (d) tourist trade is a distinct export or import sector in the Canadian model, whereas tourist trade is "somehow" aggregated with the service sector in the U.N. model. Thus, building on the original 43 sectors of the U.N. model, the Canadian model possesses 47 sectors (one of which only enters international trade).

Table 50

Canadian Model Sectoral Alignment Defined in Terms of Statistics Canada Aggregation Parameters

Model Sector	StatCan "M"	StatCan "L"
(1) Livestock		(1) cattle & calves (2) sheep & lambs (3) hogs (4) poultry (5) other live animals (9) milk (10) eggs
(2) Oilcrops		(18) oilseeds, nuts & kernels
(3) Grains		(6) rice, unmilled (7) wheat, unmilled (8) barley, oats, rye, corn, grain n.e.s.
(4) Residual Agriculture		(11) honey & beeswax (12) nuts, edible, not shelled (13) fruits, fresh, ex. tropical (14) vegetables, fresh (15) hay, forage & straw (16) seeds ex. oil & seed grades grades (17) nursery stock & related materials (19) hops incl. lupulin (20) tobacco, raw (21) mink skins, ranch, undressed (22) wool in grease (23) services incidental to agriculture & forestry (24) logs & bolts (25) poles, pit props, fence posts, etc. (26) pulpwood (27) other crude wood materials (28) custom forestry (29) fish landings (30) hunting & trapping products
(5) Food Processing	(14) meat products (15) dairy products (16) fish products (17) fruit & vegetable preparations (18) feeds (19) wheat flour, meal & flour of other cereals (20) breakfast cereal & bakery products (21) sugar (22) miscellaneous food products (23) soft drinks (24) alcoholic beverages (25) tobacco processed, unmanufactured (26) cigarettes & tobacco manufacturing	
(6) Petroleum Refining	(62) gasoline & fuel oil (63) other petroleum & coal products	
(7) Primary Metal Processing	(45) iron & steel products (46) aluminum products (47) copper & alloy products (48) nickel products (49) other nonferrous metal products	
(8) Textiles, Clothing	(30) leather & leather products (31) yarns & man-made fibres (32) fabrics (33) other textile products (34) hosiery & knitted wear (35) clothing & accessories	
(9) Wood Products	(36) lumber & timber (37) veneer & plywood (38) other wood fabricated materials	
(10) Furniture, Fixtures	(39) furniture & fixtures	
(11) Paper Products	(40) pulp (41) newsprint & other paper stock (42) paper products	
(12) Publishing	(43) prirting & publishing (44) advertising, print media	
(13) Rubber Products	(27) tires & tubes (28) other rubber products	
(14) Industrial Chemicals	(29) plastic fabricated products (64) industrial chemicals	
(15) Fertilizers	(65) fertilizers	
(16) Other Chemicals	(66) pharmaceuticals (67) other chemical products	

Table 30 (cont'd.)

Model Sector	StatCan "M"	StatCan "L"
(17) Cement	(60) cement & concrete products	
(18) Nonmetallic Mineral Products	(61) other nonmetallic mineral products including asbestos products	
(19) Motor Vehicles and Parts	(55) motor vehicles (56) motor vehicle parts	
(20) Other Transportation Equipment		(345) locomotives, cars & tenders (346) self-propel cars (347) parts for railway rolling stock (348) ships & boats, military & commercial (349) sub-assemblies, parts, ships (350) ship repairs (351) snowmobiles & misc. non-motor vehicles (352) pleasure & sporting craft
(21) Aircraft and Parts		(330) aircraft, all types (331) aircraft engines (332) specialized aircraft equipment (333) modifications, conversions, services
(22) Metal Products	(50) boilers, tanks & plates (51) fabricated structural metal products (52) other metal fabricated products	
(23) Machinery	(53) agricultural machinery (54) other industrial machinery	
(24) Electrical Products	(58) appliances & receivers, household (59) other electrical products	
(25) Scientific Instruments		(497) aircraft & nautical instruments (498) lab & scientific apparatus (499) miscellaneous measure & control instruments (500) medical & related instruments (501) ind., military & civil defence equipment (503) photographic equipment & supp. film
(26) Other Manufacturing	(69) other manufactured products	(502) watches, clocks, chronometres, etc.
(27) Services	(13) services incidental to mining (82) imputed rent on owner-occupied dwellings (83) other finance, insurance, real estate (84) business services (85) education services (86) health services (87) amusement & recreation services (88) accommodation & food services (89) other personal & miscellaneous services	
(28) Transport	(73) pipeline transportation	(530) air transportation (531) other transportation (532) services incidental to transport n.e.s. (533) water transportation (534) services incidental to water transportation (535) railway transportation (536) trade transportation (537) bus transport, interurban, rural (538) urban transit (539) taxicab transportation (541) highway & bridge maintenance
(29) Utilities	(78) electric power (79) other utilities	
(30) Construction	(70) residential construction (71) nonresidential construction (72) repair construction	
(31) Trade Margins	(80) wholesale margins (81) retail margins	(542) storage
(32) Communications	(75) radio & television broadcasting (76) telephone & telegraph (77) postal services	

Table 50 (cont'd.)

Model Sector	StatCan "M"	StatCan "L"
*(33) Transportation Margins	(90) transportation margins	
*(34) Supply, Repair Services	(91) operating, office, lab & food	
*(35) Travel, Promotion, Advertising	(92) travel, advertising & promotion	
(36) Noncompetitive Imports	(93) noncompeting imports	
(37) Copper (38) Nickel (39) Zinc (40) Lead		(36) metal ores & concentrates n.e.s.
(41) Bauxite		(35) bauxite excluding alumina
(42) Iron		(34) iron ores & concentrates
(43) Crude Petroleum		(38) crude mineral oils
(44) Natural Gas		(39) natural gas
(45) Coal		(37) coal
		(40) other crude bituminous substances
(46) Residual Mining		(31) gold ores (32) gold & alloys in primary form (33) radioactive ores & concentrates (41) sulphur, crude & refined (42) asbestos, unmanufactured, crude & fibrous (43) gypsum (44) salt (45) peatmoss (46) clay & other crude refractory materials (47) natural abrasives & individual diamonds (48) crude mineral n.e.s. (49) sand & gravel (50) stone, crude
(47) Tourist Trade	(94a) part of unallocated imports and exports	

*Indicates dummy sectors.

BIBLIOGRAPHY

Most statistical data sources, including United Nations model documentation, have already been given in Appendix B. The following references are in addition to those previously presented and were used in the text and Appendix A.

[1] Almon, C., *1985: Interindustry Forecasts of the American Economy*, D. C. Heath and Company, Toronto (1974).

[2] Almon, C., *The American Economy to 1975*, Harper and Row Publishers, New York (1966).

[3] Barker, T., "International Trade and Economic Growth: An Alternative to the Neoclassical Approach," *Cambridge Journal of Economics* (June 1977).

[4] Carter, A. P. and P. A. Petri, "Factors Affecting Long-Term Prospects of Developing Regions," Economic Council of Canada, Discussion Paper No. 117 (June 1978).

[5] Carter, A. P. (editor), *Energy and the Environment: A Structural Analysis*, Brandeis University Press, Hanover, New Hampshire (1976).

[6] Clark, P. G., "The Telephone Industry: A Study in Private Investment," in W. Leontief, *Studies in the Structure of the American Economy*, Oxford University Press, New York (1953).

[7] Department of Finance, "Canada's Economy: Medium-Term Projections and Targets," Ottawa (February 1978).

[8] Department of Industry, Trade and Commerce, *A Structural Analysis of the Canadian Economy to 1990*, Discussion Paper, Ottawa (May 1978).

[9] Economic Bulletin for Europe, "Trade Network Projections and International Consistency Texts," United Nations, Vol. 24, No. 2 (1973).

[10] Economic Council of Canada, *For a Common Future*, Ottawa (1978).

[11] Economic Council of Canada, *A Time For Reason*, Ottawa (1978).

[12] Eden, R. J., *et al*., "World Energy Demand to 2000," paper prepared by Cavendish Laboratories of Cambridge University for the World Energy Conference, Executive Summary (1977).

[13] Eyford, B. L., and B. Cain, "Simulations with CANDIDE to the Year 2000," Economic Council of Canada, Discussion Paper No. 89 (May 1977).

[14] Ginsburgh, V., and J. Waelbroeck, "A General Equilibrium Model of World Trade, Part III," Center for Operations Research and Econometrics, Discussion Paper 7714, Université Catholique de Louvain (June 1977).

[15] Grosse, R. N., "The Structure of Capital," in W. Leontief, *Studies in the Structure of the American Economy*, Oxford University Press, New York (1953).

[16] Grubel, H. G., and P. J. Lloyd, *Intra-Industry Trade*, Macmillan Press Ltd., London (1975).

[17] Hoffman, R. B., "Users Guide to the Statistics Canada Long-Term Simulation Model," Structural Analysis Division, Statistics Canada, Ottawa (February 1977).

[18] Jorgenson, D., and E. A. Hudson, "Energy Policy and U.S. Economic Growth," *American Economic Review* (May 1978).

[19] Jorgenson, D., "The Economic Theory of Replacement and Depreciation," Harvard Institute of Economic Research, Harvard University (1971).

[20] Keyfitz, N., "Resources and the World Middle Class," in K. Deutsch *et al.* (eds.), *Problems of World Modeling: Political and Social Implications*, Ballinger Publishing Company, Cambridge (1977).

[21] Klein, L., "Comment on W. Leontief *et al.*, The Future of the World Economy," Unpublished note (1977).

[21a] Knelman, F. H., *Energy Conservation*, Science Council of Canada Background Study No. 33, Ottawa (July 1975).

[22] Leontief, W., A. P. Carter and P. A. Petri, *The Future of the World Economy: A United Nations Study*, Oxford University Press, New York (1977).

[23] Leontief, W., "Projecting the Future of the World Economy," in W. Leontief (ed.), *Structure, Systems and Economic Policy*, Cambridge University Press, Cambridge (1977).

[24] Levitt, T., "The Industrialization of Service," *Harvard Business Review* (September-October 1976).

[25] Marwah, K., "A World Model of International Trade: Forecasting Market Shares and Trade Flows, *Empirical Economics*, Vol. 1 (1976).

[26] O.E.C.D., "A Comparative Evaluation of World Models," Interfutures Project, Paris (May 1977).

[27] Postner, H. H., "Canadian Implications of the United Nations World Input-Output Model," paper presented at Twelfth Annual Meeting of Canadian Economics Association, University of Western Ontario (May 1978).

[28] Postner, H. H., *Factor Content of Canadian International Trade: An Input-Output Analysis*, Economic Council of Canada, Ottawa (1975).

[29] Skolka, J., "The Substitution of Self-Service Activities for Marketed Services," *Review of Income and Wealth* (December 1976).

[30] Statistics Canada, *The Input-Output Structure of the Canadian Economy in Constant 1961 Prices, 1961-1971*, Catalogue 15-507, Ottawa (December 1977).

[31] Statistics Canada, *The Input-Output Structure of the Canadian Economy, 1961-1971*, Catalogue 15-506, Ottawa (March 1977).

[32] Statistics Canada, *The Input-Output Structure of the Canadian Economy, 1961*, Catalogue 15-501, Ottawa (August 1969).

[33] Statistics Canada, *Population Projections for Canada and the Provinces, 1972-2001*, Catalogue 91-514, Ottawa (June 1974).

[34] Statistics Canada, *Household and Family Projections for Canada and the Provinces to 2001*, Catalogue 91-517, Ottawa (November 1975).

[35] Stone, R., "The Evaluation of Pollution: Balancing Gains and Losses," *Minerva: A Review of Science Learning and Policy* (July 1972).

[36] Stone, R., "Input-Output Projections: Consistent Prices and Quantity Structures," *L'industria* (No. 2, 1968).

[37] Wilkinson, B., and K. Norrie, *Effective Tariff Protection and the Return to Capital*, Economic Council of Canada, Ottawa (1975).

[38] World Bank, *World Development Report, 1978*, Washington, D.C. (August 1978).