FLOYD, Robert Huffman, 1939-
DOMESTIC TAX SYSTEMS AND THE PROVISIONS OF
THE GENERAL AGREEMENT ON TARIFFS AND TRADE:
A THEORETICAL ANALYSIS OF THEIR IMPLICATIONS
FOR ECONOMIC EFFICIENCY.

Rice University, Ph.D., 1971
Economics, public finance

University Microfilms, A XEROX Company, Ann Arbor, Michigan

© Copyright
Robert Huffman Floyd
1971
RICE UNIVERSITY

DOMESTIC TAX SYSTEMS AND THE PROVISIONS OF THE GENERAL AGREEMENT ON TARIFFS AND TRADE: A THEORETICAL ANALYSIS OF THEIR IMPLICATIONS FOR ECONOMIC EFFICIENCY

by

Robert Huffman Floyd

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY

Thesis Director's signature:

Houston, Texas

May 1971
ABSTRACT

DOMESTIC TAX SYSTEMS AND THE PROVISIONS OF
THE GENERAL AGREEMENT ON TARIFFS AND TRADE:
A THEORETICAL ANALYSIS OF THEIR IMPLICATIONS
FOR ECONOMIC EFFICIENCY

Robert H. Floyd

The thesis examines the implications for economic efficiency and
tax neutrality of the provisions of the General Agreement on Tariffs and
Trade which codify the international treatment of internal taxes on
traded goods. In addition, several recently proposed changes in these
provisions are examined. The historical and conceptual underpinnings
of the provisions and the proposed changes in them are reviewed and in
some cases challenged. The study develops and employs a neoclassical,
two country, general equilibrium model for a theoretical analysis of
the effects of various product and factor tax schemes on consumption,
production, and trade patterns. With the exception of isolated excises,
the study finds that the application of border adjustments for domestic
taxes does not neutralize any induced international effects. Neutral
taxes remain neutral. Distortions arising from nonneutral taxes are
altered but are not eliminated. Thus, in the comparative statics con-
text of the study, the use of border adjustments to promote economic
efficiency is not supported. A more valid justification for their use
might rest on short run considerations of their implications for growth
and development.
TO MY MOTHER AND THE CHERISHED MEMORY OF MY FATHER
ACKNOWLEDGMENTS

This research began during my third year of graduate work, which was supported by a National Defense Education Act Fellowship. A fourth year was partially supported by a Rice University tuition fellowship. The material in Chapters IV-VI was in a large part presented as a paper at the November 1970 meetings of the Southern Economic Association. The Federal Reserve Bank of Atlanta generously provided the time necessary for me to complete the parts of that paper which appear in Chapters V and VI. For all of these sources of support I am deeply grateful.

Many individuals have been helpful in this research. It is impractical to thank them all individually, but a few deserve special recognition. Foremost among them is Professor Charles E. McLure, Jr. to whom I am deeply indebted and highly appreciative. His constructive criticisms and suggestions, stimulating conversations, and willing attention have been invaluable. I am also indebted to Professor Donald Huddle, who has given freely of his time and expertise. Miss Flavel McMichael, Miss Nancy Rhodes, and Miss Julie Shankle have been most helpful. Finally, I am thankful for the generous and exceptionally competent services at the typewriter of Mrs. Bonnie Watson.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Acknowledgments</td>
<td>iv</td>
</tr>
<tr>
<td>I</td>
<td>Introduction</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>The Provisions of the General Agreement</td>
<td></td>
</tr>
<tr>
<td></td>
<td>on Tariffs and Trade</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Summary of the Current Controversies</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>The Background and Purposes of the GATT Provisions</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>Introduction</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Some Historical Observations</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Purposes and Rationale</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Conclusions and Implications</td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>Concepts and Criteria</td>
<td>51</td>
</tr>
<tr>
<td></td>
<td>Introduction</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Public Finance Concepts</td>
<td></td>
</tr>
<tr>
<td></td>
<td>International Trade Concepts</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Synthesis of Concepts</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Criteria for Evaluation</td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>A General Equilibrium, Neoclassical Model of Production, Consumption,</td>
<td>97</td>
</tr>
<tr>
<td></td>
<td>Taxes, and Trade</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Introduction</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The Model</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The Model Simplified</td>
<td></td>
</tr>
<tr>
<td>V</td>
<td>The Analysis of Product Taxes</td>
<td>118</td>
</tr>
<tr>
<td></td>
<td>Introduction</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Neutral Product Taxes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Nonneutral Product Taxes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Summary</td>
<td></td>
</tr>
<tr>
<td>VI</td>
<td>The Analysis of Factor Taxes</td>
<td>143</td>
</tr>
<tr>
<td></td>
<td>Introduction</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Neutral Factor Taxes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Nonneutral Factor Taxes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Adjustments to the Earnings of Capital</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Summary</td>
<td></td>
</tr>
<tr>
<td>CHAPTER</td>
<td>Page</td>
<td></td>
</tr>
<tr>
<td>-------------------------------</td>
<td>------</td>
<td></td>
</tr>
<tr>
<td>VII. SUMMARY OF FINDINGS AND POLICY IMPLICATIONS.</td>
<td>172</td>
<td></td>
</tr>
<tr>
<td>Introduction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Summary of Findings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Policy Implications</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suggestions for Additional Research</td>
<td></td>
<td></td>
</tr>
<tr>
<td>APPENDIX.</td>
<td>191</td>
<td></td>
</tr>
<tr>
<td>BIBLIOGRAPHY.</td>
<td>199</td>
<td></td>
</tr>
</tbody>
</table>
CHAPTER I

Introduction

Domestic or internal taxation is but one of numerous national policies which influence international trade. Strangely, the trade effects of various domestic tax policies have received little attention in international trade literature. The area has remained one of largely unasked or unanswered questions. This situation contrasts sharply with the extensive attention devoted to one particular national tax—the tariff.¹

Recently the international effects of taxation policies have been given closer scrutiny. Most of the effort has been directed toward two different controversies. On the one hand, attention has focused on the alleged disadvantage in the trade position of the United States due to its use of a corporate profits tax rather than other taxes, such as a value added tax. On the other hand, the international and internal effects of economic integration and tax harmonization in Europe have received considerable study. Both issues relate to the manner in which domestic taxes are treated in international trade. Both have spurred

many policy recommendations for the international treatment of domestic taxes. These suggestions have only occasionally been based on rigorous analysis and carefully stated rationale. In addition, they have often overlooked many important aspects of the issues.

Since these issues have taken on considerable political and economic importance, a thorough study of some of their ramifications seems justified. This study addresses itself to some of the efficiency implications of domestic taxes in an international economy. The emphasis throughout is on rigorous treatment which combines the relevant portions of both public finance and international trade theories. As a beginning, let us review the current controversies and the regulations which have led to them.

1.1 The Provisions of the General Agreement on Tariffs and Trade

The regulations which presently govern the treatment of domestic taxes on goods entering international trade are found in the General Agreement on Tariffs and Trade. These rules apply to some 82 nations of the world. They cover approximately 90% of free world trade. Basically, the provisions of the GATT "permit" any nation to apply what have become known as border tax adjustments for some, but not all, internal or purely domestic taxes. A country may levy a surcharge or border tax on imports. The surcharge must be equivalent to or less

\[ \text{For brevity I shall henceforth use the commonly accepted abbreviation GATT, rather than the complete name of the treaty.} \]

than the amount of indirect taxes levied on similar products domestically produced and consumed. Similarly, a nation may rebate from the price of its exports an amount equal to or less than the amount of indirect taxes paid during their production. Alternatively, taxes may simply not be charged on goods produced for export. There are no comparable provisions for direct taxes. The combination of the import surcharge and export rebate are commonly referred to as border tax adjustments. When border tax adjustments are applied to imports and exports in order to compensate for domestic product taxes, the taxes are said to be levied in accordance with the destination principle. When border tax adjustments are not applied, the tax is levied in accordance with the origin principle.

4Since the terms "indirect tax" and "direct tax" are often ambiguous, I shall use instead the terms "product tax" and "factor tax," respectively. This distinguishes more clearly between taxes in accordance with their impact. That is, taxes are usually levied on either the transfer of a product (e.g., a sales or value added tax) in which case the value of the product is the tax base; or on a factor of production or its earnings (e.g., income taxes) in which case the earnings of the factor constitute the tax base. Also, the distinction is particularly relevant in an international context because of the standard trade theory assumption that products are fully and freely mobile, but factors of production are completely immobile. In the context of this study, product taxes correspond to taxes for which border adjustments are allowed, and factor taxes correspond to taxes for which border adjustments are not allowed.

5Since the term border tax adjustments and the abbreviation BTA's are prevalent and commonly accepted, I shall employ this terminology. It will be shown later that, at least with respect to the GATT provisions, the terminology is misleading.

The regulation primarily concerned with the surcharge on imports is found in Article III of the GATT, "National Treatment on Internal Taxation and Regulation," which states in paragraphs 1 and 2:

1. The contracting parties recognize that internal taxes and other internal charges, and laws, regulations, and requirements, affecting the internal sale, offering for sale, purchase, transportation, distribution or use of products, and internal quantitative regulations requiring the mixture, processing or use of products in specified amounts or proportions, should not be applied to imported or domestic products so as to afford protection to domestic production.

2. The products of the territory of any contracting party imported into the territory of any other contracting party shall not be subject, directly or indirectly, to internal taxes or other internal charges or any kind in excess of those applied directly or indirectly, to like domestic products. Moreover, no contracting party shall otherwise apply internal taxes or other internal charges in a manner contrary to the principles set forth in paragraph 1.7

No other articles of the GATT deal primarily with import surcharges. The provision is mentioned in other sections of the treaty, but only in order to prevent confusion from arising between the topic at hand and the provisions of Article III.8 Also, numerous interpretive statements concerning this provision are found in various

---


8For example, GATT, BISD, p. 6, paragraph 2(a) of Article II provides that any tariff concession granted by a nation shall not prevent any member nation "...from imposing at any time on the importation of any product... a charge equivalent to an internal charge imposed consistently with the provisions of paragraph 2 of Article III in respect of the like domestic product or in respect of an article from which the imported product has been manufactured or produced in whole or in part."
supplements. Since their impact is of no importance to this study, they will not be examined further.

The regulation concerned with the rebate of domestic product taxes from the prices of exports is Article XVI, which was primarily designed to discourage the application of export subsidies.\(^9\) In the Notes and Supplementary Provisions of the GATT, the note to Article XVI states that:

The exemption of an exported product from duties or taxes borne by the like product when destined for domestic consumption, or the remission of such duties or taxes in amounts not in excess of those which have accrued, shall not be deemed to be a subsidy.\(^10\)

The export rebate provision is not so much a rule concerning the granting of a rebate of taxes on exports as it is a definition that such rebates do not constitute a subsidy. As was the case with Article III, there are other related but less important sections of the treaty which are concerned with the export rebate.\(^11\)

---

\(^9\)For reasons which will be discussed later, the GATT did not prohibit subsidies.

\(^10\)GATT, BISP, p. 71.

\(^11\)For example, GATT, BISP, p. 15, Article VII, paragraph 3, states that "...the value for customs purposes of an imported product should not include the amount of any internal tax, applicable within the country of origin or export, from which the imported product has been exempted or has been or will be relieved by means of refund." In addition, GATT, BISP, pp. 12-13, Article VI, "Anti-dumping and Countervailing Duties," paragraph 1, provides that taxation differences should be considered when determining whether or not dumping has occurred. Paragraph 3 permits the use of countervailing duties to offset subsidies used by a nation practicing dumping. It is clear, however, that the use of countervailing duties should not apply to tax rebates. Paragraph 4 states that "...no product of the territory of any contracting party imported into the territory of any other contracting party shall be subject to anti-dumping or countervailing duty by reason of the exemption of such product from duties or taxes borne by the like product when destined for consumption in the country of origin or exportation, or by reason of the refund of such duties or taxes."
The salient point to note in these provisions is the word "product." There is no ambiguity concerning the type of taxes to which they apply. The sole concern is with taxes on products rather than taxes on incomes, profits, property, wages or any other non-product tax base.\textsuperscript{12} The controversies which have developed over these provisions could not have arisen from misinterpretation.

\textbf{1.1.1 Practical Application of the Provisions}

What has been the practical interpretation of these articles? While there is (or has been) general consensus on the matter, there are many exceptions. By custom as much as by rule nations have been more or less free to choose the taxes for which border adjustments are applied. The major restraint on the behavior of individual nations with regard to the taxes for which they adjust and the rates at which they adjust appears to be simple fear of reprisal by their trading parties.\textsuperscript{13} Reprisal is possible either in the form of countervailing duties or instituting new adjustments for taxes which had not been used previously. It is generally accepted, however, that the following taxes are eligible for border adjustment:

---

\textsuperscript{12}This is another justification for classifying taxes as product or factor taxes in accordance with their base. The provisions apply only to taxes on products. Taxes on income, profits, property, or wages may in a general sense be considered as taxes on a factor of production (or their owners) or at least on its income. At no point is there mention of "direct" or "indirect" taxes in the GATT, and the phrase "directly or indirectly" in Article \textsuperscript{III} could not reasonably be interpreted as a reference to the type of tax.

(1) excise taxes,
(2) single-stage sales taxes,
(3) multi-stage cumulative (turnover) product taxes, and
(4) multi-stage noncumulative (value added) product taxes.\textsuperscript{14}

A single-stage sales tax may be levied on the sale of a product at any stage of the production process. Two examples are a wholesale sales tax or a retail sales tax. Canada, Ireland, and Norway employ such taxes. Since most international trade occurs before the retail stage, border adjustments are usually not necessary for a retail sales tax. If this tax has by chance been paid on exports, or if importation is done by a final consumer, border adjustments are made.

Multi-stage cumulative taxes apply to the sale of products or components of products at numerous stages of the production process. Although they are now largely relics of the past, the German cascade tax (abandoned on January 1, 1968) was an excellent example. Austria also employs such a tax. Multi-stage cumulative taxes make accurate border adjustments difficult. Since the tax is levied on each turnover or sale, the fewer the turnovers in any particular product's production process, the fewer times the tax will be levied on taxes levied at previous stages. Thus, the more vertically integrated is a particular firm, the lower will be the effective tax on products of that firm.

\textsuperscript{14}Organization for Economic Co-Operation and Development (OECD), \textit{Border Tax Adjustments and Tax Structures in OECD Member Countries} (Paris: OECD Publications, 1968), pp. 68-70. This report is perhaps the most comprehensive study of actual border tax adjustment practices available. While the author does not concur with much of the economic rationale employed in the report, it is, nevertheless, valuable for institutional information. Since this study mentions only briefly many of these aspects, the reader is referred to the OECD report.
Since the effective tax varies from firm to firm, the amount of tax included in a product's value and, consequently, accurate border adjustments are quite difficult to estimate. Nations which used cumulative multi-stage product taxes have exercised considerable freedom in setting the amount or rate of adjustment. Various tax studies have occasionally been used as justification for changes in adjustment rates, but for the most part the rates have been arbitrary guesses or estimates.  

The best, and perhaps only, example of a multi-stage noncumulative tax is the value added tax (TVA). France, Germany, and the Netherlands are among the nations which have substituted the value added tax for other taxes. Although there are several versions of this tax and several methods of collection, basically the tax is applied at every stage of production to that part of the final value of the product which is added at that stage. The total amount of tax finally collected is the same as if the tax had been applied only to the value at the final stage.  

Excise taxes are levied on specific products. They may apply at any stage of production. Traditionally, they have been levied on luxury goods, or on goods with highly inelastic demand, or as benefit  


taxes. Excise taxes may be used somewhat extensively. For example, the British purchase tax and the Japanese commodity tax both cover a broad range of goods.\textsuperscript{17} There is little distinction between excise taxes with such broad coverage and a general product tax with a number of products exempted or taxed at different rates.

In addition to taxes levied on the final value of products, there is likely to be an element of tax arising from taxes levied on goods or services used in production of the final product. This tax element is referred to as "tax occulte." Taxes levied on expended fuel, durable capital goods, and services may give rise to tax occulte. The amount of tax occulte is probably greatest under cascade taxes. Much of the tax occulte is eliminated by deduction under the value added tax and by exemption from single stage sales taxes. Border adjustments for the amount of tax occulte vary. In general, they are not made under value added systems, are usually applied under cascade systems, and are occasionally made under sales tax systems.\textsuperscript{18}

Taxes which are generally accepted as not eligible for border tax adjustments are:

1. personal income taxes,
2. capital gains taxes and wealth taxes,
3. estate duty taxes,
4. corporation income taxes or profits taxes.\textsuperscript{19}

\textsuperscript{17}OECD, \textit{Border Tax Adjustments and Tax Structures in OECD Member Countries}, pp. 19-20.

\textsuperscript{18}Ibid., pp. 58-63.

\textsuperscript{19}Ibid., p. 69.
Of these taxes the corporation income tax is probably the most important to the balance of payments problem. At the least, it is the one which has stirred the greatest controversy. It is utilized in numerous nations, but the United States has contended most strongly that it should be among the taxes for which border adjustments are allowed.

Capital gains, wealth, and personal income taxes usually are levied directly on individuals. Essentially due to the restricted economic power of individuals, it is usually argued that these taxes cannot be avoided by the person on whom the tax is legally levied. The unique feature of the corporation profits tax is that it is levied on a legal entity rather than directly on persons or products. A corporation may possess considerable economic power. Consequently, one might argue that it is more capable than individuals of shifting taxes levied on its income. Perhaps even more important, individuals seldom engage in international trade, and corporations do. Thus, it is argued that the corporate income tax may impose a disadvantage to a nation's trade position which should be neutralized by border adjustments.

Other taxes for which border adjustments are not normally given, but for which there are exceptions, are:

1. property taxes,
2. employees' contribution to social security,
3. employers' contribution to social security,
4. payroll taxes,
5. stamp duties.20

20bid., pp. 69-70. There are nations which apply border adjustments for some if not all of these taxes.
Property taxes may be thought of as relating to the factor income of the owner. If property values are related to the income derived from property, and if property taxes are levied on all or some portion (determined by the assessment rate) of value, then the property tax would bear a relationship to the income an owner derives from his property. The relationship would, of course, vary with assessment and tax rates. Despite the close kinship with other forms of income taxation, border adjustments are apparently applied for this tax in some nations.21

Employees' social security contributions, employers' social security contributions, and payroll taxes are usually not regarded as eligible for border adjustments due to their similarity to taxes on wage income. Stamp duties applying to transfers and issues of documents are generally not eligible. There have, however, been exceptions, and border adjustments are sometimes allegedly made in some countries for these taxes.22

Obviously, there is great variety between these taxes with respect to their coverage and bases. Nevertheless, one finds that in general the taxes for which border adjustments are usually applied are those which have some valuation of products as the tax base. Taxes whose base is related to income of productive factors—either

21Ibid., p. 69. The report does not specify which nations have applied border adjustments for this tax.

22Ibid., p. 69-70. Again the report does not specify nations which have applied border adjustments for these taxes.
capital owners or laborers—are those for which border adjustments are not made.

1.2 Summary of the Current Controversies

1.2.1 The Balance of Payments Controversy

The first of the two recent controversies concerning the international effects of domestic tax policy deals with questions that have been raised in the United States about its use of a corporation income tax. It is often contended that since the GATT does not permit surcharges and rebates for factor taxes (especially the corporation profits tax) the United States is at a competitive disadvantage in world markets. More generally, it is contended that nations which use factor taxes relatively heavily are at a competitive disadvantage. Nations which rely relatively more on product taxes are said to have a competitive advantage. The argument is clearly based on the assumption that a nation's tax structure per se is at least in part responsible for the competitive position of that nation.23 That is, a nation which always employs factor taxes more heavily than other nations would always be at a competitive disadvantage according to this reasoning.24

23 Perhaps the best example of this argument is Richard W. Lindholm, "National Tax Systems and the International Balance of Payments," National Tax Journal, XIX (June, 1966), 163-72. This assumption is treated more extensively in Chapter III.

24 Such reasoning apparently underlies the suggested change in the GATT presented in Malmgren, "The Border Tax Problem: Tax Harmonization in Europe and U. S. Business," p. 40. If this were not the official position of the United States government in the working party studying the border tax problem, it was at least the personal position of the leader of the United States delegation at that time.
The argument contrasts product taxes with factor taxes. It usually attacks the GATT provisions on the grounds that they should be trade neutral, but are nonneutral since they make no provision for factor taxes. The definition of trade neutrality is seldom, if ever, specified. However, most studies apparently assume that the GATT provisions should, or were intended to, neutralize the effect of all taxes on the taxing nation's balance of trade (or payments).\textsuperscript{25} This contention is unquestionably the impetus behind the efforts of the United States to have the GATT renegotiated.\textsuperscript{26}

The corollary to this argument is that, if a nation's tax structure places it at a disadvantage in international trade, then a change in its tax structure would presumably eliminate the disadvantage. Thus, it has been argued that nations which are relatively heavy users of factor taxes could enhance their position in international trade by restructuring their tax system. This is the contention which underlies suggestions that the United States substitute a value added tax for the corporation income tax.

What is the underlying rationale to the argument? Essentially, the basis lies in the assumed effects of taxes on product prices. The contention is that a product tax which is fully shifted forward into a higher product price would hurt the taxing nation's competitive

\textsuperscript{25}Perhaps the most explicit statement of this position is Milton Leontiades, "The Logic of Border Taxes," \textit{National Tax Journal}, XIX (June, 1966), 174. Other analyses which apparently accept this viewpoint are Lindholm, "National Tax Systems and the International Balance of Payments," and Malmgren, "The Border Tax Problem: Tax Harmonization in Europe and U. S. Business."

position and its balance of trade. A rebate (or surcharge) equal to the tax would supposedly restore the product price to its **sine** tax competitive position. Similarly, to the extent that the product tax is not shifted, a border tax adjustment equal to the amount of the tax would create a competitive advantage. An analogous argument is applied to factor taxes, along with the recent, strong evidence that the corporation income tax is shifted (in some unknown direction). To the extent that the corporation income tax is shifted into higher product prices, the failure to apply border adjustments would supposedly impose a competitive disadvantage on the taxing nation. Since the GATT does not provide border adjustments for factor taxes, it is concluded that the GATT probably does not neutralize the effect of a nation's tax system on its balance of trade.

---

27The term "shifting" is used here in the narrow, indeed nearly meaningless, sense of the effect of a tax on the absolute price of the product. As will be explained in Chapter III, this is an improper use of the term. The distinction is pointed out in Walter S. Salant, "The Balance of Payments Deficit and the Tax Structure," **Review of Economics and Statistics**, XLVI (May, 1964), 131-38.

This controversy has led to three basic recommendations. They are:

(1) The GATT should be renegotiated to permit border tax adjustments for factor taxes; or

(2) The United States should apply border tax adjustments for various factor taxes with or without the renegotiation; or

(3) The United States would be well advised to shift to a value added tax (with border adjustments).

All of these rest firmly on the belief that the GATT provisions should be trade neutral, but are not.

The specific proposals for these changes take many forms. One proposal for renegotiation of the treaty suggests an upper limit on overall border adjustments. This maximum adjustment could be used to the full limit for product taxes, or some part (but less than the overall limit) could be used for factor taxes.\textsuperscript{29} An interim proposal which has received some support is that present arrangements be frozen until more conclusive evidence can be obtained on which to base any renegotiation.\textsuperscript{30} Proposals suggesting a new adjustment for direct taxes received some support in the United States until it was realized that numerous other nations rely almost as heavily on factor taxes as does the United States.\textsuperscript{31} Serious consideration that the United States


might unilaterally apply an "average" adjustment for numerous selective product taxes (such as state gasoline taxes) has been mostly abandoned, largely out of fear of reprisals by other nations.\textsuperscript{32}

Most of the theoretical studies have revolved around possible changes in the tax structure of the United States.\textsuperscript{33} The conclusions vary. The proposition that the United States replace the corporate profits tax with a value added tax has received the most attention. Some have concluded that this or similar substitutions would probably improve the nation's balance of payments, but should not be undertaken solely for that purpose.\textsuperscript{34} Still others have exercised caution about the results of tax substitution on the balance of payments. It has been noted that if other nations also made similar substitutions, the overall gain to the United States might be quite small.\textsuperscript{35} Some have warned that the relationship between taxes and their effects on

\textsuperscript{32}Ibid.


prices is so tenuous and enigmatic that sufficient knowledge is simply not available to properly evaluate proposed tax substitutions.36

While there is much to be said for many of these arguments (and despite several excellent analyses), they suffer from several deficiencies.37 One or more of the following shortcomings will usually be found:

(1) They assume without proof that the GATT provisions are based on neoclassical tax shifting assumptions (which are essentially of a partial equilibrium nature), and attack the provisions by assailing neoclassical shifting assumptions.

(2) They assume that the GATT provisions were indeed intended to prevent a tax-induced balance of trade advantage or disadvantage.

(3) They are usually found in domestic economy settings rather than in international. That is, the taxing nation is assumed to face fixed international prices. This is reflected in the several analyses which are conducted in terms of supply prices of the taxing nation rather than market prices.

(4) They fail to distinguish between partial (excise) and general taxes on products. This leads to oversights concerning the fiscal and monetary aspects which may enter into the problem.

(5) They generally fail to distinguish clearly between the effects a nation's tax structure and the GATT provisions may have on economic efficiency and the international trading patterns on the one hand, and the effects that changes in tax structures or in the GATT provisions may have on economic efficiency, international trading patterns, and the balance of trade on the other hand.


1.2.2 The Tax Harmonization Controversy

But now what of the second controversy? There the focus is upon the effects of tax harmonization (the change to uniform rate value added taxes and nearly uniform income tax types by member nations) and the elimination of fiscal frontiers within the European Economic Community (the adoption of the origin principle internally and retention of the destination principle for trade with nonmembers). Several excellent discussions of these questions are available.

The elimination of fiscal frontiers would result in administrative economies and improved efficiency. In the absence of tax harmonization, however, it could also lead to tax-induced distortions of trade flows and reduced efficiency. Thus, the discussion has been two-fold. First, what would be the distorting effects of eliminating fiscal frontiers under tax systems existing before harmonization? And, second, how could tax systems be harmonized to eliminate the distortions? For the most part, studies of this problem have concentrated primarily on various product taxes and, in particular, their

---

38 I shall henceforth use the standard abbreviation EEC in place of European Economic Community.

application under the origin and destination principles. The concern
with factor taxes has been quite limited.40

If the destination principle is applied to product taxes, taxed
items are subject only to product taxes of the nation in which they
are finally consumed. Therefore:

The net producers' receipt per unit of sale of a
good must be the same for all producers, regardless of
the country in which they produce and the country to
which they sell, abstracting from differences in transpor-
tation costs. The differences in tax rates between
countries must be absorbed by consumers... The tax rate
differentials, therefore, exert no influence on pro-
ducers' decisions as to where they produce and where
they sell, provided there is no difference between
countries in government services to the producers.
From these aspects, the destination principle, if
applied by all, is said to exert no distorting in-
fluence on competition.41

When [the origin principle]... is adopted by all
countries concerned, prices ... paid by consumers for
a given product will be equal in all countries, trans-
port costs and tariffs apart, whatever its country of
origin and whatever the amount of taxation included in
its value. The differences between countries in rates
of tax, therefore, will be absorbed by producers...
Thus, the substitution of the origin principle for the
destination principle will equalize prices for consumers
at the cost of creating differences between net pro-
ducers' prices; such differences, it is claimed, will
be contrary to the ideal of 'neutrality' of tax systems
with regard to international trade.42

40The Neumark Report devotes some attention to factor or direct
taxes. See also Peggy B. Musgrave, "Harmonization of Direct Business
pp. 207-343.

41Hirofumi Suibata, "The Theory of Economic Unions: A Comparative
Analysis of Customs Unions, Free Trade Areas, and Tax Unions,"
Shoup (New York: Columbia University Press, 1967), p. 195. This quo-
tation and the one which follows do not represent Shibata's views but
are used because they succinctly summarize the argument.

42Ibid., p. 197.
Thus, it would appear that the origin principle is neutral with respect to trade flows between nations only when tax rate differentials between nations are small. Acceptance of this argument led to the belief that elimination of fiscal frontiers between Common Market nations (that is, adoption of the origin principle internally) necessitated tax harmonization. This resulted in the plans of the EEC for adoption of a common value added tax at nearly equal rates by all member countries.\(^{43}\)

The rationale which leads to this conclusion that the origin principle is not neutral is subject to several qualifications. The argument in essence implies that if the ratio of the tax bill to Gross National Product (GNP) in country 1 is greater than in country 2, then country 1 is at a competitive disadvantage. This follows from the conclusion that producers absorb any differences in tax rates. If the rate differential is represented acceptably by the tax bill to GNP ratio, then the conclusion follows. The argument assumes a fixed exchange rate and stable absolute price levels in the two countries. "In other words, the argument is based on a comparison

\(^{43}\)For example, the Neumark Report states that "Under the assumption that the level of special and general consumption taxes varies from country to country, the application of the country of origin can bring about artificial distortions, that is to say, distortions due to tax reasons, in international trade. These distortions would only be acceptable if such disparities in tax burden were insignificant." Neumark Report, p. 147. This conclusion is based upon the assumption of fixed exchange rates. See Neumark Report, pp. 100 and 102.
of absolute costs of production for the same goods as between the two countries."\textsuperscript{44} It also ignores the benefits of government expenditures.

If one does not assume that price levels and exchange rates are fixed, the same conclusion does not necessarily obtain. Indeed, in long static equilibrium, "In real terms...the origin principle and the destination principle produce no different result, if in each country the rate of tax is the same for every product."\textsuperscript{45}

This alternative conclusion is based on the following assumptions:

(1) exchange rates or price levels are flexible,
(2) a country applies the same principle to all goods,
(3) the tax rate is the same for all commodities within a country,
(4) the same principle is applied to trade with all countries,
(5) factors of production are not internationally mobile,
(6) technology is fixed, and
(7) demand conditions do not change.

This argument is based on the theory of comparative advantage. A truly general product tax in a nation does not affect relative commodity prices within a country, and the flexible exchange rate prevents any change in relative international prices. Under these


\textsuperscript{45} Ibid., p. 198. This important qualification was first noted in the \textit{Tinbergen Report}, p. 24. See also Shoup, "Taxation Aspects of International Economic Integration," p. 92, and James E. Meade, \textit{Problems of Economic Union} (Chicago: The University of Chicago Press, 1953), pp. 22-28.
conditions, the trading relationships between the two countries in real terms remain the same. The change in tax principles is merely a nominal change expressed in monetary terms and compensated for by the change in exchange rates.

Even if the exchange rate is fixed when the origin principle is adopted, internal deflation in the countries with higher tax rates may occur due to decreased exports and increased imports and, together with internal inflation in the countries with lower tax rates, would eliminate disparity between absolute price levels of the two countries. In essence, the argument is that if exchange rates do not adjust, then price levels will.46

The differences between the two arguments concerning the neutrality of the origin principle, therefore, lie in their assumptions. The key differences are summarized in Table 1.1.

<table>
<thead>
<tr>
<th>TABLE 1.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>THE NEUTRALITY OF THE ORIGIN PRINCIPLE</td>
</tr>
<tr>
<td>Origin Principle</td>
</tr>
<tr>
<td>(1) fixed exchange rate and (2) stable price levels</td>
</tr>
</tbody>
</table>

In either case the primary concern of the harmonization discussion has not been with the balances of payments of the member nations of the EEC.

46Shibata, "The Theory of Economic Unions: A Comparative Analysis of Customs Unions, Free Trade Areas, and Tax Unions." If one believes that prices are downward rigid, the same effect would result if higher tax rate nations experience more rapid inflation than do nations with lower tax rates.
Instead, it has been with the efficient conduct of trade between
these member states.

1.2.3 Comparison of Controversies

In summation, let us compare the more important aspects of these
two major controversies. The first contrasts the use of a factor tax
without border adjustments with a product tax levied under the desti-
nation principle. It asks if a nation employing a factor tax is at a
competitive disadvantage relative to nations which use product taxes
due to the taxation provisions of the GATT. Its concern has been pri-
marily the taxing nation's balance of trade and balance of payments.
The discussion has centered around the effects on absolute product
prices of various taxes. At least implicit in these studies is the
assumption that the taxing nation faces fixed product prices and fixed
exchange rates in international markets. Because of this assumption,
most of these analyses are essentially dealing with disequilibrium
situations or with only small nations. That is, their assumptions
characterize a situation for which full international adjustment has
not been achieved. If exchange rates or price levels are fully
flexible, the problem does not exist.

The second controversy considers primarily product taxes but
contrasts their application under the origin principle with their
application under the destination principle. It has sought to deter-
mine the conditions under which the use of product taxes, particularly
an origin principle product tax, within an economic union would be
neutral. The concern is less with the balance of trade than with
possible distortions of trade in a welfare sense. The neutrality of
the origin principle depends upon the assumptions which one makes
about the trading world. If one assumes that product price levels
or exchange rates are flexible, then neutrality obtains for a general
product tax under either the origin or destination principle.

Both controversies deal with the effects of taxation on foreign
trade. They have, however, been conducted in different settings and
for different purposes. Their underlying assumptions differ. It is
obviously desirable that an analysis of both factor and product tax
systems, the GATT provisions for their treatment in international
trade, and the proposed changes in both be analyzed with the same
concern for economic efficiency as has been given to the tax har-
monization issue.

The purpose of this study is to conduct a uniform, theoretical
analysis of the effects on trade and economic efficiency of various
domestic tax systems in an international setting, the present GATT
rules governing their international treatment, and recently proposed
changes in these rules. The results of the study should provide
additional information for the formulation of future policy changes.

What shall be the approach to this problem? First, one should
establish certain criteria which domestic tax systems and the rules for
their international treatment should satisfy. This requires that a
normative judgment be made concerning the proper objectives for such
rules. Since a set of rules already exists in the GATT, one ought
first to ask what was the rationale underlying their inclusion in the
treaty. One needs to learn whether or not the GATT provisions were
intended, as often alleged but never proven, to neutralize the effects of taxes on the balance of international trade.\textsuperscript{47} Thus, Chapter II is a background study of the GATT provisions. A thorough investigation of the negotiations leading to the GATT and of earlier trade agreements provides both a conclusive answer to the question of the original intent and a starting point for the development of the criteria.

A prerequisite to development of the objective criteria is the establishment of a conceptual framework. A considerable part of existing literature exhibits a salient lack of understanding of the meaning of certain concepts. This is especially true of concepts and terminology from the theory of public finance, but the phenomena also exists to a lesser extent with regard to international trade theory. Chapter III discusses and defines the relevant concepts of taxation, international trade, and some involving both of these fields. With this foundation the chapter concludes with the development of the criteria which are used, together with the analytical results, to appraise the effects on economic efficiency and international trade of the various proposed tax schemes and policy recommendations.

Chapter IV and especially V and VI constitute the core of the study. These chapters include the theoretical framework which is used to study the effects on efficiency and trade of various taxes and several proposed rules for their treatment. This is in line with Ohlin's suggestion when he stated that in his opinion, "...only by

\textsuperscript{47}This allegation is at least implicit in any of the numerous attempts to show that either the GATT's provisions should be renegotiated or that nations using factor taxes would be well advised to switch to product taxes.
careful study of a number of simplified theoretical models... can conclusions... be reached about the effects of different types of taxes... on foreign trade."48

Chapter IV develops a general equilibrium, multi-tax, two country, two good, two factor model of international trade. The model permits a uniform analysis of both product and factor taxes without many of the presuppositions frequently encountered in the literature. Since the study's concern is limited primarily to the efficiency implications of the GATT provisions, the design of the model is similarly limited. Thus, the implications derived from it are less relevant to other related problems, such as tax harmonization issues. For example, whereas a two country model is sufficient for analysis in an international trade context, a three country model is more appropriate to harmonization issues which frequently involve both international and interregional aspects. Also, an assumption of factor immobility is more palatable in an international trade setting than in the context of a common market.

Chapter V uses the results of the model for investigation of product taxes, and Chapter VI contains the analysis of factor taxes. Chapter VII concludes the study. It points out the qualifications which must be considered when basing recommendations on the results of the study. The chapter then collects and summarizes the analytical results of the various taxes. The study closes with specific policy

implications based upon the criteria established, the results of the analysis, and the observations of conditions existing in the real world. Finally, recommendations for further study are made.
CHAPTER II

The Background and Purposes of the GATT Provisions

2.1 Introduction

The controversy over the balance of payments effects of the GATT provisions and the tax harmonization controversy are similar in one important aspect. Both regard export rebates and import surcharges as complementary provisions which constitute a set of adjustments for domestic product taxes. The GATT is thought of as codifying a set of regulations for the international treatment of national tax systems. That is, it permits "border tax adjustments" for product taxes, but not for factor taxes.¹

Sprinkled throughout the literature concerning the GATT provisions, however, are occasional admissions that it is not clear why the GATT provided border tax adjustments for only product taxes. Their rationale is an enigma.² It is generally assumed that the GATT simply accepted the neoclassical tax shifting assumptions that product taxes raise product prices, but factor taxes do not. The neutrality of the GATT provisions with respect to the balance of payments is then said

¹This statement is not intended to apply to the EEC provisions for border tax adjustments, which are contained in the Treaty of Rome, Articles 95-99. The text and succession of these articles strongly indicates that the provisions for export rebates and import surcharges were intended to constitute a complementary set of adjustments for product taxes.

to depend on the validity of the shifting assumptions. If the assumptions are not correct, then the provisions do not neutralize the effects of domestic taxes on the balance of payments or trade. By questioning the validity of the assumptions, the effectiveness of the provisions is questioned. ³

This chapter discloses the original purposes of the GATT provisions and the rationale on which they were based. Although historical intentions have little claim to serve as guides for current policy matters, they can illustrate differences and similarities between current and past settings. These of course, can be relevant for enlightened policy decisions. The chapter points out important differences between the current controversies and the setting in which the provisions were written. The assumptions on which most current proposals are based are revealed to be partially inaccurate. Finally, the chapter concludes by noting that although valid justifications for renegotiation of the GATT may exist, they do not constitute the foundation for many current proposals. Nor do the original GATT intentions justify renegotiation.

³This rationale is generally attributed to the GATT provisions and should be distinguished from similar, but clearly independent, rationales advanced for the practices of granting export rebates (exemptions) and levying import surcharges for product taxes. As will be discussed at length in Chapter III, the practices are usually justified on the basis of a competitive argument and a belief that government expenditures benefit consumers. These justifications are employed in support of destination principle product taxes, rather than origin principle product taxes. The distinction between these arguments and those concerning the GATT is further clarified by considering the two objectives. The rationale in the text is employed in connection with the balance of payments or trade; the rationale in this note in connection with efficiency and welfare.
2.2 Some Historical Observations

To assist in ascertaining the original purposes and rationale of the GATT provisions, it is convenient to trace briefly the development of the agreement. The GATT was never intended to become the permanent institution into which it has evolved. It was to be an interim agreement to serve until the Havana Charter for an International Trade Organization (ITO) received international approval. The United Nations Conference on World Trade and Employment led to both the GATT and the Havana Charter. A series of meetings in London, Lake Success, Geneva, and Havana between October 1946 and March 1948 produced a series of draft charters which resulted finally in the Havana Charter. The GATT itself emerged from the London meetings and was adopted at the Geneva meeting.

The clause concerning import surcharges was substantially the same in all of the various charter drafts and in the GATT. Each of the various drafts of the ITO charter also contained a provision analogous to the supplementary note to Article XVI of the GATT. This provision also underwent no important change during the drafting of

---

the several charters. The first GATT, however, did not include the provision for export rebates. Not until 1955 was the omission rectified with the addition of the supplementary note.\textsuperscript{5, 6} Nevertheless, provision for export rebates was implicit in the sections of the original GATT which dealt with anti-dumping and countervailing duties. These sections prohibited the imposition of countervailing duties to offset rebates of indirect taxes paid on exports.\textsuperscript{7}

\textsuperscript{5}The reason for omission of a provision for export rebates in the original GATT is not clear. The omission occurred during the post-war negotiations and can probably be attributed to political considerations. The export rebate provision was tied to the treatment of subsidies to production. Subsidies were common and in popular use at that time, both in the United States and other nations. By weakening the provisions on subsidies and their corollaries, the GATT more closely resembled earlier bilateral trade agreements. Whereas the Havana Charter strongly discouraged the use of subsidies, the GATT placed no stronger restriction on them than the requirement that a nation give notification of their use to the other contracting parties. Weakening of the provision might have been attempted in hopes of improving the chances for approval of the GATT. Once the GATT was accepted, approval of the Havana Charter would have been more likely.

\textsuperscript{6}In 1955, a list of practices to be considered as subsidies in the sense of Article XVI was adopted by the contracting parties. The list interprets rebates of both direct taxes and social welfare charges as subsidies, but not indirect taxes. Since the supplementary note was added in the same year, it probably amounted to little more than additional clarification.

\textsuperscript{7}General Agreement on Tariffs and Trade, Vol. I (Lake Success: United Nations, 1947), pp. 13-14. Article VI, paragraph 3, states that,

"3. No product of the territory of any contracting party imported into the territory of any other contracting party shall be subject to anti-dumping or countervailing duties by reason of the exemption of such product from duties or taxes borne by the like product when destined for consumption in the country or origin or exportation, or by reason of the refund of such duties or taxes."

Paragraph 1 of Article VI provides that,

"Due allowance shall be made...for differences in conditions and terms of sale, for differences in taxation, and for other differences affecting price comparability."
It is not surprising that the import surcharge provision remained unchanged through the several charters. It was not a new idea. Similar provisions had appeared in earlier treaties between nations for many years. They were common in the bilateral trade agreements of the 1930's. Among the treaties with similar provisions to which the United States was a party were the following agreements:

El Salvador, Article IV, May 31, 1937;
Costa Rica, Article IV, August 2, 1937;
Canada, Article VIII, June 17, 1939;
Venezuela, Article V, December 14, 1940;
Cuba, Article VIII, September 3, 1934;
Haiti, Article IV, June 3, 1935;
Honduras, Article III, March 2, 1936.8

Such provisions are found in even earlier treaties. The 1923 trade agreement between the United States and Germany contained such a clause. Also, among the papers relating to the Commercial Agreements between the United States and Spain for Cuba and Puerto Rico proclaimed August 1, 1891, a letter from the United States' Secretary of State, James G. Blain, dated June 8, 1891, contains a paragraph similar to later clauses on import surcharges.9


9U. S., Congress, Senate, Committee on Finance, Hearings, on Extensions of Reciprocal Trade Agreements Act, 81st Congress, 1st Session, part 2, p. 1099. This letter states,

"Respecting the North American articles of food, drink and fuel...which are imported into said islands, the Government of Spain, without restricting the rights of the municipal councils, will seek to have the latter impose upon them no greater municipal duties than those which national products pay, and that they shall not materially increase the price of said articles."
The United States appears to have been slow to adopt such clauses in its commercial treaties. Other nations used import surcharge clauses long before 1923. Article IX of the Treaty of Commerce and Navigation between Germany and Greece, signed July 9, 1884, is such a provision. Similar clauses are in Article X of the Treaty of Commerce between Egypt and Russia, signed March 13, 1909, and Article IX of the Treaty of Commerce and Navigation between Great Britain and Portugal, signed August 12, 1914.

Provisions for export rebates did not appear in earlier treaties. There is no evidence of an analogous clause in any of the treaties cited with reference to import surcharges. Nevertheless, it was the common practice of nations to rebate (or exempt) taxes on exported goods. The practice was cited in hearings on the Havana Charter before the United States Senate in 1947.

---

10U. S. Tariff Commission, Handbook of Commercial Treaties (Washington, D. C.: Government Printing Office, 1923), p. 555. The treaty provides that, "Duties of excise, consumption, octroi, and other similar duties levied in either country...must not bear more heavily on imported products of the other country than on national products."

11Ibid., pp. 346, 386.

12U. S., Congress, Senate, Committee on Finance, Hearings, Trade Agreements System and Proposed International Trade Organization, part 1, p. 34. John M. Leddy, a central figure in the development of the surcharge and rebate provisions, testified that, "It is almost a universal practice to exempt exported goods from domestic consumption taxation." Mr. Leddy later confirmed this statement in an interview with the author.

13Ricardo discussed use of both surcharges and rebates in his essay on agriculture. His discussion is limited to selective excise taxes levied on particular products. See David Ricardo, On Protection to Agriculture (4th ed.; London: John Murray, 1922), pp. 13-16.
Even though these practices were customary, they were not included in the GATT solely with respect for tradition. Indeed, there is evidence that the provisions were carefully considered, especially the import surcharge provision. The model for all of the various draft charters was a *Suggested Charter for an International Trade Organization* which was developed within and was presented by the United States Government to various other national governments for consideration.\(^\text{14}\) Prior to the Suggested Charter, the United States had published the *Proposals for the Expansion of World Trade*.\(^\text{15}\) Both of these documents were developed almost entirely by several committees which worked primarily within the United States Department of State.


"The products of any Member country imported into any other Member country shall be exempt from internal taxes or other internal charges higher than those imposed on like products of national origin."


"1. To afford products imported from other members treatment no less favorable than that accorded to domestic products with regard to matters affecting internal taxation and regulation of trade in goods."
The records of these committees provide considerable insight into the purposes of the GATT provisions.\textsuperscript{16} Official consideration of possible use of these provisions in post-war trade agreements was initially recorded in the "First Progress Report of the Subcommittee on Indirect Protectionism," dated July 23, 1943. Among the items contained in an outline of topics under this subcommittee's jurisdiction was the use of differential taxes on imports.

\textsuperscript{16}Although a complete review of all of the various committees--their membership, function, organizational structure, and duration--which developed post-war policy is not necessary, a brief review of those directly concerned with the relevant provisions is worthwhile. A chronological and functional history of the various committees can be found in the unpublished History of the Division file of the Commercial Policy Division of the U. S. Department of State.

The principal committee concerned with the post-war foreign policy of the United States was the Advisory Committee on Post-war Foreign Policy. There were originally two subcommittees--the Subcommittee on Economic Policy and the Subcommittee on Economic Reconstruction. In April 1943, these two subcommittees merged into the Committee on Post-war Foreign Economic Policy (often referred to as the Taylor Committee for its Chairman, Myron Taylor). In April 1944, this became the Executive Committee on Economic Foreign Policy (ECEFP). Although the Committee was of an inter-departmental nature, it operated under the Office of International Trade Policy of the Department of State.

Under the ECEFP, there was the Special Committee on Relaxation of Trade Barriers or, as it was known after 1944, the Committee on Trade Agreements. By 1944, this Committee had been assigned the explicit duty to prepare a draft on commercial policy for international consideration. (See U. S., Department of State, "Preliminary Report of the Subcommittee on Committees," Executive Committee on Economic Foreign Policy file, ECEFP D-1-44, pp. 4-5.) Of the numerous subcommittees of the Committee on Trade Agreements, there was one which had the specific function to consider differential taxes on imports as a nontariff trade barrier or a measure for control of imports and the role of subsidies in international trade. (See U. S., Department of State, "First Progress Report of the Subcommittee on Indirect Protectionism," Trade Barriers - R, Subcommittee No. 4, 1-3 file, Trade Barriers Memo 3, July 23, 1943.) It was first known as the Subcommittee on Indirect Protectionism. After January 1944, the name was changed to Subcommittee F on International Commercial Organization and Commercial Principles. This was the subcommittee which first prepared a draft of the provision which eventually became Article III and the interpretative note to Article XVI of the GATT.
as a nontariff trade barrier and the use of subsidies. Explicit plans for the import surcharge provision were developed by this sub-committee within a few months. By the end of 1943, a decision had been made to incorporate a clause concerning import surcharges into plans for a post-war trade agreement. On January 19, 1944, a draft of the provision appeared. It was almost exactly the same as the analogous provision in the Suggested Charter.

The provision for export rebates was also developed by the Subcommittee on Indirect Protectionism. Consideration of the provision began early. For example, the records of the informal talks between the United States and the United Kingdom state that rebates of internal taxes on exported products should not be considered a

17U. S., Department of State, "First Progress Report of the Subcommittee on Indirect Protectionism." The date of this report precedes by two full months the first discussions of post-war trade policy between the United States and the United Kingdom, which were held in Washington from September 20 to October 16, 1943. Since these were the first inter-governmental discussions of the matter, one must assume that the intention to include this provision in any post-war commercial treaty originated with the United States.


19Documented evidence concerning the development of the export rebate provision was not available to the author. At the time the research for this study was conducted (March-April 1968), all Department of State records dated after 1944 were closed to the public. Few of the records dated before 1945 deal with export rebates in any detail. Mr. John M. Leddy, former Assistant Secretary of State for European Affairs, was a member of the Subcommittee on Indirect Protectionism at the time the Suggested Charter was developed. He participated in the development of the sections of the GATT which contain the provision on international taxation. Many of the important arguments herein were developed from or supported by the statements of Mr. Leddy during a personal interview with the author. I am deeply indebted to him for his generous and extremely valuable assistance.
subsidy and would be permitted. As was the case with the import surcharge provision, the export rebate provision did not undergo any significant change in purpose or substance during the development of the Suggested Charter.

2.3 Purpose and Rationale

2.3.1 The Import Surcharge Provision

The study of the GATT's background also reveals that the purposes originally envisioned for these provisions are quite different from those currently associated with them. Consider the import surcharge provision. The purpose of Article III was to prevent excess protection of an industry in the taxing (importing) nation. The evidence is overwhelming. In publications and testimony giving the official policy of the United States Government on import surcharges, the theme is repeated consistently. For example, in Analysis of the General Agreement on Tariffs and Trade the limits on protective excise taxes on imports,

...are intended to prevent the value of the tariff concessions from being impaired by the use of other devices...

Tariff concessions can be easily nullified by internal excise taxes ... which operate to protect home industries by laying greater burdens on the imported than on the domestic product ... .

---


they confront the foreign trader with hidden trade barriers in addition to direct barriers raised at the border.\textsuperscript{22}

Testimony before various Congressional committees reiterates the same purpose at various times throughout the post-war negotiations. For example, it was noted that Article III of the GATT covered,

\begin{quote}
...a subject matter which has always appeared in our trade agreements ... it is a traditional and customary article in our trade agreements [and] is designed to see that countries do not nullify the tariff concessions ... by the use of internal taxes which are discriminatory against imports. Because if you receive a tariff concession on a product, and then the other country is free to impose a tax on that product, which applies only to the imported product and not to the domestic product, you could have a nullification of the tariff concession. That is the purpose of the first part of the article....\textsuperscript{23}
\end{quote}

The prevention of protectionist use of internal taxes had also been the


purpose of import surcharge provisions in the bilateral trade agreements which preceded the GATT.\textsuperscript{24}

The public testimony and publications are substantiated by the records of the Subcommittee on Indirect Protectionism. An analysis of the import surcharge provision noted that it was the intent of the drafting committee that internal taxes on imports should be treated as taxes, in contrast to tariffs which were to be subject to reduction, so long as the nation's law made them apply equally to imports and to the comparable domestic product.\textsuperscript{25}

Two possible purposes for an import surcharge provision were explicitly considered by the subcommittee. Two alternative drafts of

\textsuperscript{24}U. S., Congress, House, Committee on Ways and Means, \textit{Hearings, Reciprocal Trade Agreements}, 73rd Congress, 2nd Session, 1934, pp. 8-9. An interchange between the Secretary of State Hull and Representative Fred Vinson illustrates the situation which the GATT's Article III was designed to eliminate,

\begin{quote}
Hull: "... a good many countries have made their chief weapon, both for offensive and defensive purposes, the collection of internal taxes, whatever they may be called, which are enacted and operated at least for the purpose of defending national situations, by forcing other nations, through keeping out every vestige of imports from given countries, to come seeking trade agreements that would involve mutual concessions."
\end{quote}

\begin{quote}
Vinson: "With reference to the excise tax, so called that in reality is a tariff, I get the point quite well, but that which we know to be internal revenue taxes \textit{per se} is not intended to be included."
\end{quote}

\begin{quote}
Hull: "... nothing is contemplated here except that which partakes entirely of the nature of and is a substitute for an obstruction to imports in international trade."
\end{quote}

\textsuperscript{25}U. S., Department of State, "Analysis of Draft Tariff Section of Proposed Multilateral Convention on Commercial Policy."
the provision were developed corresponding to the two purposes: one
designed to discourage protection; the other designed to discourage
the use of excise tax systems by nations. The draft which was designed
to limit protection was later adopted. This draft was actually
intended to serve two objectives. The first was, of course, the pre-
vention of protection of domestic industries. The second objective
was to permit the use of internal taxes in order to replace revenue
losses resulting from tariff reductions. The subcommittee noted that
participating nations in the international agreement would be required
to reduce existing tariffs on products which they did not produce
domestically and would therefore suffer a loss of tax revenue.

Consequently, the surcharge provision was written so that it was not
necessary that there actually be any domestic production of imported
products in order to apply a compensating import surcharge.²⁶ A tax
on imports would be considered as an internal tax, rather than a
tariff, so long as domestic production of the taxed good, if there
were any, would be taxed no less heavily than imports of the good.
Nations could replace the revenue loss from reduced tariffs with
additional revenue duties or internal taxes on both domestic produc-
tion and imports equally. By limiting the tax permitted on imports

²⁶ United Nations, Conference on Trade and Employment, Reports of Committees and Principal Subcommittees (Havana Reports), Geneva: Interim Commission for the International Trade Organization, 1948), p. 41. This view was challenged at the Havana Conference, but apparently no change resulted.
to that applied to domestic products, protection would be prohibited, but at the same time revenue sources would not be eliminated.\textsuperscript{27}

The alternative draft of the import surcharge provision considered by the subcommittee was intended to \textit{discourage} the use of excise taxation by participating nations. It would have required that substantial domestic production of a given product exist before import surcharges could be levied on imports of that product. In this case, shifting from a tariff on imports to a domestic tax on importables would not replace the revenue loss from tariff reduction. This draft was rejected.

During the drafting of the import surcharge provision, there was no explicit application of economic theory to the problem by the subcommittee. Nor was there any questioning or review of existing tax incidence or shifting theory. The subcommittee merely accepted implicitly the prevalent partial equilibrium, neoclassical rationale.\textsuperscript{28} The situation which the surcharge provision was intended to prohibit is illustrated in Chart 2.1. The graph depicts a small country which both produces and imports good \(X\). Domestic production at various prices is indicated by the supply schedule \(S\) if there is no tax. If a unit production tax, \(T\), is imposed, domestic production is indicated by \(S + T\). Demand is indicated by the schedule \(D\). At the fixed

\textsuperscript{27}This illustrates the proper interpretation of the term "revenue duty" which appears frequently in the literature of the period. A revenue duty was a tax with the primary purpose of raising revenue, as opposed to a tariff duty with the primary purpose of protecting domestic industries.

\textsuperscript{28}John M. Leddy, interview, March 28, 1968.
Chart 2.1 - Partial Equilibrium Effects of an Import Surcharge
international price $P_i$, the country's demand for the good, $OF$, is
satisfied by domestic production equal to $OB$ and imports equal to $BF$.

If a tax equal to $T$ were imposed on only domestic production, imports would rise to $AF$ and domestic output would fall to $OA$. If an equal surcharge were also applied to imports of $X$, raising the international price as seen in the taxing nation to $P_i + T$, domestic output would return to the same tax level $OB$, and imports would satisfy the remainder of domestic demand $OE$.

If an additional tax, say $TX$, were imposed on imports, the international price of $X$ would rise to $P_i + T + TX$. Domestic production would rise to $OC$. The excess tax $TX$ would induce additional domestic production equal to $BC$. It was the use of excess taxes such as $TX$ that the GATT provision was intended to prohibit. That is, the GATT prohibited the use of domestic "taxes" for protective purposes.

The concept of protection and, therefore, the import surcharge provision are best interpreted in terms of single industries. This setting is obviously quite different from the current controversy over border tax adjustments for general taxes.

2.3.2. The Export Rebate Provision

The intent of the subcommittee regarding the export rebate provision is somewhat less obvious. The vehicle used was to recognize that

---

29 There was apparently no consideration of the decline in demand and, hence, imports as a result of tax/surcharge-induced rise in the price of the good.

30 The import surcharge provision prohibits use of taxes to create a situation analogous to the "protective effect" familiar in international trade theory. The provision sought to make the "protective effect" zero. For example, see C. P. Kindleberger, International Economics (3rd ed.; Homewood, Illinois: Richard D. Irwin, Inc., 1963), p. 218.
a rebate of indirect taxes paid on exports was not the same as a subsidy and would not be subject to any restriction placed on subsidies. Countervailing duties could not be applied for rebates. Even the first GATT, however, did not prohibit the application of countervailing duties for rebates granted in excess of indirect taxes paid on the export. Thus, it seems clear that the purpose of the export rebate provision as originally drafted by the Subcommittee on Indirect Protectionism was to prohibit rebates in excess of indirect taxes actually paid and, thus, to prevent indirect subsidization.

The rationale behind this purpose was essentially the same as it was for the import surcharge provision. The proposals clearly indicate that excise taxes were thought to raise product prices. To the minor extent that this provision was considered in dept its intent was to permit offsetting adjustments for taxes which would affect prices of exportables. A rebate equal to the tax would lower the price of a traded good to its sine tax level. By limiting the rebate to the amount of the tax, the provision prevented buyers in the importing nation from paying the tax of the exporting nation and, at the same time, prevented rebates in excess of the tax from being used as a substitute for subsidies. Again, the underlying rationale was based entirely on partial equilibrium, neoclassical rationale. The provision was written with regard to rebates of selective excise taxes only. The concern was with indirect subsidization of particular industries.
Again, there was no explicit consideration of reexamination of economic theory. 31

There was no intended relationship between the export rebate and the import surcharge provisions of the GATT. The purposes for which these two clauses were developed were, at least superficially, not the same. Nevertheless, the limit placed on export rebates is, in its partial equilibrium economic effects, analogous to the prevention of protection by limiting import surcharges. That is, both provisions prohibit the use of tax policy to provide assistance to domestic industries in international markets.

2.4 Conclusions and Implications

What conclusions and implications for current controversies can be drawn from this information? It should be emphasized first that the

---

31 John M. Leddy, interview, March 28, 1968. These arguments are based on the statements of Mr. Leddy. Mr. Leddy felt that the intent behind the provision on rebates was primarily the need to include in the agreement the common practice of the time. There was little detailed reanalysis of the practice.

An interview with Mr. John Evans, April 3, 1968, presented a slightly different interpretation. Mr. Evans was Chairman of the United States' initial delegation to the Havana Conference and was a member of the delegation to the Geneva Conference. He was involved in discussions of the provisions during the negotiating sessions. He indicated that the practices developed because differences in taxation were thought to result in differences in prices. A businessman in a country with relatively higher taxes would be at an inequitable competitive disadvantage. To avoid such disadvantages, nations usually allowed tax rebates on exports. See also U. S., Department of State, "Recommendation and Documents on Trade Policy," Trade Barriers - R, Subcommittee No. 51 - 8 file, December 21, 1944, p. 18.
process of development of the GATT provisions on internal taxation did not involve nearly the thought or in-depth study which one might have expected. Between the bilateral agreements and the ITO charters and the GATT there was no detailed re-analysis of economic theory and little analysis of the provisions. In effect, the GATT merely codified existing practices or repeated previous provisions. There is no evidence to indicate anything other than a passive and implicit acceptance of neoclassical tax shifting assumptions. Although taxes on products were thought to affect product prices, there was no concern for whether or not factor taxes raised product prices.

To the extent that any rigorous economic thought was employed, it was entirely partial equilibrium analysis. The GATT provisions were written with respect to selective excise taxes on particular products. This was in keeping with the structure of tax systems prevalent at the time the provisions were drafted.32 In the context of excise taxation, partial equilibrium analysis was entirely acceptable. The provisions were not written with respect to general or broadly-based product taxes, such as a value added tax. There was no consideration of national tax systems, whether composed primarily of product or of factor taxes.33 There was no application of general equilibrium analysis.

32John M. Leddy, interview, March 28, 1968. A distinction between general taxes and selective excise taxes was also drawn by Ricardo. He felt that surcharges and rebates were necessary "to restore competition" in the case of selective product taxes, but not for a tax affecting all products. See Ricardo, On Protection to Agriculture.

A major source of misunderstanding about the GATT provisions is the failure to realize that they do not directly permit either import surcharges or export rebates. Indeed, the provisions were intended to limit these practices. Import surcharges were limited to comparable domestic taxes. Excess border taxes were prohibited. Rebates were limited to the amount of domestic taxes. Rebates in excess of domestic taxes would be considered a subsidy subject to a countervailing duty in the importing nation. Neither provision was primarily concerned with either the type or amount of any tax itself, but rather referred to rebates and surcharges in excess of the tax. There was no requirement in the GATT that nations adjust for product taxes. There is only the requirement that they do not overadjust.

The purposes of the provisions explains another point. Many have questioned why the GATT provisions do not permit adjustment for factor taxes. In the case of import surcharges the reason was simple. Article III was intended to prevent the use of domestic taxes for indirect protection of domestic industries. Factor taxes had neither been designed nor used for protective purposes. Goods are traded, and factor taxes do not apply to goods. A tax on a factor usually applies to all or to many uses of that factor. Because of their general nature it is nearly impossible to discriminate between those industries which are to be protected and those which are not. Thus, there was no need to prohibit a protective border tax on factors or factor inputs. On the other hand, product taxes apply to things which are traded and had been used as a protective device. Therefore, the protective element, excess surcharges, was prohibited.34

34Ibid.
In the case of export rebates the reasoning is equally simple. Recall that the purpose of the provision was to offset the price effects of taxation and to limit the offset to the amount of the tax. The provision was written, as critics allege, with an implicit acceptance of the economic principles which prevailed at that time. Neoclassical theory maintained that taxes on products increased the price of the products. Taxes on factors were generally thought to reduce the return to the factor without affecting product prices. If these principles are accepted, then there is no need to compensate for the price effects of factor taxes. The export rebate provision was written, therefore, with regard to only product taxes.35

It is significant that the two provisions had somewhat different purposes.36 The difference in purpose, their concern with selective excise taxes, and the negative phrasing of the provisions combine to imply that they were never intended to operate as a pair of complementary rules. The distinction is clear when one realizes that the phrase "border tax adjustments" cannot be found in literature concerning the GATT or the several charters for the International Trade Organization. There was no thought of converting origin principle taxes to destination principle taxes by applying border adjustments. The belief that import surcharges and export rebates are a set of "border tax adjustments" is a much more recent concept—a child of the tax harmonization

35 Ibid. Mr. Leddy agreed that the planners of the provision did accept the neoclassical tax shifting assumptions, but emphasized that the acceptance was purely implicit. There was never any detailed or rigorous thought given to the matter.

36 See p. 45.
era. The current assumption is that the GATT also intended them as a set of provisions. This assumption, as well as various other purposes associated with the GATT provisions, is quite inaccurate. Indeed, many contemporary critics have attributed far more to the GATT than can be supported. The GATT provisions were simply not designed to neutralize the effects of tax systems on international trade. They were in no sense concerned with rectifying tax-induced disadvantages on a nation's balance of trade.\textsuperscript{37}

The current controversies have uncovered an obviously empty economic box. That is, it cannot properly be said that the GATT provisions are inadequate for neutralizing the effects of domestic tax systems on either trade balances or economic efficiency. They were not intended for either purpose. It can, however, properly be said that there exist no internationally accepted regulations for the international treatment of domestic tax systems, nor even acceptance of the objectives on which such regulations should be based. The GATT does not provide this, nor, for example, does the Treaty of Rome which applies to only a few European nations.

If the GATT is to be renegotiated, a more proper justification would be that the existing provisions provided no rules and were not concerned with national tax systems, not that they are inadequate. This, of course, raises important questions about just what effects, if any, should be neutralized. Should international treatment of domestic tax systems be designed to eliminate effects on a trade

balance? Or should they be designed to eliminate inefficient distortions in production and consumption patterns? These questions are considered in the next chapter.
CHAPTER III

Concepts and Criteria

3.1 Introduction

An analysis of the treatment of domestic tax systems in international transactions necessarily involves the fields of both public finance and international trade. The need of a concise conceptual framework is obvious. The existing GATT provisions were not based on such a framework. In much of the more recent literature, there is confusion and misuse of many fundamental concepts. Inaccurate use of terminology from public finance theory is particularly pronounced. Concepts from international trade theory are often poorly specified. A rigorous analysis demands careful specifications of relevant concepts from these two fields. This chapter focuses on the concepts and terminology which are important to this study. This framework permits the chapter to conclude with the selection of an objective criteria by which the various tax schemes, the GATT provisions, and many of the proposed changes in them can be evaluated.

3.2 Public Finance Concepts

3.2.1 Types of Taxes

In Chapter I, taxes were divided into two types according to their base. Taxes may be considered as either a tax on one or more products or as a tax on the earnings of one or more factors of
production. This breakdown is particularly useful in the context of this study. A large part of international trade theory is formulated in terms of products and factors of production. Also, the GATT provisions apply to taxes on products but not to taxes on factors. The value of this classification becomes even more apparent in this chapter, especially in the discussions of tax equivalence and the international treatments of taxes.

There is another useful tax classification. Taxes may be grouped according to their coverage. A tax may be either general or partial. A general product tax is one which applies at an equal rate to all or virtually all transactions in all products. Value added taxes are perhaps the best examples. A partial product tax is one which applies to one or more specified products, but not to all. Selective excise taxes are examples.

A general factor tax applies to the earnings of all factors in all of their uses. A general income tax on all households is an example. A partial factor tax applies to the earnings of a given factor in all of its uses. A tax on payrolls, such as the social security tax, is an example. A doubly partial factor tax applies to the earnings of one factor derived from only some of its uses. The corporate profits tax is an example as it applies only to the earnings of capital invested in corporations.

The coverage of a tax is critically important. A tax which applies to one or only a few of a multitude of products is likely to have significant effects only in the market for the taxed item. For such taxes, partial equilibrium analysis may suffice. As the number or
importance of taxed products grows, however, the validity of partial
equilibrium analysis declines. Other variables within the economy may
be affected significantly by changes induced in the taxed market. The
adjustments spread throughout the entire economy, and only general
equilibrium analysis is appropriate for studying the results of these
adjustments.

3.2.2 Tax Equivalence

Two taxes or combinations of taxes are equivalent if in all cir-
cumstances they have the same effect on relative prices of products and
factors of production.\footnote{An excellent statement of tax equivalence propositions for a
closed economy can be found in Richard A. Musgrave, The Theory of
In a closed, competitive economy, with no
savings, a general tax on all factors is equivalent to a general pro-
duction or consumption tax at equal ad valorem rates. A tax on either
production or consumption of any particular product is equivalent to
a tax on all factors used in the production of that product.

There are numerous combinations of equivalent taxes. These com-
binations may be depicted by use of an equivalence matrix. Consider a
closed, competitive economy producing two goods, \(X\) and \(Y\), with two fac-
tors of production, capital \((K)\) and labor \((L)\). Let \(T\) with appropriate
subscripts represent ad valorem tax rates. For example, \(T_{KX}\) would repre-
sent a tax on capital used in the production of good \(X\).\footnote{It is theoretically a matter of indifference whether the tax
is administratively imposed on the buyer's side or the seller's side
of any given market.} Let \(T_p\) and \(T_p\)
represent taxes on all factors' uses (or purchases) and on all product sales (or purchases) respectively. The equivalence matrix for a closed economy is shown in Figure 3.1.

\[
\begin{array}{ccc}
T_P & T_F & T_K & T_L \\
T_X & T_{KX} & T_{LX} & \\
T_Y & T_{KY} & T_{LY} & \\
\end{array}
\]

Figure 3.1 - Tax Equivalence Matrix for Closed Economy

The matrix may be interpreted simply. Any tax in the left column is equivalent to a combination of the taxes (at equal ad valorem rates) in the same row but in Columns 2 and 3. That is, \( T_{11} = T_{12} + T_{13}. \)

Similarly, any tax in row 1 is equivalent to the combination of the taxes in the same column but in rows 2 and 3. Thus, \( T_{1j} = T_{2j} + T_{3j}. \)

For example, a tax on all capital is equivalent to equal rate taxes on capital employed in the production of both X and Y. A tax on X is equivalent to equal rate taxes on capital and labor used in production of X. Also, since \( T_P \) and \( T_F \) are equivalent, and since \( T_F = T_K + T_L \), we have \( T_P = T_K + T_L. \)

In tax analyses the equivalence propositions are valuable time savers. If one knows the incidence of \( T_X \) and \( T_K \), the determination

\[3\text{The addition sign should be interpreted to mean a combination of the taxes indicated.}\]
of the incidence of $T_{Kx}$ only is sufficient to determine the incidence of $T_{Lx}$ and $T_{Ky}$. Thus, not every tax need be analyzed individually in order to ascertain its incidence.

3.2.3 Tax Shifting and Tax Incidence

Among the concepts which have been improperly used, tax shifting and tax incidence are signal. The abuse has been profound. Most of the confusion over terminology has apparently arisen from the concern over whether the GATT provisions correspond to the effects of taxes on absolute product prices. For example, a factor tax which raises product prices is often said to be shifted forward and borne by consumers. If a product tax lowers factor returns but does not alter product prices, it is said to be shifted backward and borne by factors. This approach inaccurately equates tax incidence with the effects of taxes on absolute product and factor prices. The two are not necessarily the same.

Tax incidence primarily concerns the distributive effects of taxes on the after-tax private incomes of various groups. Tax incidence

---

4 Others have noted this deficiency. See, for example, Salant, "The Balance of Payments Deficit and the Tax Structure," pp. 131-32. Salant's conclusion concerning the incorrect use of the term "incidence" does not appear convincing. Salant notes that incidence really deals with relative shares, but concludes that if foreign prices are given this is probably equivalent to changes in absolute domestic prices. In small nation cases, however, there is considerable doubt that forward shifting of a corporate profits tax in the form of higher product prices could occur for traded goods. See also Richard A. Musgrave, The Theory of Public Finance, Chapter 15, and Charles E. McClure, Jr., "Tax Incidence, Macroeconomic Policy, and Absolute Prices." Quarterly Journal of Economics, LXXXIV (May, 1970), 254-76.
has been defined to be "... the change in the distribution of income available for private use ..."\textsuperscript{5} Changes in the distribution of real income may result either from a change in the earnings a person obtains for his services or from a change in the prices a person pays for goods and services he buys. The former is the sources side; the latter is the uses side.

Modern incidence analysis recognizes that the incidence of a tax is not adequately described by "the final resting place of the tax." It emphasizes the effects of a tax on the 
\textit{distribution}, not the \textit{level}, of after-tax private real incomes. Since incidence is concerned with the changes in distribution among income groups, it is primarily concerned with \textit{relative} prices of products and factors.\textsuperscript{6} Changes in absolute prices are largely irrelevant to the incidence analysis since a given set of relative prices may be consistent with an infinite variety of absolute prices.

Incidence analysis in this sense recognizes that the imposition of a tax \textit{per se} does not impose a burden on private economic units. Real resources are transferred from the private sector to the public sector only by government purchases or expenditures. Thus, the burden


\textsuperscript{6}Richard A. Musgrave, \textit{The Theory of Public Finance}, pp. 218-21. This provides a simple algebraic illustration of the proposition. See also McLure, "Tax Incidence, Macroeconomic Policy, and Absolute Prices."
of taxation and budgetary activity depends crucially on the level and composition of government expenditures and, in addition, the benefits which the private sector receives as a result of government expenditures. The imposition of a tax without a concurrent increase in government expenditures may create no real increase in the level of burden on the private sector of the economy. For example, a proportional tax on all incomes without increased government purchases of goods and services may simply lead to proportional deflation of all commodity prices which leaves the real income position (but not the real wealth position) of economic units unchanged.

Within the above broad definition of incidence, there are several approaches.\(^7\) These are primarily methods of analysis, rather than definitions of a concept. As such, they may be applied to problems other than tax incidence. Specific tax incidence is the distributional change resulting from a change in only one particular tax while real government expenditures are held constant. Differential tax incidence is the distributional change resulting from a balanced budget change in more than one tax (that is, tax substitutions) while real government expenditures are held constant. Balanced budget incidence is the distributional change resulting from equal changes in both real government expenditures and taxation.

The choice of a particular approach is largely a matter of the problem under consideration. Of the three, differential incidence is perhaps the most analytically pure. Specific incidence mixes the

\(^7\)Tbid., pp. 211-17.
effects of tax changes and inflation or deflation. The balanced budget approach involves the incidence of both tax and expenditure changes. Differential incidence, however, provides an approach for analyzing the differential effects of using various taxes to finance a given expenditure program chosen on the basis of other criteria, such as stabilization or allocative objectives.

Two additional concepts of incidence are useful to discussions of tax shifting. The imposition of a tax places a specific, statutory obligation on certain economic units to pay the tax. A change by the amount of the tax in the income position of the legally obligated economic unit would represent the impact incidence of the tax.

There is no a priori reason to expect that the impact incidence will represent the final change in the distribution of income. Price and earnings adjustments may occur which affect all economic units of the economy. The actual change in the distribution of income which finally results from the tax change may be called the effective incidence of the tax. When the impact and effective incidences are different, then the tax has been shifted.

Tax shifting may occur through adjustments in either relative factor prices or in relative product prices, or both. It is the final result on relative real income positions rather than absolute price movements which is important. Although the change in the distribution of real income depends on the changes in relative prices, which in turn are accomplished through changes in absolute prices, there is

---

no necessity to determine the direction of change in absolute prices
in order to ascertain the incidence of a tax.

The definition of shifting above follows from the definition
of incidence. However, it differs sharply from the definition used
in much of the literature on border tax adjustments. For example, it
is hardly consistent with the statement that,

...tax shifting...is regarded as the difference
between the pre-tax and post-tax price without
attempting to isolate the tax as a cause of the
change.\(^9\)

or that,

The GATT assumes product prices are not in-
creased by direct taxes. In tax parlance this
means the tax cannot be 'shifted' forward, so the
full burden must rest on the producer.

The GATT also assumes that indirect taxes
do affect prices. They are not shifted backward,
so the full burden is paid by the consumer.\(^10\)

It is clear from the preceding discussion of tax incidence and
shifting that much of the current concern over the balance of trade
(or payments) effects of various taxes has been misguided. Indeed,
one of the more important implications of incidence analysis is that
changes in absolute product prices cannot be determined from knowledge
of only changes in taxation policies.\(^11\) One must also know other
accompanying macroeconomic policies, such as government expenditure,

\(^9\) Border Tax Adjustments and Tax Structures in OECD Member
Countries, p. 75.

\(^10\) Leontiades, "The Logic of Border Taxes," p. 175.

\(^11\) McLure, "Tax Incidence, Macroeconomic Policy, and Absolute
Prices."
debt management, or monetary policy. This, of course, does not mean that absolute price movements are unimportant. It means only that they are not the sole result of changes in tax policy. There are, however, determinable movements in relative prices which may result solely from tax changes and which may be of great importance not only for tax incidence but also for international trade and the GATT provisions on internal taxation. These relative price movements have been largely ignored in the border tax adjustment literature.\footnote{The preceding discussion is written primarily as if all taxes and production processes were single stage. Additional problems of absolute and relative price changes arise when production occurs in a series of stages. These may be especially important when cumulative multi-stage taxes are employed. The usual argument is that the effects of such taxes on absolute product prices cannot be determined. With regard to the GATT provisions, this has been interpreted to mean that border tax adjustments can only be estimates. The adjustment may over- or under-compensate for a cumulative tax. The implication is that the adjustment should equal the amount of the tax reflected in the absolute price of the product. This argument also seems to be misguided. First, it would be more proper to assert that the adjustment should be equal to the total tax included in the value of the product. This amount may or may not be the same as the effect of the tax on absolute prices, and it may be equally difficult to ascertain empirically. Second, and even more important, depending on the structure of the economy, relative product and factor prices may be changed by either multi- or single-stage taxes. This result holds even if the tax is general and applies to all products at the same rate. Only a value added tax leaves relative product prices unchanged and only under certain stringent conditions. See Ann F. Friedlaender, "Indirect Taxes and Relative Prices," Quarterly Journal of Economics, LXXI (February, 1967), 125-39, John F. Due, "Indirect Taxes and Relative Prices: Comment," Quarterly Journal of Economic, LXXXII (May, 1968), 340-43, and Ann F. Friedlaender, "Reply," Ibid., 344-45.}
3.2.4 Tax Neutrality, Allocative Efficiency, and Equity

Before considering the international aspects, one additional public finance concept should be defined—neutrality. Taxes or combinations of taxes are said to be neutral if they do not induce distortions into the economy which would not exist in their absence. Thus, they do not interfere with the functioning of the market mechanism. Relative factor returns and relative product prices, hence patterns of production and consumption, are not altered. A neutral tax is one which, aside from distributing the tax burden in some intended pattern, does not discourage efficient use of resources. Neutral taxes create no excess burden. The use of neutral taxes, therefore, promotes economic efficiency and minimizes the burden of taxation.\(^{13}\) Whereas tax incidence is concerned primarily with tax-induced changes in real incomes, tax neutrality deals primarily with efficient use of economic resources. Both concepts, however, depend vitally on tax-induced effects on relative product and factor prices.

A tax may be efficient but not equitable. The question of the equity of taxes centers around whether or not they are fair. In closed economies, tax equity is usually evaluated in accordance with two principles which differ fundamentally in their views of the public revenue-expenditure process.\(^{14}\)

\(^{13}\)Richard A. Musgrave, *The Theory of Public Finance*, pp. 140-41. Musgrave notes that a neutral tax is efficient only if, in addition to not interfering with the market, it accomplishes the intended purpose of an efficient budget policy.

\(^{14}\)Ibid., pp. 61-115.
The benefit principle combines both sides of the budgetary process by treating taxes as payments for specific public goods or services provided by the government. The economic unit which receives the benefit is the one which pays the tax. The public sector is treated as analogous to the market place of the private sector. While this principle has the advantage of simultaneously determining government revenue and expenditure patterns and of efficient resource allocation, it suffers from at least one major disadvantage.

Perhaps the signal characteristics of pure public goods are the impossibility of exclusion and equal consumption by all. If exclusion is impossible, individuals have no reason to reveal their preferences in the form of tax payments for benefits received. Thus, it appears that the benefit principle fails for the case of pure public goods. Nevertheless, because of its implications for allocative efficiency, the benefit principle has been used in connection with the question of how domestic taxes should be treated in international transactions.

The ability-to-pay principle separates the revenue and expenditure processes and treats taxes as essentially compulsory. Economic units are taxed in accordance with some ability index. It is not ordinarily employed in an international context since questions of fairness become particularly intractable when both interpersonal and international comparisons must be made.15

15 For one attempt at these comparisons, see Richard A. Musgrave, *Fiscal Systems*, pp. 243-48, 251-52, and 271.
3.3 International Trade Concepts

Having introduced concepts of public finance theory which are relevant to this study, we may now proceed with some concepts of international economic theory. Much of the literature dealing with the GATT provisions neglects many important aspects of international trade theory. Even the better studies have been conducted essentially within the framework of a closed economy, apparently because of the preoccupation with the direction of shifting of various taxes. They generally consider the effects of various taxes on absolute domestic product prices without regard to international product prices. In a trading world, the effects of taxes on domestic product prices and other economic variables are closely related to events in international markets. Certainly, an analysis of the GATT provisions should be conducted in an international context. Thus, this section reviews some basic theoretical concepts of international economics which are relevant to analysis of the problem.

3.3.1 Absolute and Comparative Advantage

Trade between nations occurs when one nation has a comparative advantage in the production of goods. Suppose that country 1 produces good X at a lower absolute cost than does country 2, but that 2 produces good Y at a lower absolute cost than does 1. Country 1 will then export good X, and country 2 will export good Y. Each country specializes in the good for which it has an absolute advantage. In the constant cost case, specialization is complete. If production exhibits increasing costs, specialization occurs but may be less than
complete. Each country still produces some of each good. Table 3.1 illustrates the proposition.

**TABLE 3.1**

**ABSOLUTE ADVANTAGE**

<table>
<thead>
<tr>
<th>Country 1</th>
<th>Country 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>$X$</td>
<td>$X$</td>
</tr>
<tr>
<td>$Y$</td>
<td>$Y$</td>
</tr>
</tbody>
</table>

Factor Input Cost of One Unit of:  
1 2 1.5 1.5

Let $P$ with appropriate subscripts and superscripts denote prices. Thus, trade occurs in the absolute advantage case if $P^1_X < P^2_X$, and $P^1_Y > P^2_Y$.

Even if one nation has an absolute advantage in the production of both goods, the law of comparative advantage holds that trade will still take place. If a country can produce a commodity at a lower relative cost than in any other country, then it has a comparative advantage in production of that commodity. Total national income of a country can be increased by exporting goods in which it has a comparative advantage in exchange for goods in which it is at a comparative disadvantage. This is depicted in Table 3.2.

**TABLE 3.2**

**COMPARATIVE ADVANTAGE**

<table>
<thead>
<tr>
<th>Country 1</th>
<th>Country 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>$X$</td>
<td>$X$</td>
</tr>
<tr>
<td>$Y$</td>
<td>$Y$</td>
</tr>
</tbody>
</table>

Factor Input Cost of One Unit of:  
1 4 5 10

Relative Cost: 4:1 2:1
In Table 3.2, country 1 has an absolute advantage in both X and Y, but it has a comparative advantage in only X. Country 2 has a comparative advantage in Y. In country 1, to produce one additional unit of Y requires the sacrifice of four units of X. If country 1 purchases Y from country 2, only two units of X need be foregone. Trade will occur so long as in the absence of trade the following supply price (factor input cost) relationship obtains

\[ \frac{p^1_x}{p^1_y} \neq \frac{p^2_x}{p^2_y}. \]

As trade occurs and due to it, each country specializes in the good in which it has a comparative advantage. If costs are constant so that price ratios cannot equalize, trade continues until each country is completely specialized. If costs are increasing, each country tends toward specialization, but the tendency is removed when costs increase to the point at which they are equal in both countries—before complete specialization.

It is comparative advantage, rather than absolute advantage, which is the basis for trade between nations. In the absence of comparative advantage, trade will not occur. Alternatively, it is relative price differences, not absolute price differences, which give rise to trade. Even the absolute advantage example is also an example of comparative advantage.16

---

Let us ask what lies behind relative price differences or comparative advantage. Assume that demand conditions and factor endowments are identical in all nations. Assume also that production functions are linear homogeneous and are the same in all nations, although they may differ between goods. Assume finally that competition is perfect in all countries. If these conditions hold, there would be no relative price differences between countries, no comparative advantage, and no trade. If any one of these conditions does not obtain, relative price differences develop, and trade occurs. For example, according to the well-known Heckscher-Ohlin Theorem differences in factor endowments between nations lead to trade. Ceteris paribus a country tends to have relatively lower costs in, and thus export, commodities using relatively more of the factors of production which are relatively abundant (hence cheap) in that country. Failure of any of the other conditions to hold could substitute for, offset, or strengthen this pattern. For example, it has been observed that product taxation by altering competitive equilibrium could lead to trade even if all other conditions hold.17

In order to determine how much is traded, one must know both demand and supply conditions. One approach which has been used to ascertain the level of trade is the use of Marshallian reciprocal demand curves or offer curves. This general equilibrium technique determines both the level of trade and the ratio of prices at which goods are exchanged under the assumption that trade is balanced. For purposes

of this study, the important point is that supply and demand conditions in both countries are required to determine the solution. It is assumed that neither nation dominates trade. Thus, analysis of one nation alone is not sufficient.\textsuperscript{18}

3.3.2 Monetary Adjustments and Classical Equilibrium

The discussion to this point has been expressed entirely in real terms. For example, product prices have been expressed in terms of units of factor inputs. The same results would obtain if a monetary system were superimposed upon the real system.\textsuperscript{19} Suppose that money is introduced into the system, that prices are expressed in terms of two monetary units, pounds and dollars, and that an equilibrium exchange rate between the two currencies represents the ratio of absolute price levels in the two countries. For example, an equilibrium exchange rate for the post-trade situation depicted in Table 3.3 would be 2L/1$.

<table>
<thead>
<tr>
<th>Country $</th>
<th>Country L</th>
</tr>
</thead>
<tbody>
<tr>
<td>$1.25</td>
<td>$1.75</td>
</tr>
<tr>
<td>$1.25</td>
<td>$1.75</td>
</tr>
</tbody>
</table>

TABLE 3.3
EQUILIBRIUM EXCHANGE RATE

\textsuperscript{18}The reader is again referred to any standard text. See Kindleberger, International Economics, pp. 106-21

\textsuperscript{19}This argument ignores a multitude of implications which may be found in more contemporary monetary theory. The monetary system in the text is essentially a classical system in which money is neutral with respect to all of the real variables of the system.
Suppose that some exogenous changes disturbs the existing equilibrium. Assume, for example, that the money supply in country L is doubled, or that a general product tax is levied and accompanied by an increase in the money supply. Suppose finally that this results initially in doubled product prices in country L. Table 3.4 illustrates the proposition.

**TABLE 3.4**

**DISEQUILIBRIUM EXCHANGE RATE**

<table>
<thead>
<tr>
<th>Country $</th>
<th>Country L</th>
</tr>
</thead>
<tbody>
<tr>
<td>$X$</td>
<td>$X$</td>
</tr>
<tr>
<td>$Y$</td>
<td>$Y$</td>
</tr>
</tbody>
</table>

Prices in $ $1.25 $1.75 $2.50 $3.50

Prices in L 15.00 17.00

At the initial exchange rate (2L/1$) citizens of country L would be better off to buy more of its consumption of both X and Y from country $. If X were its export and Y were its import, it would import more of both Y and X (or, alternatively, export less X). From country $'s point of view, it is better off to import less X and to substitute domestically produced X. It would also need to increase its output of Y to satisfy country L's increased demands. The argument requires that country $ must increase its output of both X and Y, and country L must reduce its output of both X and Y.

At the initial exchange rate, the system is no longer in equilibrium. For prices and the exchange rate to remain at the assumed initial level, the implicit assumption would be that the elasticity
of supply of both X and Y in both countries $ and L is infinite. Clearly, this could be true only over very short periods of time. The disequilibrium in this example is purely monetary. It could be corrected by merely redefining the exchange rate. A new equilibrium exchange rate would be 4L/1$. Alternative monetary adjustments in either economy could also restore equilibrium. For example, absolute factor prices in country L could fall to maintain full employment. More probably, a flow of international monetary assets from country L to country $ would lead to a monetary expansion and general inflation in country $. The process would continue until the monetary disequilibrium was eliminated and balanced trade was restored. The system would return to a state of classical equilibrium.

Classical international economic theory usually assumed that in the long run trade would be balanced. All markets in all trading economies would be in equilibrium in the sense that excess demands and supplies for all goods were equal between economies, and that there was no net flow of any internationally acceptable monetary asset between economies. Equilibrium would be maintained by the familiar price-specie flow mechanism. If a nation developed a trade surplus, it experienced an inflow of gold. The inflow caused a general inflation in the level of all prices which would eliminate the trade surplus. The crucial link was the connection between prices and the flow of an internationally acceptable asset, gold. The effect was exactly the

---

same as if the exchange rate between trading nations were flexible. Trade imbalance was prevented by movements in general price levels.

In the classical system, trade imbalances are only a short-run, monetary phenomena. The underlying determinant of international trading patterns is comparative advantage and the factors which determine it. Trading patterns can be changed only by altering comparative advantage. In the real world, classical equilibrium is not readily attained. Trade surpluses and deficits exist between trading nations.

The international economy operates more or less continuously in a disequilibrium state which is financed by the flow of internationally acceptable monetary assets, such as gold or more recently SDR's. In terms of classical economics, the disequilibrium occurs because the adjustment mechanism operates slowly or imperfectly. Price and production changes do not occur instantly. Continuous exogenous shocks tend to keep the international system in a state of disequilibrium.

Classical equilibrium, however, remains a valuable analytical tool. In the absence of distortion, it would represent a set of relative prices and factor allocation which is efficient. To assume that trade is balanced in an economic analysis means that one is concerned with more basic factors than those which prevail in the very short run. It allows one to go beyond immediate effects into more fundamental and more important problems.

The similarity between efficiency, incidence analysis, and comparative advantage is noteworthy. All are fundamental concepts. All are determined, not by movements in absolute prices, but rather changes in relative prices. In each concept, absolute prices are largely a
monetary phenomena only incidentally related to changes in relative factor and product prices. Moreover, just as a neutral tax does not alter the distribution of the tax burden, it does not alter comparative advantage. It does not alter relative prices. It change nothing in real terms. It is efficient.

3.4 Synthesis of Concepts

The preceding two sections provide a background of public finance and international trade concepts which are useful to this analysis of the GATT provisions. There are some concepts yet to be presented—concepts which have become important in the international treatment of national taxes. This section addresses itself to these ideas.

3.4.1 The Origin and Destination Principles; the Source and Residence Principles

The origin and destination principles of product taxation were introduced in Chapter I. To reiterate, when border tax adjustments are applied for a product tax on exportables or importables, the tax is levied in accordance with the destination principle. If they are not applied, the origin principle is employed.\(^{21}\) The GATT, by allowing border tax adjustments for product taxes but not for factor taxes, in effect implements the destination principle for product taxes.

In an international context the provisions have one unambiguous economic effect. A tax which is levied without border adjustments is

---

\(^{21}\)See pp. 2-3, and 18-22. It should be recalled that the terms origin principle and destination principle originate with the tax harmonization controversy, not with the GATT.
in effect a tax on all production, but not necessarily consumption, of the taxed commodity. If border adjustments are applied, the same tax becomes a tax on all consumption of the taxed commodity, but not all production.

For an open economy, production and consumption of any particular good need not be equal. Suppose there are two countries 1 and 2 (denoted by superscripts) whose production and consumption of two goods (denoted by a subscript x or y) are represented by Q and C, respectively. All that is produced is consumed so that there is no saving. Assume that country 1 exports good X and imports good Y, and that country 2 exports Y and imports X. We have, therefore, the following relationship:

\[ Q_x^1 = C_x^1 + (C_x^2 - Q_x^2) , \]

and

\[ Q_y^2 = C_y^2 + (C_y^1 - Q_y^1) . \]

The imposition of a tax on all production of a good in one country is no longer equivalent to a tax on all consumption of that good, as it was in the closed economy case. When imports, as well as domestically produced and consumed products, are taxed, and when no tax is charged on goods produced domestically but consumed in other countries, the tax is a tax on domestic consumption of the commodity. Conversely, if all production, including exports, are taxed, and imports are not taxed, the tax is applied to all domestic production of the commodity. Thus, in this context the application of border tax adjustments changes a product tax from a tax on production to a tax on consumption.
When taxes on remuneration to factors of production are considered, the residence principle is usually applied. The income of a factor of production is taxed in the country where the factor owner lives, rather than in the country in which the factor of production is employed, and the income produced. The alternative is taxation of income in the country in which the income is actually produced; that is, in accordance with the source principle. 22

The residence principle is employed because of its administrative practicality, and because it is said to neutralize distortions of factor flows between nations. If gross returns to factors are equalized, net returns will differ if one nation's tax structure is such that it taxes factors more heavily than do other nations. If the taxed factor is mobile, and if the source principle is applied, it can increase its net earnings by moving to employment in other nations. If only the nation of employment of a taxed factor changes, and not the residence of the factor owner, and if the residence principle is applied, there is no advantage to be gained from changing the nationality of employment. 23

If income is repatriated by a nation and an equalizing tax is applied for any tax differentials, the residence principle appears to be similar to the destination principle. Income, like goods, is taxed

---

22 This discussion is not intended to be thorough. For more comprehensive treatments of the problem, see the Neumark Report, p. 149; Richard A. Musgrave, Fiscal Systems, Chapter 10; and Shoup, "Taxation Aspects of International Economic Integration," pp. 101-104.

23 Usually only capital is considered to be mobile without ownership moving also. The situation also applies to commuting workers.
at the rate of the country of its destination (that is, country of residence of its owners). However, if income is earned and used in one nation by foreign owners, the residence principle does not restore neutrality. The source principle and the residence principle in the absence of income repatriation are quite similar to the origin principle of product taxation. Income and goods alike are taxed by the country in which they are produced.

Finally, note that neither the source nor the residence principle involves adjustments to product prices to compensate for factor taxation included in the product values. Such adjustments would be of a fundamentally different nature. Adjustments to tax bills for taxes on a factor's income are intended to neutralize factor flows. Proposed border tax adjustments to product prices for factor taxes are presented as a neutralizing adjustment for product flows and balances of trade and payments.

3.4.2 Tax Equivalence in Open Economics

It is helpful to reinterpret the tax equivalence matrix with regard to the observations in the previous section. Because the

24Earnings on foreign investments are not usually subject to differential taxes or tax credits until they are actually repatriated. See Joseph A. Pechman, Federal Tax Policy (Washington: The Brookings Institution, 1966), p. 102.

25This contrasts with approaches which discuss border tax adjustments for income taxes. The application of surcharges and rebates for the corporation income tax is sometimes referred to as placing the tax on the destination principle. In the absence of border adjustments the tax is said to be on the origin principle. See Carl S. Shoup, "Indirect and Direct Taxes and their Influence on International Trade," in U. S. Congress, House, Committee on Ways and Means, Excise Tax Compendium (Washington: U. S. Government Printing Office), pp. 63-64.
economy was closed, the matrix in Figure 3.1 made no distinction between a tax on production of a product and a tax on consumption of that product. Since the two are not equivalent in an open economy, the equivalence matrix must be rewritten. Using the same notation plus a subscript p to indicate a production tax and a subscript c to indicate a consumption tax, the equivalence matrix for a production tax becomes:

\[
\begin{bmatrix}
T^i_p = T^i_f \\
T^i_{px} \\
T^i_{py}
\end{bmatrix}
= \begin{bmatrix}
T^i_k \\
T^i_{kx} \\
T^i_{ky}
\end{bmatrix}
+ \begin{bmatrix}
T^i_l \\
T^i_{lx} \\
T^i_{ly}
\end{bmatrix}
\] ^26 (i = 1 or 2)

The set of vectors must be expanded to include consumption taxes. Let e and m be subscripts denoting exports and imports, respectively. Using equations (3.1) and (3.2), we may determine the proper alterations to equation (3.3) in order to include consumption taxes. If a country consumes more of a product than it produces, a tax on its production plus an equal tax on its imports constitute a tax on all of its consumption of that good. Similarly a tax on a country's production of any good plus a negative tax (or subsidy, or tax rebate) on its exports of that good constitute a tax on only its consumption of the good. We may now write the equation for the open economy case.

---

^26 The matrix is written as a series of column vectors in this case for easier interpretation. The first element of each column vector may still be thought of as the sum of the second and third elements of that vector. Similarly, an element of the first (left) vector may be thought of as a combination of the corresponding elements in the remaining vectors.
\[
\begin{align*}
\begin{bmatrix}
T_{cx}^i \\
T_{cy}^i
\end{bmatrix} & = \begin{bmatrix}
T_{ip}^i \\
T_{ipx}^i
\end{bmatrix} + \begin{bmatrix}
-T_{e}^i \\
-T_{ex}^i
\end{bmatrix} + \begin{bmatrix}
T_{im}^i \\
T_{mx}^i
\end{bmatrix} \\
(3.4)
\end{align*}
\]

or alternatively,

\[
\begin{align*}
\begin{bmatrix}
T_{cx}^i \\
T_{cy}^i
\end{bmatrix} & = \begin{bmatrix}
T_{ik}^i \\
T_{ikx}^i
\end{bmatrix} + \begin{bmatrix}
T_{il}^i \\
T_{ilx}^i
\end{bmatrix} + \begin{bmatrix}
-T_{e}^i \\
-T_{ex}^i
\end{bmatrix} + \begin{bmatrix}
T_{im}^i \\
T_{mx}^i
\end{bmatrix} \\
(3.4a)
\end{align*}
\]

\[(i = 1 \text{ or } 2).\]

Equation (3.4) illustrates clearly that a tax on all production of one commodity in one country is no longer equivalent to a tax on all consumption. For example, \(T_{cx}^i \neq T_{ipx}^i\). Thus, a partial product tax under the origin principle is not equivalent to the same tax levied under the destination principle. Note, however, that a tax on production of all commodities is equivalent to a tax on consumption of all commodities in one country, so long as trade is balanced so that total production and consumption of all goods are equal.\(^{27}\) Alternatively, when trade is balanced, a general product tax levied under the origin principle is equivalent to the same tax levied under the destination principle.

\(^{27}\)See the Tinbergen Report. If trade is not balanced in real terms, the conclusion does not hold. Since such an imbalance would persist in only the short run, the two taxes would be equivalent in the long run.
Equation (3.4) also illustrates that even though in an open economy national consumption and production taxes may not be equivalent, taxes on world consumption and world production are equivalent. That is, an equal rate tax on all production and consumption in both countries 1 and 2 is illustrated by adding the left and right sides of (3.4) for which $i = 1$ to the left and right sides of (3.4) for which $i = 2$. But in this case, $T_{\text{ex}}^1 = T_{\text{mx}}^2$, and $T_{\text{my}}^1 = T_{\text{ey}}^1$. Thus, $T_c^1 + T_c^2 = T_p^1 + T_p^2$. A tax on world consumption of goods $x$ and $y$ is equivalent to a tax on world production of them. A similar conclusion holds for partial product taxes. A tax on production of one commodity in all countries is equivalent to a tax on consumption of that commodity in all countries.

These formulations illustrate another point. It has been contended that border adjustments for a corporation income tax would offset competitive advantages of nations using a value added tax. Suppose that the former tax is represented by $T_{Kx}^i$ in the matrix and the latter tax by $T_c^i$. Assume that border adjustments for the two taxes are set such that
\[ T_c^i = T_e^i = T_m^i, \]
and
\[ f_{T_{Kx}^i}^i = T_{\text{ex}}^i = T_{\text{mx}}^i. \]

As written the matrices describe tax structures. Using differentials would be more appropriate for description of tax changes. The results are the same for equivalence analysis, and there is no need for use of differentials. Also note that the matrices do not apply to the source and residence principles or the related problems of nonresident factor owners and tax induced factor flows. A similar matrix could be constructed for these problems. However, since the primary concern of this study is neutrality with respect to product flows, the construction has not been undertaken.
where \( f_{Kx}^i \) represents the effect of the tax on the price of \( X \) under the assumption that the tax is fully "shifted" forward into a higher product price. From the matrix we see that \( T_{C}^i \) is equivalent to \( T_{p}^i - T_{e}^i + T_{m}^i \); it is not equivalent, therefore, to \( T_{Kx}^i - T_{ex}^i + T_{mx}^i \). They would differ by the amount of taxes on labor in both goods, taxes on capital employed in \( Y \) production, and border adjustments for these taxes. The same is true if the corporation income tax were represented by \( T_K \). The application of border adjustments for this tax will not make it equivalent to \( T_{C}^i \), and would not offset trade effects, if any, arising from \( T_{C}^i \).

3.4.3 Neutrality, Efficiency, Incidence, and Shifting in Open Economies

Tax neutrality for the open economy case may be defined as an extension of the definition for a closed economy. Recall that a neutral tax does not introduce distortions into a closed economy. It is an efficient tax. A tax or combination of taxes is neutral in an open economy if it does not introduce distortions into either the domestic or international economies. A neutral tax interferes with neither domestic nor international product and factor markets. Production and consumption patterns are not altered. Relative product and factor prices do not change. The tax induces no change in trading patterns and does not alter factor flows, if any, between economies. It does not affect comparative advantage.

In the short run, before the international monetary adjustment mechanism has restored equilibrium, a neutral tax might be defined as one which did not alter the absolute prices of products of factors between nations. That is, relative international product and factor prices would not be altered. For example (using the previous notation), the ratio \( \frac{P_{1x}}{P_{2x}} \) would not be affected. This has been the concept most frequently
used in the balance of payments controversy. Recalling that absolute prices are determined as much by accompanying policies as by the tax structure, this short run definition of a neutral tax seems inadequate. The nonneutrality is primarily a monetary phenomena rather than a tax phenomena. Thus, this study rejects this short run interpretation.

What does tax incidence mean in an open economy setting? Incidence, it will be recalled, deals with tax induced changes in the distribution of real income from either the sources or uses side. In the short run incidence may be related to trade balances between nations. A trade surplus means that a nation is exporting more than it is importing. In the absence of inventory changes this means that the country produces more goods than it consumes with the trade surplus representing the difference. Alternatively, one might say that income produced in a surplus country exceeds income consumed. In a deficit country income consumed exceeds income produced. Assuming there is no savings for the world as a whole, a trade imbalance thus represents a transfer of real income or purchasing power over goods from the surplus to the deficit nation. In a temporary sense, a tax induced trade balance would alter the international distribution of income and hence might be thought of as representing the incidence of the tax.

Again, the short run definition fails as soon as the monetary adjustment mechanism has restored balanced trade. In addition, it does not take into account the stock of internationally acceptable IOU's accumulated by the surplus nation in exchange for commodities. This stock represents a future claim on the production of the deficit nation and represents an offsetting reduction in its future income. This short run approach to international incidence is similar to the confusion in the
closed economy case of the effects domestic taxes on absolute prices with their incidence. In both the closed and open economy cases absolute price movements are primarily a monetary phenomena, corrivable by a monetary adjustment.

A more fundamental interpretation of tax incidence in open economies would be one which cannot be offset by monetary changes. This must necessarily be accomplished by tax induced changes in relative product and factor prices. If factors are internationally immobile and are owned and employed in the same nation, changes in the international distribution of real income could be accomplished only through tax induced changes in the terms of trade.\textsuperscript{29} In the terminology of international trade theory, international incidence would be one aspect of the terms of trade effect.\textsuperscript{30} Changes in domestic income distribution could still be accomplished through changes in both the terms of trade and in relative domestic factor prices. Thus, incidence in an international context should include both the incidence of the tax within the taxing economy and, in addition, between the taxing economy and its trading partners. If there is a change in income distribution between nations, then it could be said that the taxing nation had shifted some of the burden of its tax to (or from) its trading partners.

Closely related to questions of domestic taxation, efficiency, neutrality, incidence, and shifting is the question of whether interest should focus on domestic tax structures \textit{per se}, or on changes in tax structures. The answer depends upon the effect in which one is

\textsuperscript{29}Richard A. Musgrave, \textit{Fiscal Systems}, pp. 283-84.

\textsuperscript{30}See Kindleberger, \textit{International Economics}, pp. 229-34.
interested. It has been shown that for balance of trade analyses, it is changes in domestic tax structures and rates which are relevant. Any given tax structure may have remained unchanged over long periods during which changing price levels, incomes, or exchange rates could have offset any effects on trade balances originally resulting from that tax structure. Thus, comparisons of existing tax structures between nations and consideration of a particular nation's tax structure are largely irrelevant for analyses of how taxes affect a nation's balance of trade. A change in tax structures, however, may alter a country's competitive position in the period before the international monetary adjustment mechanism offsets the change. Even this temporary effect could be offset, of course, by some concurrent or subsequent, nontax policy change.

Questions of tax efficiency, incidence, and neutrality, on the other hand, are inherently a matter of tax structures and their international treatment. These matters are concerned with the real effects of taxes on economic structure and are not offset by monetary adjustments. Distortions induced by a particular tax are likely to continue until the tax is removed, or possibly offset by another inefficient tax with opposing effects. Changes in structures are, of course, also relevant in that they would induce changes in the patterns of distortions. Nevertheless, even this remains a question of comparisons of the structural effects of the old tax and the new tax. These matters differ from balance of trade analyses in that they are more fundamental

31McLure, "Taxes and the Balance of Payments: Another Alternative Analysis."
and that they will not be automatically eliminated over any period of time. In the long run a bad tax structure will remain a bad tax structure.

A similar argument, but different conclusions, applies to the structure of government expenditures and changes in that structure. An analysis of the GATT provisions, however, should be ultimately concerned only with the international treatment of tax structures, not the government expenditures which they finance. If one employs the concept of balanced-budget or specific incidence, the structure of expenditures and changes in it may become important. If one is concerned with differential incidence, however, then various taxes are treated as alternative means to finance a given expenditure structure to which the international adjustment mechanism may have already adjusted. Thus, the pattern of expenditures may be ignored.

Of course, changes in government expenditure patterns may have important effects on both the domestic and international economies. They may, in fact, be more important than tax induced effects. Major changes in tax structure are probably far less frequent than structural changes in government expenditure patterns. The argument here is that they can and should be treated as independent decisions which are not tied to any specific change in taxes.32

Similar conclusions apply to monetary policy. Any particular tax change may be financed by any of a variety of monetary policies, or accompanied by no monetary action at all. Thus, one should analyze a tax change separately from a monetary change. Again, this does not mean that monetary action would not affect at least the short run

---

32 This contention must be modified when the benefits of government expenditures are not general. See Section 3.4.4.
outcome. It implies only that the effects of a tax change and a monetary change are independent and should be treated as such.

3.4.4 The Origin Principle, The Destination Principle - Which is Preferred?

If the origin and destination principles are not equivalent in all circumstances, are there factors which make one principle preferable? There have been several attempts to define the conditions under which either the origin principle or the destination principle would be the proper one to employ for product taxes on traded goods. In general, two arguments have been used in support of the destination principle. First, there is the belief that product taxes burden consumers, and government expenditures benefit consumers. Thus, the taxing government and the taxed consumer should reside in the same country. Second, there is a competitive argument that in the absence of border tax adjustments a country with high product taxes cannot compete with countries having lower product taxes.

Either argument implies that use of the destination principle is appropriate. Consider each of these separately. Recall that, if the destination principle is applied, product tax rate differentials are absorbed by consumers without affecting producers. Thus, if benefit taxation is used, and if government expenditures benefit consumers, then product taxation should conform to the destination principle.

33 Perhaps the most explicit statement of these arguments can be found in Shoup, "Indirect and Direct Taxes and Their Influence on International Trade," pp. 59-62.
Turn now to the competitive argument. It implies that failure to use border tax adjustments to standardize product tax systems between nations would interfere with the international flow of commodities. Essentially producers in the taxing nation would be at a competitive disadvantage relative to producers in other countries with lower tax rates. Demand would shift from goods produced in high tax nations to goods produced in low tax nations. Producers in the former country would suffer as their customers (foreign or domestic) switched to foreign goods. The basis of this argument apparently is that producers attempt to escape product taxes by raising product prices. Otherwise, there would be no reason for their customers to flee to other, foreign sources of supply. If border tax adjustments are applied, the disadvantage is eliminated.34 The competitive argument, as noted earlier, is based on assumptions of fixed exchange rates and fixed prices in international markets.

It is important to note that the two arguments are not consistent in the extreme. The argument based on consumers' benefits requires a rebate equal to the tax in order to prevent foreign buyers from paying the exporting nation's tax. Domestic consumers pay the tax under the destination principle. This implies that the seller can force either foreign or domestic buyers to pay the tax in the

34An alternative interpretation is that the highly taxed producers absorb the tax in the form of lower net receipts and profits. As a result, some producers will eventually exit the taxed industry in favor of more profitable employment. This implies that producers force the shift of demand to foreign sources by reducing the supply rather than raising prices.
absence of the rebate. The competitive argument, on the other hand, contends that a rebate equal to the tax must be given to the seller in order to avoid placing him at a competitive disadvantage. This implies that, if there were no rebate, the seller would pay all of the tax, and therefore the foreign buyer would pay none. That is, the seller cannot force the buyer to pay the tax. Clearly, the two arguments are inconsistent. Thus, they may be considered as substitutes but not as complements.

Only the competitive argument has been employed with regard to factor taxes. The question of benefits financed from factor taxes has been largely ignored. There is no discernible reason that a similar argument could not be applied to factor taxes with similar conclusions. For example, if a corporate income tax finances expenditures which benefit consumers, then the benefit-to-consumers argument would imply that border adjustments should be applied. Alternatively, a factor tax which finances expenditures that benefit producers may not imply a need for border tax adjustments.

The basic assumption of the consumer benefit argument has been questioned. It is far from obvious that many product taxes benefit only consumers. This seems especially suspect for many of the broadly based taxes to which border adjustments apply, such as value added taxes in European nations. It is also feasible to argue that producers benefit from government expenditures which lower production costs. If producers, rather than consumers, receive cost-lowering benefits from government expenditures, then producers, not consumers, should pay the tax. Since an origin principle product tax is basically a tax on production but not consumption, origin principle product
taxation would be appropriate. Since the effects of cost-increasing 
taxes are offset by cost-lowering benefits, the alleged distorting 

A similar argument could be made for cases of externalities 
resulting from spill-overs of benefits across national borders. If, 
for example, the German Government expends tax revenue for public 
sanitation programs, one might expect that citizens of France and 
other contiguous nations share in the benefits. A healthy, non-
diseased German clearly would increase the probability that a French-
man would not contract disease. A healthy German worker should improve 
the efficiency of German industry and lower product costs and prices 
to Germans and Frenchmen alike. French flood control projects may 
benefit similar German programs. Yet, if all taxes are rebated, the 
would prevent tax spill-over, but it would be appropriate for non-
Germans to pay some tax for the benefits accruing to them.\footnote{Neither of these two interpretations of the benefit argument 
seem to have been the ones used in framing the Treaty of Rome. The 
\textit{Neumark Report} mentions benefits from government expenditures. However, 
its primary discussion deals with the impossibility of linking any 
particular tax with a particular expenditure, benefit or otherwise. 
Its most emphatic realization that consumers should contribute to the 
public expenditures of their own nation does not mention benefits to 
consumers. Cost-lowering government expenditures are recognized only 
in passing. See \textit{Neumark Report}, pp. 27-28, 79.} Thus, 
the origin principle is called for.
Even these alternative arguments are not particularly satisfactory. Although the underlying conditions are seldom stated, they are apparently based upon assumptions of fixed exchange rates and constant international prices. As a matter of efficiency, it is unimportant whether government expenditures benefit consumers or producers, so long as they benefit either or both equally. 38 Consider the following example. Suppose that government expenditures benefit either producers entirely or consumers entirely. Thus, if producers receive no benefits, consumers receive all benefits. 39 Also assume that benefits are distributed equally among producers or consumers, and that no benefits spill over (or that spill-overs are equally distributed). Let P represent supply prices of commodities with a subscript to indicate the commodity (X or Y). A superscript indicates either country 1 or 2. Country 1 is the taxing nation. All prices are expressed in a common currency. A second superscript (i) is used to indicate the price as it would be seen by foreign buyers—that is, the price as seen in international markets. For example,

38 It is not clear that this conclusion also applies to equity arguments. Since equity is not the focus of this study, it is not discussed further. The conclusions of the remainder of this section are based on the analysis contained in Chapters IV-VI and are not intended to be exhaustive. A thorough study of the effects of expenditure benefits would require a general equilibrium analysis analogous to that in Chapters IV-VI and is beyond the scope of this study.

39 This assumption is used only for illustration and is not crucial. The important aspect is that benefits accrue equally (or proportionately), not that they accrue exclusively to either producers or consumers.
\( p_x^1 \) represents the price as seen by a buyer in country 1, and \( p_x^{1i} \) represents the price of the same commodity as seen by a buyer in country 2. Assume finally that the taxing nation exports \( X \) and imports \( Y \).

Table 3.5 illustrates a partial tax on \( X \) under which both \( X \) and \( Y \) producers either benefit from government expenditures by the amount of the tax or benefit not at all. The effects on absolute prices differ according to the benefit assumption. Obviously, this may lead to a short run trade imbalance. For the case of flexible exchange rates or in the longer run these changes are of little importance. The effects on trading patterns or comparative advantage are illustrated by the ratios \( p_x^{1i}/p_y^{1i} \) and \( p_x^{2i}/p_y^{2i} \)—that is, by relative prices in domestic and international markets. For these ratios, the effects are the same, regardless of the benefit pattern assumed. For example, the ratio \( p_x^{1i}/p_y^{1i} \) remains constant if the destination principle is employed but rises if the origin principle is employed. The ratio \( p_x^{2i}/p_y^{2i} \) rises for the destination principle but remains constant for the origin principle. Regardless of which taxation principle is employed, or which group receives the benefits, the equality between the ratios \( p_x^{1i}/p_y^{1i} \) and \( p_x^{2i}/p_y^{2i} \) is destroyed. Thus, the pattern of comparative advantage is changed. Thus, it cannot be said from an efficiency viewpoint that either principle is appropriate. Neither would neutralize the effects of this tax policy on trading patterns regardless of the distribution of benefits.

A similar construction for a general product tax would show that comparative advantage is not affected so long as the benefits
TABLE 3.5
THE EFFICIENCY ASPECTS OF GOVERNMENT EXPENDITURE BENEFITS

<table>
<thead>
<tr>
<th>Before Tax/Benefits</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>( p_{1x}^{1} = p_{1x}^{ii} = 1.00 )</td>
<td>( p_{1y}^{1} = p_{1y}^{ii} = 1.00 )</td>
<td></td>
</tr>
<tr>
<td>( p_{2x}^{1} = p_{2x}^{ii} = 1.00 )</td>
<td>( p_{2y}^{1} = p_{2y}^{ii} = 1.00 )</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cum Tax Prices</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>( p_{1x}^{1} = 1.10 )</td>
<td>( p_{1y}^{1} = 1.00 )</td>
</tr>
<tr>
<td>( p_{2x}^{2} = 1.00 )</td>
<td>( p_{2y}^{2} = 1.00 )</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cum Tax/Benefit Prices</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>( p_{2x}^{2} = 1.00 )</td>
<td>( p_{2y}^{2} = .90 )</td>
</tr>
<tr>
<td>( p_{2x}^{2} = 1.00 )</td>
<td>( p_{2y}^{2} = 1.00 )</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Destination Principle</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>( p_{1x}^{ii} = .90 )</td>
<td>( p_{1y}^{ii} = .90 )</td>
</tr>
<tr>
<td>( p_{2x}^{ii} = 1.10 )</td>
<td>( p_{2y}^{ii} = 1.00 )</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Origin Principle</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>( p_{1x}^{ii} = 1.00 )</td>
<td>( p_{1y}^{ii} = .90 )</td>
</tr>
<tr>
<td>( p_{2x}^{ii} = 1.00 )</td>
<td>( p_{2y}^{ii} = 1.00 )</td>
</tr>
</tbody>
</table>

|  |  |  |
|  |  |  |
| \( T_{x} = .10; T_{y} = 0; \text{Equal Producer Benefits} \) |  |  |

<table>
<thead>
<tr>
<th>Before Tax</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>( p_{1x}^{1} = p_{1x}^{ii} = 1.00 )</td>
<td>( p_{1y}^{1} = p_{1y}^{ii} = 1.00 )</td>
<td></td>
</tr>
<tr>
<td>( p_{2x}^{2} = p_{2x}^{ii} = 1.00 )</td>
<td>( p_{2y}^{2} = p_{2y}^{ii} = 1.00 )</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cum Tax Prices</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>( p_{1x}^{1} = 1.10 )</td>
<td>( p_{1y}^{1} = 1.00 )</td>
</tr>
<tr>
<td>( p_{2x}^{2} = 1.00 )</td>
<td>( p_{2y}^{2} = 1.00 )</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Destination Principle</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>( p_{1x}^{ii} = 1.00 )</td>
<td>( p_{1y}^{ii} = 1.00 )</td>
</tr>
<tr>
<td>( p_{2x}^{ii} = 1.10 )</td>
<td>( p_{2y}^{ii} = 1.00 )</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Origin Principle</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>( p_{1x}^{ii} = 1.10 )</td>
<td>( p_{1y}^{ii} = 1.00 )</td>
</tr>
<tr>
<td>( p_{2x}^{ii} = 1.00 )</td>
<td>( p_{2y}^{ii} = 1.00 )</td>
</tr>
</tbody>
</table>

|  |  |  |
|  |  |  |
| \( T_{x} = .10; T_{y} = 0; \text{No Producer Benefits} \) |  |  |
of government expenditures are distributed equally among producers and/or consumers. The pattern of comparative advantage would be affected, however, if the tax is general, but the benefits are not equally distributed. For example, suppose that only one industry receives the benefits, and both are taxed. The relative price of the commodity produced by the industry receiving the benefits would fall. The conclusions hold regardless of whether the origin or destination principle is used. The choice of principle does not alter the effect of the tax/benefit pattern on relative product prices.

Finally, suppose that a product tax is imposed on only one industry's output, and that only producers in the taxed industry receive benefits from government expenditures. The situation is illustrated in Table 3.6. If the destination principle is employed, the relative price of the taxed commodity rises. If the origin principle is adopted, relative prices remain unchanged. Similarly, if consumers of only the taxed commodity receive the benefits, then the destination principle is appropriate.

Thus, knowledge only of who receives the benefits reveals little about the choice between the origin and the destination principles. Knowledge of both the pattern of taxes and benefits is required. So long as the tax and the benefits are not distributed in the same manner, relative product prices and trading patterns are altered regardless of the principle employed. If they are distributed similarly, then the choice of principle does depend on whether producers or consumers receive the benefits. Thus, it is the distribution of the benefits
and the tax which is significant. Consequently, from the effects on comparative advantage, it cannot be said that the origin principle is appropriate if producers receive the benefits, or that the destination principle is appropriate if consumers receive the benefits. Indeed, in many instances neither principle would neutralize the effects of the taxation policy and the benefit distribution on relative price and real economic variables.

### TABLE 3.6

EFFICIENCY ASPECTS OF UNEQUAL GOVERNMENT TAXATION AND EXPENDITURE BENEFITS

<table>
<thead>
<tr>
<th></th>
<th>Before Tax/Benefits</th>
<th>Cum Tax Prices</th>
<th>Cum Tax/Benefit Prices</th>
<th>Destination Principle</th>
<th>Origin Principle</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( p^i_X = p^{li}_X = 1.00 )</td>
<td>( p^i_Y = 1.00 )</td>
<td>( p^i_X = 1.00 )</td>
<td>( p^{li}_X = .90 )</td>
<td>( p^{li}_X = 1.00 )</td>
</tr>
<tr>
<td></td>
<td>( p^2_X = p^{2i}_X = 1.00 )</td>
<td>( p^2_Y = 1.00 )</td>
<td>( p^2_X = 1.00 )</td>
<td>( p^{2i}_X = 1.10 )</td>
<td>( p^{2i}_X = 1.00 )</td>
</tr>
<tr>
<td></td>
<td>( p^1_X = 1.10 )</td>
<td></td>
<td>( p^1_X = 1.00 )</td>
<td></td>
<td>( p^{1i}_X = 1.00 )</td>
</tr>
<tr>
<td></td>
<td>( p^2_Y = 1.00 )</td>
<td></td>
<td>( p^2_Y = 1.00 )</td>
<td></td>
<td>( p^{2i}_Y = 1.00 )</td>
</tr>
</tbody>
</table>
3.5 Criteria for Evaluation

Chapter I noted that this study would analyze domestic product and factor tax systems, the GATT provisions for their international treatment, and proposed changes in both with primary regard for their efficiency implications. Chapter II noted that the GATT provisions were not written with regard to tax systems, but rather with regard to selective excise taxes. The provisions were primarily designed to prohibit the use of domestic taxes for protective purposes, not to permit border tax adjustments for reasons of either balance of payments or tax harmonization. This means that there exist no internationally accepted regulations intended for the treatment of domestic tax systems in international transactions.

The present chapter's discussion of pertinent concepts from both public finance and international economics noted the similarity between many of these concepts. The role of tax induced changes in absolute prices in tax incidence theory is similar to short run trade balances in international trade. The importance of relative price changes in taxation theory is similar, however, to changes in comparative advantage. Similarly, the concepts of tax incidence and shifting find an analogy in the terms of trade effect of international trade theory. A truly neutral tax is one which does not disturb relative product and factor prices in a closed economy setting and, hence, does not alter comparative advantage in an open economy setting.

Tax induced changes in relative product and factor prices are fundamentally different from absolute price changes in that they cannot be offset by monetary adjustment. In a domestic setting, they
cannot be neutralized by changes in domestic monetary policy. In an international setting, even perfect working of the classical international monetary adjustment mechanism cannot reverse tax-induced changes in relative prices. Yet, it is these relative price changes which determine the effects of taxes on allocative efficiency and comparative advantage. They may have effects on the real economy which cannot be reversed unless the inducing tax policy is changed.

It seems proper, therefore, that domestic tax systems, the rules for their international treatment, and the proposed changes in both be evaluated, not with regard to their short run effects on the balance of payments, but rather with regard to their long run implications for allocative efficiency. Ideally, domestic taxes systems and their international treatment should not interfere with either world or national efficiency. They should be neutral with respect to real production, consumption, and trade patterns.

For an individual, closed, competitive economy neutral tax systems maximize welfare for any given income distribution. They avoid losses arising from excess burden. Much the same can be said of national tax systems in international settings. It is possible, however, that an individual nation might employ a tax system which reduces both domestic and world efficiency but still incurs a gain for itself. Whether the taxing nation gains or losses from the

---

imposition of a nonneutral tax varies with the circumstances of the case. The use of such a tax in an otherwise distortion-free world, however, would lead invariably to a reduction in total world welfare. To whatever extent the taxing nation gains, the losses of the rest of the world are increased. Pareto Optimality in the international economy would be reached (given national income distributions) only when it is not possible to make one nation better off without making another nation worse off. In the absence of other distortions, this implies that all nations must be using neutral tax structures. For this point of view, tax systems should be neutral in both domestic and world economies.

The choice between world and national welfare is unambiguous when considering multilateral agreements such as the GATT. The objective should be to promote world efficiency. One country should not be permitted to gain at the expense of all or most others by international agreement. To whatever extent an individual nation does not employ a neutral tax system, the GATT provisions should be designed to neutralize, if possible, the international effects of national tax structures. Tax induced distortions should be quarantined to the taxing nation. This approach would have the additional effect of forcing the taxing nation to bear the entire burden of its taxes. It could not increase its own efficiency at the expense of other nations. Thus, there would be an additional incentive for nations do adopt neutral tax systems in order to reduce their own excess burden.

To summarize, domestic tax systems should be patterned to maximize domestic and, therefore, world efficiency. The burden of taxation
would be minimized. The GATT provisions should be designed to neutralize international distortions of national tax systems. The burden would be quarantined. Changes in these policies should be structured to achieve these objectives. Such policies and policy changes would tend to optimize production and consumption patterns in both domestic and international economies. The pattern of trade would be optimized.

Rejected is the possible use of domestic tax policy to maximize domestic welfare at the expense of other nations. There is no scope for an optimum tariff or "optimum tax" in these criteria. Rejected also is the notion that fundamental changes in national tax structures or the rules for their international treatment should be based on short run balance of trade or balance of payments effects.  

Clearly, this criterion is more stringent that most which have been used. Some writers have concluded that use of tax policy for balance of payments considerations is acceptable to the extent that it does not interfere with internal tax policy objectives, such as equity, growth, stabilization, or expenditure benefits.  

---

41The analyses which follow disregard tax-induced distortions in the savings/consumption choice and the labor/leisure choice. While admittedly unfortunate, this omission is permitted for the sake of simplicity in already complicated analyses.

The problems of second-best considerations are also generally ignored. There is one possible interpretation of the analyses for these problems, however. If one tax change would introduce distortions into an otherwise distortion-free economy, then elimination of the tax would presumably remove the distortion. Thus, to replace an existing distortion creating tax with a different, neutral tax should return the economy to Pareto Optimality, so long as only this single distortion existed.

deliberate use of domestic tax policy is acceptable in accordance with this criterion only if the primary purpose of the tax change is to promote tax neutrality. Improvements in the balance of trade would be merely coincidental. Another rejected argument is that, while in theory tax policy should be neutral with respect to trade policy, present GATT arrangements are not neutral, and a nonneutral change favoring the United States would rectify the distortion.\(^\text{43}\)

While these may be valid uses of domestic tax policy, they should be of secondary importance in international agreements. Consequently, they are not treated in this study.

The concepts and criteria are now developed. They bear a startling resemblance to the original intent of the GATT provisions. The next task is to develop an analytical framework with which to analyze the GATT rules and proposals for changing them.

CHAPTER IV
A General Equilibrium, Neoclassical Model of Production, Consumption, Taxes, and Trade

4.1 Introduction

This chapter develops a general equilibrium, linear, neoclassical model of the production, consumption, and trading relationships of two countries. The model provides a theoretical framework for a uniform analysis of various domestic tax systems in an international setting. The model is used to evaluate the present GATT rules governing the international treatment of domestic tax systems and some recently proposed changes in the rules and tax systems. In particular, it is used to ascertain the effects of changes in tax policies on the allocation of productive factors within each country and the terms of trade between the two countries. The model includes both product and factor taxes. ¹

¹To my knowledge there have been few attempts to analyze rigorously the effects of factor taxes in an international setting. The case of general factor (and product) taxes with complete specialization is treated in Charles E. McLure, Jr., "The Inter-Regional Incidence of General Regional Taxes," Public Finance, XXIV (1969), 457-83. The present study extends the analysis to the case of partial taxes with incomplete specialization. Although the Neumark Report devotes some attention to direct or factor taxes, it is a far from rigorous analysis. No attention is devoted to the effects of applying border adjustments for factor taxes.

Product taxes have received only slightly more attention. When compared with the extensive treatment which tariffs have received, the lack of examination of both product and factor taxes is lamentable. Perhaps the major contribution to product taxation in international trade theory is James E. Meade, The Theory of International Economic Policy, Vol. II, Trade and Welfare, and the Mathematical Supplement. Another important contribution is Mundell, "The Pure Theory of International Trade."
The ability to examine factor taxes in the same theoretical framework with product taxes is perhaps the signal advantage of the model. In addition, the mathematical framework is in real terms, thus permitting examination of the effects of the imposition of factor taxes without presupposing the direction of change of absolute product or factor prices. Such presuppositions are both undesirable and unnecessarily restrictive, and they may be thought of as special cases of the model to be presented. The model isolates the effects of changes in taxation policy from the effects of any accompanying changes in either monetary policy or government expenditure policy.

Finally, the model can be used to isolate the effects of both general and nongeneral, but broadly based, taxes in general equilibrium terms. Since most of the present controversy clearly concern broadly based, if not entirely general, taxes, the model should provide more meaningful statements about their effects on international trade and economic efficiency. Conventional partial equilibrium analysis is useful for taxes which apply to only one or a few products, but it is not suitable for a study of broadly based, general taxes. Only general equilibrium analysis is valid in such cases.

---

2The intent is to avoid the usual comparisons of results under various assumptions about the effects of taxes on absolute prices. That is, what happens to the balance of trade or efficiency assuming that a profits tax is "shifted" forward in the form of higher product prices. See Lindholm, "National Tax Systems and the International Balance of Payments," and Leontiades, "The Logic of Border Taxes."
What should the model tell us? It should provide clear indications of some of the efficiency implications of various domestic tax systems and possible changes in them. Obviously, one should exercise great care in using the generalized results of simple theoretical models to derive policy implications. Nevertheless, with appropriate recognition of its limitations, the analysis does yield certain implications for current controversies over domestic tax systems, border tax adjustments, and suggested changes in the GATT.

4.2 The Model

This section develops a model describing production, demand, and trading relationships between two countries. The model is an adaption of one developed by Harberger. Since the underlying relationships might otherwise be obscure, they are first presented in considerable detail and then simplified to yield the desired form.

---

3 The model involves many of the familiar assumptions of international trade theory and is subject therefore to the objections which have been leveled at these assumptions. These assumptions, of course, impose no greater restrictions on the results of this model than are imposed on the bulk of international trade theory.

Consider a world with two countries (denoted always by superscripts 1 and 2) producing two goods X and Y under perfectly competitive conditions in all markets. Specialization in production is not complete so that each country produces and consumes some of each good before and after trade occurs, and before and after taxation changes alter the trade pattern which exists in the absence of tax changes. All production functions are assumed to be linear homogeneous. Some of each of two factors of production, capital (K) and labor (L), is used in the production of each good in each country. Total endowments of factors of production are assumed to be fixed in each country and, therefore, for the world. Both factors are freely mobile within each country but are completely immobile between countries. Assume also that all factors are fully employed at all times in each country.

There is no need to assume any of the conditions which give rise to either factor price equalization or to the Heckscher-Ohlin factor proportions theory (that is, different factor endowments), or the absence of factor intensity reversals. Although the model is not inconsistent with any of these propositions, they are unnecessary for present purposes. Instead, assume only that some condition has given rise to trade, that country 1 is the taxing nation, and that it participates in world markets as an exporter of good X and an importer of good Y, which is country 2's export. Assume that before any change in taxation occurs, the two economies are in equilibrium. Trade is balanced in real and monetary terms. The exchange rate is an equilibrium rate. Also assume that the exchange rate remains fixed after any tax change. This allows all absolute prices
in the model to be expressed in terms of only one currency, which may for convenience be that of the taxing nation. Let quantities of goods and factors be defined so that all prices of goods and returns to factors are initially one.\(^5\) All prices are assumed to be fully flexible.

As a matter of notation let consumption of X and Y be represented by capital letters. Production of the two goods is represented by lower case letters x and y.\(^6\) The amount of a factor used in production is denoted by K or L with a lower case subscript to indicate the good produced and a superscript to indicate the country of production. For example, \(K^1_x\) represents the amount of capital used in the production of good X in the country 1. The letter P, with subscripts to indicate the good or factor, and superscripts to indicate the country,

---

\(^5\)In the absence of factor price equalization and international factor mobility, one unit of a factor need not be the same in corresponding uses in the two countries. That is, one unit of labor used in the production of good X in country 1 would not necessarily be the same quantity as one unit of labor used in production of X in country 2. For example, if the (wage rate) price of labor is (in terms of 1's currency) $2 in 1 and $1 in 2, then one unit of labor in 1 is 1/2 of a unit of labor in 2. This is of no concern with international factor immobility since the two quantities will not need to be compared. It is possible, of course, that the prices are absolutely equal and, therefore, the units also. If factor price equalization had occurred, the physical units would obviously be equal. This implies that production functions and/or factors of production need not be identical between countries—both conditions of factor price equalization. Since prices of goods are assumed to be equal between countries before any tax change, it is obvious that one unit of a good is the same in either country.

\(^6\)The use of upper and lower case letters to distinguish between production and consumption is restricted to the mathematical model. In the remainder of the text, capital letters will be used to indicate the two goods without any distinction between production and consumption implied.
represents prices. The letter T represents taxes per unit indicated by subscripts in the country indicated by the superscript.

The assumption of full price flexibility, full employment of factors in their country of residence, and homogeneous production functions imply that real income produced within each country varies only with the terms of trade. Since there are no stocks of assets fixed in money terms or savings in the model, aggregate real income available to be spent by consumer groups within each country in the absence of taxation varies only with the terms of trade.

The direct effects of taxation changes on consumer demand must be considered. The imposition of a new tax means that income of consumers is reduced, their demand is restricted, and thereby resources are released for the government's use. The ultimate reaction of prices will depend on how the government spends its tax revenue. If the government's expenditure pattern differs from that of the taxed consumer groups, then relative product prices will change because of the differences in expenditure patterns. This is a problem of income distribution between the government and all other consuming groups. There is another aspect. The tax may also alter the distribution between all nongovernment consumer groups (in this model, capitalists and laborers).

Since our primary concern is the effects of one tax as contrasted with that of another tax with other policies remaining the

---

7 For factors of production the variable P actually represents the earnings of the factors—wages of labor and the return (interest and economic profits) of capital.

8 For example, see Jaroslav Vanek, International Trade: Theory and Economic Policy, Chapter 14.
same, it is desirable to eliminate effects arising directly from tax re-
duced (and redistributed) disposable incomes and differences in expendi-
ture patterns. These may be avoided in several ways. Assuming that a
balanced budget approach is adopted, one may assume that the government
has the same expenditure pattern as does the private sector and, in
addition, pays the tax on any purchases. One also needs to assume that
any tax-induced redistribution of disposable income among private con-
sumers does not alter their overall pattern of demand. This approach,
however, leaves unanswered the question of who receives the benefits of
additional government expenditures.

An alternative solution is to assume that one tax is substituted
for another tax of equal yield and that the pattern of government expendi-
tures does not change with the substitution. This approach is superior
in that it avoids the problem of benefits from government expenditures.
The assumption that income redistribution among nongovernment consuming
groups will not alter the overall pattern of demand is still convenient.9

---

9This is similar to the problem and solution considered by Mundell,
"The Pure Theory of International Trade." In Mundell's analysis, the
imposition of a tax is coupled with an income subsidy to consumers. The
subsidy may be thought of as augmenting the incomes of all nongovernment
consumer groups. A tax substitution involves a similar effect. For
example, suppose that tax A is replaced with tax B. The incomes of those
who originally bore the burden of tax A will be augmented by its removal.
This group may or may not be the same as the group which bears the burden
of tax B. If the two groups are not the same, and if their expenditure
patterns at the margin differ, then the effects of different expenditure
patterns would be mixed with the effects of different taxes. The assump-
tion that the overall expenditure pattern is not altered by any tax-
induced redistribution of disposable income eliminates the former effect
and leaves only the effect of the tax per se. In this model, as in
Mundell's, this implies that demand elasticities are income compensated.
See also discussions in Lloyd A. Metzler, "Tariffs, the Terms of Trade,
and the Distribution of National Income," Journal of Political Economy,
LVII (February, 1949), 1-29, Mieszkowski, "On the Theory of Incidence," and
Charles E. McLure, Jr., "The Theory of Tax Incidence with Imperfect Factor
Mobility," Finanzarchiv, forthcoming.
The quantity demanded of goods may now be expressed as a function of relative product prices. Thus,

\[ \frac{dX^1}{X^1} = -E^1_X \frac{d\left[ \frac{P^1_X}{P^1_Y} \right]}{P^1_X/P^1_Y} = -E^1_X(dP^1_X - dP^1_Y); \]

\[ \frac{dY^1}{Y^1} = -E^1_Y \frac{d\left[ \frac{P^1_X}{P^1_Y} \right]}{P^1_Y/P^1_X} = -E^1_Y(dP^1_Y - dP^1_X); \]

\[ \frac{dX^2}{X^2} = -E^2_X \frac{d\left[ \frac{P^2_X}{P^2_Y} \right]}{P^2_X/P^2_Y} = -E^2_X(dP^2_X - dP^2_Y); \]

\[ \frac{dY^2}{Y^2} = -E^2_Y \frac{d\left[ \frac{P^2_Y}{P^2_X} \right]}{P^2_Y/P^2_X} = -E^2_Y(dP^2_Y - dP^2_X); \]

where \( E^1_X \) is country 1's income compensated elasticity of demand for \( X \) with respect to the price of \( X \) in terms of \( Y \) (\( E^1_X, E^2_X, E^1_Y, E^2_Y > 0 \)).

Since production functions are linear homogeneous, they may be represented as

\[ \frac{dx^1}{x^1} = f^1_K \frac{dk^1_X}{k^1_X} + f^1_L \frac{dL^1_X}{L^1_X}; \]

\[ \frac{dy^1}{y^1} = f^1_K \frac{dk^1_Y}{k^1_Y} + g^1_L \frac{dL^1_Y}{L^1_Y}; \]
\[ \frac{d\bar{K}}{\bar{x}} = f^2_K \frac{dK^2}{K^2_x} + f^2_L \frac{dL^2}{L^2_x}; \]

\[ \frac{d\bar{Y}}{\bar{y}} = g^2_K \frac{dK^2}{K^2_y} + g^2_L \frac{dL^2}{L^2_y}; \]

where \( f \)'s and \( g \)'s with appropriate subscripts represent the initial shares of labor and capital in production of goods \( X \) and \( Y \), respectively. Thus, \( f^1_L \) is the initial share of labor in production of \( X \) in country \( 1 \).

The relationship between factor and product prices for each industry may be derived from the assumptions of homogeneous production functions and of competition. These two assumptions assure that together factor payments and tax bills will exhaust total receipts in each industry.

\[ dp^1_X = \left( dp^1_L + T^1_{Lx}\right) f^1_L + \left( dp^1_K + T^1_{Kx}\right) f^1_K + T^1_x; \]

\[ dp^1_Y = \left( dp^1_L + T^1_{Ly}\right) g^1_L + \left( dp^1_K + T^1_{Ky}\right) g^1_K + T^1_y; \]

\[ dp^2_X = \left( dp^2_L + T^2_{Lx}\right) f^2_L + \left( dp^2_K + T^2_{Kx}\right) f^2_K + T^2_x; \]

\[ dp^2_Y = \left( dp^2_L + T^2_{Ly}\right) g^2_L + \left( dp^2_K + T^2_{Ky}\right) g^2_K + T^2_y. \]

Due to the assumption of constant returns to scale and competition, the percentage change in factor proportions will equal the elasticity of substitution times the percentage in the relative prices of the factors employed, that is,

\[ \frac{d(K^i_j/L^i_j)}{K^i_j/L^i_j} = -s_j \frac{dp^i_j/P^i_j}{p^i_j/P^i_L}. \]
For each industry we have,

\begin{equation}
\frac{dK_x^1}{K_x^1} - \frac{dL_x^1}{L_x^1} = -S_x^1 \left( dP^1_K + T^1_{Kx} - dP^1_L - T^1_{Lx} \right);
\end{equation}

\begin{equation}
\frac{dK_y^1}{K_y^1} - \frac{dL_y^1}{L_y^1} = -S_y^1 \left( dP^1_K + T^1_{Ky} - dP^1_L - T^1_{Ly} \right);
\end{equation}

\begin{equation}
\frac{dK_x^2}{K_x^2} - \frac{dL_x^2}{L_x^2} = -S_x^2 \left( dP^2_K + T^2_{Kx} - dP^2_L - T^2_{Lx} \right);
\end{equation}

\begin{equation}
\frac{dK_y^2}{K_y^2} - \frac{dL_y^2}{L_y^2} = -S_y^2 \left( dP^2_K + T^2_{Ky} - dP^2_L - T^2_{Ly} \right).
\end{equation}

and

\begin{equation}
\frac{dK_x^2}{K_x^2} + \frac{dK_y^2}{K_y^2} = 0;
\end{equation}

\begin{equation}
\frac{dL_x^1}{L_x^1} + \frac{dL_y^1}{L_y^1} = 0;
\end{equation}

\begin{equation}
\frac{dK_x^2}{K_x^2} + \frac{dK_y^2}{K_y^2} = 0;
\end{equation}

\begin{equation}
\frac{dL_x^2}{L_x^2} + \frac{dL_y^2}{L_y^2} = 0.
\end{equation}

Equations (4.13) – (4.16) are defined so that $S^i_j$ ($i = 1, 2; j = x, y$) is positive.

The assumption of fixed factor supplies within each nation is described by the following four equations:

\begin{equation}
\frac{dK_x^1}{K_x^1} + \frac{dK_y^1}{K_y^1} = 0;
\end{equation}

\begin{equation}
\frac{dL_x^1}{L_x^1} + \frac{dL_y^1}{L_y^1} = 0;
\end{equation}

\begin{equation}
\frac{dK_x^2}{K_x^2} + \frac{dK_y^2}{K_y^2} = 0;
\end{equation}

\begin{equation}
\frac{dL_x^2}{L_x^2} + \frac{dL_y^2}{L_y^2} = 0.
\end{equation}

There are now twenty equations in twenty-four unknowns. The system to this point is similar to a more conventional general equilibrium system. That is, equations (4.1) – (4.4) give the demand relationships. Also, equations (4.5) – (4.20) together may be thought of as four supply relationships which have been expressed in greater detail.
The assumption of equilibrium and no savings requires that the amounts demanded and supplied must be equal. That is,

\[ x^1 + x^2 = x^1 + x^2. \]

Thus, the condition of equilibrium is

\[ (4.21) \quad dx^1 + dx^2 = dx^1 + dx^2. \]

This condition, along with the equality of income produced and expended within each nation, implies that the remaining market for \( Y \) is cleared and that product trade is always balanced.

With trade, product prices will be equalized between nations. Relationships are also required to describe these conditions. When product taxes are employed, the condition will vary depending on whether the origin or destination principle is applied to taxes on traded goods. The destination principle requires that in equilibrium net prices to producers be equal; prices to consumers differ by any product tax differential. The origin principle requires in equilibrium that gross product prices be equal. Producers absorb any tax differential.

The analysis of border adjustments should not be restricted to product taxes. We need to allow for proposed rebates for domestic profits taxes, and border taxes on imports to compensate for domestic profits taxes.\(^{10}\)

\(^{10}\)As developed in this chapter, the model depicts the most prevalent proposals for border adjustments for capital taxes. The model, and especially equations (4.13) - (4.16), do not reflect a more recent proposal that adjustments be made to the return to capital rather than the prices of products. The model will be modified in Chapter VI to analyze this proposal.
The various possible combinations of border taxes and rebates can be described by introducing appropriate adjustment parameters. Suppose that $B^1 > 0$ represents the rate of compensation for product taxes levied on exportables in country 1. That is, if a total tax of one dollar is imposed on one unit of country 1's exportable, but the rebate granted on exports is only sixty cents per unit, then $B^1 = .6$. Using superscripts to indicate the adjusting nation, the parameters are

- $\alpha^i = \text{rate of compensation for tax on } Y$;
- $\beta^i = \text{rate of compensation for tax on } X$;
- $\theta^i = \text{rate of compensation for tax on capital used in production of } Y$;
- $\lambda^i = \text{rate of compensation for tax on capital used in production of } X$.

The equilibrium conditions for prices are, therefore

\begin{equation}
(4.22) \quad dP_x^2 - \beta^2 T_x^2 - \lambda^2 T_{Xx}^2 = dP_x^1 - \beta^1 T_x^1 - \lambda^1 T_{Xx}^1,
\end{equation}

and

\begin{equation}
(4.23) \quad dP_y^2 - \alpha^2 T_y^2 - \theta^2 T_{Ky}^2 = dP_y^1 - \alpha^1 T_y^1 - \theta^1 T_{Ky}^1.
\end{equation}

The system is still underdetermined. There are only 23 equations in 24 unknowns. There is no relationship to set the absolute level of prices. A numeraire is required. Recalling that all prices are expressed in terms of country 1's currency, the level of prices may be determined by the monetary conditions prevailing in that country. Assume that

\begin{equation}
(4.24) \quad dP_L^1 (L_x^1 + L_y^1) + dP_K^1 (K_x^1 + K_y^1) = dH^1 v^1.
\end{equation}
Equation (4.24) depicts an assumption that total factor payments, net of taxes, equals the money supply in 1, $M^1$, times the constant income velocity of money in 1, $v^1$.\(^{11}\)

4.3 The Model Simplified

The system has 24 independent equations and 24 unknowns. A solution is possible. However, it is obvious that an attempt to solve the system in its present form would be extremely cumbersome and probably would yield ambiguous results. It has been developed thoroughly so that an alternative approach may be clearly understood and employed. This full exposition can now be reexpressed entirely in terms of relative prices to provide the alternative and more manageable system.

The change in relative product prices is

$$\frac{d}{P_y} \begin{bmatrix} P_x \\ P_y \end{bmatrix} = \frac{dP_x P_y - dP_y P_x}{P_y^2} = (dP_x - dP_y).$$

But the change in relative product prices is merely the change in the terms of trade if one is considering international prices. Since this analysis is primarily interested in tax-induced changes from the point of view of country 1, we must consider relative international prices (that is, country 2's prices) inclusive of any border tax adjustments in country 2. Letting $t$ denote relative international prices we have

\(^{11}\)No importance should be attached to this particular monetary specification. Equation (4.24) is used solely for illustration and will be discarded when the system is reexpressed in relative prices. There is no intention nor requirement that money be assigned the dichotomized role implied by equation (4.24). A similar problem is encountered by McIure, "Tax Incidence, Macroeconomic Policy, and Absolute Prices," in a closed economy. McIure's solution is essentially the same as the use of equation (4.24) in the present model.
\[ t = \frac{\beta^2 T_x^2 - \lambda^2 T_{Kx}^2}{\frac{p^2_y}{p^2_x}} \],\text{12}

and

\[ dt = \left( dP^2_x - \beta^2 T_x^2 - \lambda^2 T_{Kx}^2 \right) - \left( dP^2_y - \alpha^2 T_y^2 - \theta^2 T_{Ky}^2 \right), \]

\[ = dP^2_x - dP^2_y - \beta^2 T_x^2 + \alpha^2 T_y^2 - \lambda^2 T_{Kx}^2 + \theta^2 T_{Ky}^2. \]

As defined, \( t \) is the ratio of the quantity of \( l \)'s imports received per unit of exports given up. Thus, \( t \) represents the price of \( X \) in terms of \( Y \). From the point of view of country \( l \), an improvement in the terms of trade would be represented by an increase in this ratio. That is, if the ratio increases, then more imports are received per unit of exports. Thus, when \( dt > 0 \), country \( l \)'s terms of trade have improved.

Similarly, let the changes in relative factor prices in countries \( l \) and \( 2 \) be denoted by two new variables, \( dR^1 \) and \( dR^2 \), respectively. Let

\[ dR^1 = d\left[ \begin{array}{c} \frac{p^1_K}{p^1_L} \\ \frac{p^1_K}{p^1_L} \end{array} \right] = dP^1_K - dP^1_L, \]

and

\[ dR^2 = d\left[ \begin{array}{c} \frac{p^2_K}{p^2_L} \\ \frac{p^2_K}{p^2_L} \end{array} \right] = dP^2_K - dP^2_L. \]

\text{12If there were taxes initially in the system, then this equation would be written as}

\[ t = \frac{p^2_x - \beta^2 T_x^2 - \lambda^2 T_{Kx}^2}{p^2_y - \alpha^2 T_y^2 - \theta^2 T_{Ky}^2}. \]
These two expressions for relative factor price changes, along with $dt$, may be used to rewrite the system in terms of relative prices.

With proper substitutions of $dt$, $dR^1$, and $dR^2$ equations \((4.9)\) through \((4.12)\) may be rewritten as two equations

\[
dt = dR^1(\epsilon^1_L - f^1_L) + T^1_x(1 - \beta^1) - T^1_y(1 - \alpha^1) + T^1_{Lx}f^1_L - T^1_{Ly}\theta^1_L + T^1_K(f^1_K - \lambda^1) - T^1_Ky(\epsilon^1_K - \theta^1)
\]

and

\[
dt = dR^2(\epsilon^2_L - f^2_L) + T^2_x(1 - \beta^2) - T^2_y(1 - \alpha^2) + T^2_{Lx}f^2_L - T^2_{Ly}\theta^2_L + T^2_K(f^2_K - \lambda^2) - T^2_Ky(\epsilon^2_K - \theta^2).
\]

Since these two equations contain considerable economic meaning, a heuristic explanation may be useful. The equations show that any tax change may be absorbed by either a change in relative factor prices or in relative product prices (the terms of trade), or by some combination of the two in the taxing nation. To whatever extent a tax change in one country results in a change in the terms of trade, the equations imply that it must also be partially absorbed by relative factor prices or tax changes in the other country. These relationships exist because it is assumed that in equilibrium international product prices are equalized—relatively and absolutely in the absence of taxes.

In the relative price system demand relationships are completely specified by equations in only $X^1$ and $X^2$.\(^1\)\(^3\) Similarly, production

\(^1\)Demand relationships for $Y^1$ and $Y^2$ are not required. Under our assumptions, the demand functions for $X^1$ and $X^2$ are sufficient to determine the residual demands for $Y^1$ and $Y^2$. This procedure avoids the complexity of including two additional equations in two additional unknowns.
relations may be completely specified by two supply equations for good X, four factor substitution, and four factor supply equations. The factor substitution equations are merely the same equations as previously, but reexpressed in terms of relative prices. The two goods supply equations and four factor supply equations are unchanged. The previous equations describing equilibrium of absolute prices (4.22) and (4.23) are no longer required in the relative price system. These conditions are implicit in the definition of the terms of trade. One market clearing equation is still required.

Since the system is expressed entirely in relative prices, the monetary specification equation (4.24) is no longer required to set the level of absolute prices. One may instead assume that the monetary specification, whatever its form, does not change with taxation changes. Thus, the same monetary policy applies to all tax policies.

---

14As a result of the assumptions of international immobility and internal mobility and full employment of factors of production, and the assumption that prices are initially one, in each country dx = -dy. Thus, only one supply equation is needed for each country.

The use of only one supply and one demand equation in each nation means that the model is confined to movements along the taxing nation's transformation curve. Thus, the model does not include possible losses of real income (representing an inward shift of the transformation curve) which could result from factor market distortions induced by a partial factor tax. These distortions are examined in Harry G. Johnson, "Factor Market Distortions and the Shape of the Transformation Curve," Econometrica, XXXIV (July, 1966), 686-698. Johnson finds that these losses are likely to be small even for large distortions. Since the model describes only first order approximations, the distortions do not appear. See also Harry G. Johnson and Peter Mieszkowski, "The Effects of Unionization on the Distribution of Income: A General Equilibrium Approach," Quarterly Journal of Economics, LXXXIV (November, 1970), 539-561.
The entire system in terms of relative prices becomes,

\[\frac{dX_1}{X_1} = -\varepsilon_1 \left[ dt + \beta_1 T_{1x} - \alpha_1 T_{1y} + \lambda_1 T_{1Kx} - \theta_1 T_{1Ky} \right] ;\]

\[\frac{dX_2}{X_2} = -\varepsilon_2 \left[ dt + \beta_2 T_{2x} - \alpha_2 T_{2y} + \lambda_2 T_{2Kx} - \theta_2 T_{2Ky} \right] ;\]

\[\frac{dL_1}{L_1} = f_1 K_1^L \frac{dK_1}{K_1^L} + f_1 L_1^L \frac{dL_1}{L_1^L} ;\]

\[\frac{dL_2}{L_2} = f_2 K_2^L \frac{dK_2}{K_2^L} + f_2 L_2^L \frac{dL_2}{L_2^L} ;\]

\[dt = dR_1 (g_1^L - f_1^L) + T_{1x}^1 (1 - \beta_1) - T_{1y}^1 (1 - \alpha_1) + T_{1Kx}^1 (f_1^L - \lambda_1) - T_{1Ky}^1 (g_1^K - \theta_1) + T_{1Lx}^1 f_1^L - T_{1Ly}^1 g_1^L ;\]

\[dt = dR_2 (g_2^L - f_2^L) + T_{2x}^2 (1 - \beta_2) - T_{2y}^2 (1 - \alpha_2) + T_{2Kx}^2 (f_2^L - \lambda_2) - T_{2Ky}^2 (g_2^K - \theta_2) + T_{2Lx}^2 f_2^L - T_{2Ly}^2 g_2^L ;\]

\[\frac{dK_1}{K_1^L} - \frac{dL_1}{L_1^L} = -s_1^x (dR_1 + T_{1Kx}^1 - T_{1Lx}^1) ;\]

\[\frac{dK_1}{K_1^L} - \frac{dL_1}{L_1^L} = -s_1^y (dR_1 + T_{1Ky}^1 - T_{1Ly}^1) ;\]

\[\frac{dK_2}{K_2^L} - \frac{dL_2}{L_2^L} = -s_2^x (dR_2 + T_{2Kx}^2 - T_{2Lx}^2) ;\]

\[\frac{dK_2}{K_2^L} - \frac{dL_2}{L_2^L} = -s_2^y (dR_2 + T_{2Ky}^2 - T_{2Ly}^2) ;\]
(4.11a) \[ dK_x^1 + dL_y^1 = 0; \]
(4.12a) \[ dL_x^1 + dL_y^1 = 0; \]
(4.13a) \[ dK_x^2 + dK_y^2 = 0; \]
(4.14a) \[ dL_x^2 + dL_y^2 = 0; \]
(4.15a) \[ dx^1 + dx^2 = dx^1 + dx^2. \]

The fifteen equations may be reduced by appropriate substitution to seven equations in seven unknowns.

Substitution of (4.1a), (4.2a), (4.3a), and (4.4a) into (4.15a) yields

\[
dt(\lambda^1_{\bar{E}} + \lambda^2_{\bar{E}}) + dK_x^1 + dK_y^2 + dL_x^1 + dL_y^2 = \\
-\lambda^1_{\bar{E}} \left[ \lambda^1_{\bar{T}} - \lambda^1_{\bar{\lambda}} + \lambda^1_{\bar{\lambda}} - \lambda^1_{\bar{T}} \right] - \lambda^2_{\bar{E}} \left[ \lambda^2_{\bar{T}} - \lambda^2_{\bar{T}} \right] + \lambda^2_{\bar{T}} - \lambda^2_{\bar{T}} - \lambda^2_{\bar{T}} - \lambda^2_{\bar{T}}.
\]

Leaving (4.7a) and (4.9a) unchanged while substituting (4.11a) and (4.12a) into (4.8a), and (4.13a) and (4.14a) into (4.10a) gives

\[
\frac{dK_x^1}{K_x^1} - \frac{dL_y^1}{L_y^1} = -\lambda^1_{\bar{E}} (T_{\bar{K}} - T_{\bar{L}}); \\
- \frac{dK_x^1}{K_x^1} + \frac{dL_y^1}{L_y^1} = -\lambda^1_{\bar{E}} (T_{\bar{K}} - T_{\bar{L}}); \\
\frac{dK_x^2}{K_x^2} - \frac{dL_y^2}{L_y^2} = -\lambda^2_{\bar{E}} (T_{\bar{K}} - T_{\bar{L}}); \\
\frac{dK_x^2}{K_x^2} + \frac{dL_y^2}{L_y^2} = -\lambda^2_{\bar{E}} (T_{\bar{K}} - T_{\bar{L}}).
\]
\[- \frac{dK_X^2}{K_Y^2} + \frac{dL_X^2}{L_Y^2} + S_Y^2 dR^2 = - S_Y^2 (T_{K_Y}^2 - T_{L_Y}^2) .\]

These five equations along with equations (4.5a) and (4.6a) contain seven unknowns—\(dK_X^1, dL_X^1, dK_X^2, dL_X^2, dR^1, dR^2\), and \(dt\). The entire system may be expressed as seven by seven matrix system of the form

\[[D] \ [d] = [T],\]

and then solved for any tax-induced change in the values of these seven unknowns.

The matrix \([D]\) is a seventh order array of the coefficients of the seven equations. Vector \([d]\) is a column vector (1 x 7) of the seven unknowns. Vector \([T]\) is a column vector (1 x 7) of the exogenous tax changes. The full system is, therefore,
\[
\begin{bmatrix}
+1 & +1 & +1 & +1 & 0 & 0 & (x_1^1E^1_x + x_2^2E^2_x) \\
- \frac{1}{L_x^2} & + \frac{1}{K_x^2} & 0 & 0 & + S_x^2 & 0 & 0 \\
+ \frac{1}{L_y^2} & - \frac{1}{K_y^2} & 0 & 0 & + S_y^2 & 0 & 0 \\
0 & 0 & - \frac{1}{L_x^2} & + \frac{1}{K_x^2} & 0 & + S_x^1 & 0 \\
0 & 0 & + \frac{1}{L_y^2} & - \frac{1}{K_y^2} & 0 & + S_y^1 & 0 \\
0 & 0 & 0 & 0 & (f_L^2 - g_L^2) & 0 & +1 \\
0 & 0 & 0 & 0 & (f_L^1 - g_L^1) & +1 & 0 \\
\end{bmatrix} \times
\begin{bmatrix}
dL_x^2 \\
dK_x^2 \\
dL_y^2 \\
dK_y^2 \\
dR^2 \\
dR^1 \\
dt \\
\end{bmatrix}
\]

\[
-x_1^1E_x^1(\beta_1^1T_x^1 - \alpha_1^1T_y^1 + \lambda_1^1T_{Kx}^1 - \theta_1^1T_{Ky}^1) - x_2^2E_x^2(\beta_2^2T_x^2 - \alpha_2^2T_y^2 + \lambda_2^2T_{Kx}^2 - \theta_2^2T_{Ky}^2)
\]

\[
- S_x^2(T_{Kx}^2 - T_{Lx}^2)
\]

\[
- S_y^2(T_{Ky}^2 - T_{Ly}^2)
\]

\[
- S_x^1(T_{Kx}^1 - T_{Lx}^1)
\]

\[
- S_y^1(T_{Ky}^1 - T_{Ly}^1)
\]

\[
T_{Lx}^2(T_{Lx}^2 - T_{Lx}^2 + T_{Kx}^2(f_K^2 - \lambda^2) - T_{Ky}^2(g_K^2 - \theta^2) + T_x^2(1 - \beta^2) - T_y^2(1 - \alpha^2)
\]

\[
T_{Lx}^1(T_{Lx}^1 - T_{Lx}^1 + T_{Kx}^1(f_K^1 - \lambda^1) - T_{Ky}^1(g_K^1 - \theta^1) + T_x^1(1 - \beta^1) - T_y^1(1 - \alpha^1)
\]
The solution to the system is

\[ [d] = [D]^{-1}[T]. \]

The system is now in a form which can be employed to ascertain the effects of the various possible taxes or tax schemes on its dependent variables. By deleting all tax terms in the exogenous \([T]\) vector except those terms which depict the policy under investigation and then solving the system, one may analyze the effects of the policy on the seven endogenous variables of the reduced system.
CHAPTER V

The Analysis of Product Taxes

5.1 Introduction

The methodology of the analysis is first to ascertain one tax structure which meets the neutrality criteria. Then other tax structures are assumed to be substituted for it, and the effects of the change on both countries are determined. Obviously, if the change in structure is not neutral, then the alternative policy is not neutral. The analysis also points out the possibility of changes in taxation by the second country to offset the effects resulting from taxation changes in the first country. In each case, the results of the analysis are interpreted with regard to some of the proposed changes in the rules for international treatment of domestic taxes and in domestic tax systems themselves.

The determination of at least one neutral tax structure cannot employ differential analysis. This problem is best discussed in terms of balanced budget analysis, which raises the question of additional government expenditures and the benefits resulting from them. For expenditures, it was assumed that the government spends the tax proceeds in the same manner as would those who bear the burden of the tax. This avoids the problem of relative price changes arising from differences
between the spending patterns of the government and the private sector of the economy.¹

The question of who receives the benefits of government expenditures was discussed in Chapter III.² Either of two assumptions are available in order to avoid the distorting effects which may arise from the distribution of benefits from government expenditures. One may assume that government expenditures benefit no one. Alternatively, one may assume that government expenditures benefit everyone proportionately to their income. If consumption and benefits may be equated, the latter assumption is consistent with government provision of pure public goods.³ Although this observation may mean that the latter assumption is preferable from a methodological standpoint, in the context of this model an assumption of either proportional benefits or no benefits is appropriate.

Either is acceptable since they would result in either a proportional price level change or no change at all. Neither would affect relative prices, the allocation of factors of production, nor the pattern of consumption. Either together with the expenditure pattern

¹Obviously, this assumption ignores the implication that government expenditures are not used to purchase pure public goods. If one also assumes that the government hires factors in the same proportion that they exist in the economy, then this problem is circumvented.


assumption permits determination of neutral tax structures independent of effects arising from expenditure and benefit patterns. This might not be possible if it were assumed that the benefits are distributed in the same manner as the benefits from the foregone private expenditures would have been distributed. Unless the tax were borne equally by all members of the economy, such an assumption would also violate the usual requirement that public goods benefit all equally.

These assumptions permit the determination of a neutral tax structure which may be used as a benchmark. They are not required when tax substitutions are considered. Differential analysis may be employed. Assuming that they are invariant under tax substitutions, government expenditures and the benefits derived from them are not relevant.\textsuperscript{4}

The criteria developed for tax policies and changes in them may now be expressed more precisely in terms of the variables of the model. Recall the criteria for a desirable change in taxation. Neutral taxes are preferred to nonneutral taxes. Thus, changes in taxes should result in a neutral tax structure. The \textit{new tax structure} should therefore be such that, when the tax is imposed, it would affect neither relative product prices nor factor allocation. Consequently, neither the pattern of production nor the pattern of consumption in either economy would be affected by the new tax structure. Trading patterns would

\textsuperscript{4}It is analytically a matter of indifference which tax is replaced by the other. I shall assume that a neutral tax always serves as a benchmark and is replaced with some other tax.
not change. In terms of the variables of the model, this means that when the new tax is substituted into the exogenous [T] vector, solution of the system should yield
\[
\frac{dt}{x} = \frac{dx}{x} = \frac{dx}{x} = 0. \quad (i = 1, 2)^5
\]
Any substitution which yields a nonzero value for any of these five variables would not represent a neutral tax structure.

In each country, there are three product taxes—two partial taxes, \(T_x\) and \(T_y\), and a general tax on both products, which may be represented by \(T = T_x = T_y\). However, any of these may be levied under either the origin or the destination principle. Thus, the three tax terms along with the \(\alpha\) and \(\beta\) adjustment parameters represent a total of six possible tax structures. Finally, there are three other possibilities. If border adjustments are applied imperfectly (0 \(\leq\) \(\alpha\) \(\leq\) 1; 0 \(\leq\) \(\beta\) \(\leq\) 1), the resulting tax is neither an origin principle nor a destination principle tax, but rather some combination of the two. Thus, there are nine possible combinations which may be analyzed.

Fortunately, it is not necessary to analyze all of the cases. The combination of any two origin principle taxes is equivalent to the

---

5It might be argued that the condition \(dt = 0\) might not result in unchanged consumption patterns. Conceivably, this situation might arise when border adjustments are applied for taxes. For example, suppose that an adjustment \(\beta T_x\) is applied for \(T_x\). From equation (4.1a) consumption neutrality in country 1 would require that \(dt = -\beta T_x\). But this would alter production patterns in countries 1 and 2 and the consumption pattern in country 2 unless we also have \(\beta T_x = \beta T_x\). Thus, it is sufficient in this analysis to require only that \(dt = 0\). Note also that it is not required that \(dR_{x} = 0\) (i = 1 or 2) since relative factor prices might change without changing consumption or production patterns in either country.
third. The same is true for destination principle taxes and the taxes with imperfect border adjustment. This means that only six taxes need be analyzed. These may be summarized (from the point of view of country 1) as

Case Tax
(1) $T^1_X$ - partial tax on exportable--origin principle ($\beta^1 = 0$);
(2) $T^1_Y = T^1_X = T^1$ - general tax--origin principle ($\alpha^1 = \beta^1 = 0$);
(3) $T^1_X$ - partial tax on exportable--destination principle ($\beta^1 = 1$);
(4) $T^1_Y = T^1_X = T^1$ - general tax--destination principle ($\alpha^1 = \beta^1 = 1$);
(5) $T^1_X$ - tax on exportable--imperfect adjustment ($0 < \beta^1 \neq 1$);
(6) $T^1_Y = T^1_X = T^1$ - equal tax on importable and exportable--imperfect adjustment ($0 < \alpha^1 \neq 1; 0 < \beta^1 \neq 1$).\(^6\)

5.2 Neutral Product Taxes

Are any of the product taxes neutral in that they leave the dependent variables of the system unaffected? If the exogenous vector $[T]$ is a null vector after substitution of a particular tax or tax combination, there would be no change in any of the dependent variables. Cases (2) and (4) give this result. Thus, imposition of general product tax does not alter the terms of trade, nor any other dependent variable of the system. This result holds regardless of whether the tax is levied under the origin or destination principle. Case (6) will also result in a neutral tax structure, if and only if $\alpha^1 = \beta^1$. Thus,

\(^6\)Cases (1) - (4) are, of course, only special cases of the general cases (5) and (6).
the degree of border adjustment does not matter so long as it is equal for both products.\textsuperscript{7}

With the imposition of any of these taxes, the allocation of factors of production between the two industries remains unchanged in both countries. That is, \( \frac{dK_1}{K} = \frac{dK_2}{K} = \frac{dL_1}{L} = \frac{dL_2}{L} = 0 \). Thus, there is no change in the amounts of goods \( x \) or \( y \) produced in either country. Also, since \( dt = 0 \), \( T_x^1 = T_y^1 \), and \( \alpha^1 = \beta^1 \), there is no change in quantities demanded of \( X \) and \( Y \) in the two countries. This implies that trade between the two countries is not affected as a result of the imposition of these taxes.

What is the economic meaning of this result? The neutrality of general product taxes under either the origin or destination principle has often depended on the assumption that exchange rates are flexible. In the present model, the neutrality and equivalence obtains because of the flexibility of prices in both countries. A proportional movement of absolute prices in either country leaves relative prices unchanged within the country and acts as a substitute for flexible exchange rates between the currencies of the two countries.\textsuperscript{8}

\textsuperscript{7}This result has been documented previously in Shibata, "The Theory of Economic Unions: A Comparative Analysis of Customs Unions, Free Trade Areas, and Tax Unions," p. 203; Mundell, "The Pure Theory of International Trade," p. 29; and the Timbergen Report, p. 25. Although none of these note that the same result obtains for a general product tax with equal, but imperfect, adjustments for all products, the conclusion should not come as a surprise.

It is not possible to ascertain from the model whether the adjustment occurs in the absolute level of factor prices or the absolute level of product prices. Similarly, one cannot learn whether the adjustment occurs in the taxing or in the nontaxing nation. It may be in the form of higher product prices in the taxing country, lower factor prices in the taxing nation, higher product prices in the international economy, lower factor prices in the international economy, or (as seems most likely) in some combination of these. One can say only that the adjustment occurs in the form of proportional movements in absolute prices so that nothing is changed in real terms. None of the dependent variables of the model are affected.

With a completely general product tax this result should be no surprise. Since a general tax on all products is equivalent to a general tax on all factors used in the production of all goods, there should be no effect on the allocation of factors of production. The model uses the standard classical assumption that factors of production are not mobile between nations but are fully mobile within nations. Since factor prices are equalized initially between all uses at least within each country, any equal tax on all products will have proportional effects on factor earnings regardless of their use. Whatever the effect on the earnings of a unit of capital or labor, it will be the same in the production of good X as in the production of good Y. Thus, there will be no incentive for either factor to shift its employment to any other industry, nor any incentive for producers to substitute among factors.
The model reveals that three product tax structures meet the criteria of neutrality. From the model one cannot conclude that one is preferable to another. In this long run, static equilibrium context, all three are equivalent. Thus, any preference must be based on factors which are not present in the model. For example, absolutely rigid international product prices might result in one tax not being neutral.

5.3 Nonneutral Product Taxes

5.3.1 A Partial Tax on the Exportable - Origin Principle

The results of a change in policy for product taxes can now be ascertained and transcribed into the context of the policy controversies. We wish to determine the effects on the dependent variables of the system of a substitution between the nonneutral tax structures--cases (1), (3), (5), and (6)--and the neutral tax structures--cases (2), (4), and sometimes (6). To begin the study, consider the effects of a substitution between a partial origin principle tax on \( X \), case (1), and any of the neutral tax structures. It is not necessary to consider this (or the other partial taxes) as partial in the sense that

9Solutions of the model reveal that none of the other product taxes yield neutral tax structures except under extremely stringent assumptions concerning the values of the parameters of the system. Although the discussion has been carried out from the point of view of country 1's taxes, the same taxes in country 2 would also satisfy the neutrality criteria.

10The approach will be to substitute the nonneutral tax, for example, \( T_x \), into the \([T]\) vector and to compare it with a null \([T]\) vector.
it applies to only one good. Instead, one may consider it as a tax differential. For example, when referring to a partial tax on exportables, \( T_X \), it may also be thought of as a tax which for some reason falls more heavily on \( X \) production than on \( Y \) production. Two possible real world applications are obvious. In a multi-stage, cumulative, tax system, the less vertically integrated an industry, the more the effective tax will be. If the exportable industry were less vertically integrated than the importable industry, the effective tax on \( X \) would probably be greater than that on \( Y \). This would hold even if the tax were general in that it is levied on all turnovers of all goods at the same nominal rate. The second application may arise even under a value added system. In some cases, some industries are simply not taxed at the same rate as other industries. This is frequently true for agricultural and investment goods. To the extent that any such industry tended to be primarily an export or import-oriented industry, a partial tax in the model would apply.\(^{11}\)

The imposition of a partial tax on exportables in country 1 results in the following changes in the dependent variables.

\[
\begin{align*}
\text{dt} &= \frac{T_X^{1}}{Z(g_L^{1} - \ell_L^{1})} > 0 ;
\end{align*}
\]

\(^{11}\)The manufacturers' sales tax in Canada might represent this case if there does exist, as alleged, an element of tax occult in the product price, and if the production stage tax had been paid and a refund subsequently granted. Also, the manufacturing stage tax on specified goods levied in Japan might exemplify this tax to the extent that rebates do not cover component parts of the export. See also the discussion of Carl S. Shoup, "Experience with the Value-Added Tax in Denmark, and Prospects in Sweden," Finanzarchiv, XXVII (March, 1969), 226-52.
\[ dR^1 = T^1_x \left[ \frac{1 - Z(g_L^1 - f_L^1)}{Z(g_L^1 - f_L^1)(g_L^2 - f_L^2)} \right] ; \]
\[ dR^2 = \frac{T^1_x}{Z(g_L^1 - f_L^1)(g_L^2 - f_L^2)} ; \]
\[ dK_x^1 < 0 ; \]
\[ dL_x^1 < 0 ; \]
\[ dK_x^2 > 0 ; \]
\[ dL_x^2 > 0 . \]

As a result of the imposition of the tax, the terms of trade move in favor of the taxing nation, but by less than the amount of the tax since \( Z(g_L^1 - f_L^1) \) is greater than unity. Unlike the sign of \( dR_t \), which is unambiguous, the directions of change in relative factor earnings in the two countries, \( R^1 \) and \( R^2 \), depend solely on the relative factor intensity in the two nations. Since \( 1 - Z(g_L^1 - f_L^1) = \)

\[ \left[ \frac{g_L^2 - f_L^2}{g_L^1 - f_L^1} \right] \left[ \frac{g_L^1 - f_L^1}{g_L^2 - f_L^2} \right] \left[ \frac{+s_{xy}^1 s_{xy}^2 + s_{xk}^1 f_L}{g_L^2 - f_L^2} \right] -E \left[ \frac{(g_L^1 - f_L^1)(g_L^2 - f_L^2)}{+s_{xy}^1 s_{xy}^2 + s_{xk}^1 f_L} \right], \]

\[ ^{12} \text{The solutions for } dK_x^1, dL_x^2, dK_x^2, \text{ and } dL_x^2 \text{ are not explicitly presented in order to avoid additional cumbersome expressions. In some cases, the sign of the solution depends upon the relative values of } g_L^1 \text{ and } f_L^1. \text{ These are discussed in the text.} \]

The term \( Z \) represents a lengthy expression involving most of the parameters of the model. It always has the same sign as the expression \( (g_L^1 - f_L^1) \). In addition, it can be shown that \( Z(g_L^1 - f_L^1) > 1 \). See Appendix.
which is unambiguously negative, the sign of the solution for $dR^1$ will be the opposite of the sign of its denominator. Since $Z$ has the same sign as $(g^{1}_L - f^{1}_L)$, $dR^1$ will have the sign of $(f^{1}_L - g^{1}_L)$.

Since the product $Z(g^{1}_L - f^{1}_L)$ is always positive, the sign of the solution for $dR^2$ depends only on the relative size of $g^2_L$ and $f^2_L$. Thus, if, and only if, $X$ is relatively capital intense so that $g^2_L > f^2_L$, then $dR^2$ is positive.

The imposition of the tax causes the taxing country to divert resources away from good $X$ in which it has a comparative advantage to good $Y$ in which the country is at a comparative disadvantage. In a sense, one might say that the taxing nation's comparative advantage in good $X$ is not so great as that which is implicit in the initial equilibrium (and fixed) exchange rate. In country 2 resources shift from $Y$ to $X$ production.

An intuitive explanation may be useful. When the tax is imposed, at the initial terms of trade production of the exportable becomes less advantageous than production of the importable. Both factors of production shift from production of the exportable to production of the importable in order to avoid reductions in earnings. If the exportable production is relatively capital intensive ($g^1_L > f^1_L$), then relatively more capital is released than the importable industry is willing to accept at the initial relative factor prices. In order to prevent

---

13 This is true only if factor intensity reversal does not occur.
unemployment the price of capital must fall relative to the wage of labor. If the production of the exportable is labor intensive, the opposite conclusion holds.

As relative factor prices fall, the terms of trade are affected. The price of the factor (capital) used more intensively in production of the taxing nation's exportable falls relative to the price of the factor used less intensively. The opposite, of course, occurs in importable production. Net of the tax, this tends to lower the price of the exportable relative to the price of the importable. However, under the origin principle the tax must be included in the price of the exportable. With the inclusion of the tax, the price of exportable rises relative to the price of the importable. The effect of the change in relative factor prices on the terms of trade is more than offset by the effect of the tax itself so that

$$\frac{dT_X}{Z(g^1_L - f^1_L)} < T^1_X.$$ 

Thus, although in equilibrium the gross price received by exportable producers rises relative to the gross price received by the importable producers, the net price received by exportable producers falls.

On the other hand, since the price of good X rises relative to that of good Y in international markets and in country 2, factors of production shift from the Y industry to the X industry in the nontaxing country. If X is capital intense ($g^2_L < f^2_L$), then the ratio of capital to labor leaving Y will be lower than that which producers of
X will wish to hire at the initial factor price ratio. The price of capital will be bid up relative to the price of labor. Precisely the opposite reasoning would apply if X were the labor intensive industry.

Finally, one implication of many arguments concerning border tax adjustments is that equal taxes in the two countries would have no effect on trade or factor allocation.\textsuperscript{14} Such, however, is not the case. One finds, for example, that

\[ dt = d_{76}^{-1} T_{x}^{2} + d_{77}^{-1} T_{x}^{1} \cdot \]

Since \( d_{76}^{-1} \neq -d_{77}^{-1} \), equal production taxes in the two countries will not leave the terms of trade, and therefore factor allocation, unchanged. The direction of change in the dependent variables depends on the relative values of both \((g_{L}^{1} - f_{L}^{1})\) and \((g_{L}^{2} - f_{L}^{2})\).\textsuperscript{16}

5.3.2 Partial Tax on the Exportable - Destination Principle

Consider a partial consumption tax on the exportable, that is, a tax on the exportable levied under the destination principle (case

\textsuperscript{14} Although these arguments are usually concerned with alleged balance of payments controversy, their neutrality aspects are certainly of interest. For example, see Robert Z. Aliber and Herbert Stein, "The Price of U. S. Exports and the Mix of U. S. Direct and Indirect Taxes." The authors contend that substitution of a value added tax for a corporate income tax in the U. S. might lead to offsetting tax substitutions in other nations.

\textsuperscript{15} Any term \( d_{ij}^{-1} \) represents the element in the \( i \)th row and \( j \)th column of the inverted \([D]\) matrix.

\textsuperscript{16} Although the model can be solved for situations involving taxes in both countries, no effort is made to do so. The complexity of the solutions is so great that only limited information could be obtained from the added effort.
3). For this tax the $[T]$ vector contains only the term $-X^1T^1_{XX}$ as the first element. All other elements are zero. The solution of the system gives the following changes in the dependent variables:

$$
dt = - \left[ \frac{\ell_L^1 - l_L^1}{S_{XX}^1 x_L^1 + S_{XX}^1 y_L^1} \right] \left[ \frac{1}{Z} \right] X^1E^1T^1_{XX} < 0 ;
$$

$$
dR^1 = - \left[ \frac{S_{XX}^1 x_L^1}{(S_{XX}^1 y_L^1 + S_{XX}^1 x_L^1)Z} \right] X^1E^1T^1_{XX} ;
$$

$$
dR^2 = - \left[ \frac{S_{XX}^1 y_L^1}{Z(g_L^2 - f^2)(S_{XX}^1 y_L^1 + S_{XX}^1 x_L^1)} \right] X^1E^1T^1_{XX} ;
$$

$$
dK^1_x < 0 ;
$$

$$
dL^1_x < 0 ;
$$

$$
dK^2_x < 0 ;
$$

$$
dL^2_x < 0 .
$$

Furthermore, it can be shown that

$$|dt| < T^1_x,$$

so that the relative price of $X$ rises for consumers in the taxing nation, but by less than the amount of the tax. In the nontaxing nation, the relative price of good $X$ falls.

---

17 Prior to August 1966, Portugal employed a selective retail sales tax on consumer goods which, to the extent that it fell more heavily on exportables, might represent this tax.
Heuristically, with the imposition of the consumption tax on $X$, consumers in country 1 tend to consume more $Y$ and less $X$. At the initial terms of trade, producers in country 1 would have an excess supply of $X$ and face an excess demand for $Y$. Thus, the price of $X$ falls relative to the price of $Y$, somewhat offsetting the initial shift away from $X$ consumption in country 1. Also, resources shift to production of importables in country 1, somewhat offsetting the initial excess supply of $X$. The change in the terms of trade induces consumers in country 2 to substitute $X$ for $Y$ in their market basket at the same time that producers shift from $X$ production to $Y$ production. In each country the change in relative factor prices depends on the initial shares in the two industries. If the $Y$ industry is relatively capital intensive so that $(g^1_L - f^1_L)$ and $(g^2_L - f^2_L)$ are both negative, then the price of capital rises relative to the wage of labor.

Next, let us ask what would be the effect of substituting a destination principle tax on $X$ for an equal rate origin principle tax on $X$. This shift might represent the situation when a nation begins to apply border adjustments for an already existing tax. An example might be the granting of export rebates by the United States for elements of tax occult and state and local taxes. In terms of the model, this is described by the elimination of a case (1) tax and the imposition of a case (3) tax. From the previous solutions, the changeover would unambiguously lead to a deterioration in the terms of trade. In the taxing nation, factors of production shift to production of the exportable. If exportable production is capital intensive, the relative price of capital rises. In the nontaxing nation,
factors shift to production of Y, leading to a fall in the relative price of capital if Y production is relatively labor intensive. It is also noteworthy that similar effects would result from the granting of export rebates for an existing general product tax levied in accordance with the origin principle. This is equivalent to substituting a destination principle tax on X and an origin principle tax on Y for the general origin principle tax. Except for the differences in the rate of the tax, the same [T] vector results for the two substitutions.

Finally, as was the case for a production tax, imposition of equal consumption tax on X in country 2 would not exactly offset the effects of country 1's consumption tax on X. In this case,

\[
dt = d_{T_1}^{-1} \left[ -X_1 E_x^1 \beta T_1^1 X - X_2 E_x^2 \beta T_2^2 X \right] = d_{T_1}^{-1} T_x \left[ -X_1 E_x^1 - X_2 E_x^2 \right] \neq 0.
\]

Indeed, the attempt would augment the effects resulting from country 1's tax alone by inducing consumption in both countries to shift from X to Y.

5.3.3 A Partial Tax on the Exportable with Imperfect Border Adjustment

What if the rebate or surcharge does not exactly equal the amount of the tax included in the value of the product? Suppose that the rebate granted on exports does not equal the amount of the tax on exportables (case 5). That is, \( \beta^1 \neq 1 \). In this case

\[18\text{Cases of imperfect border adjustment for exports arise most frequently with multi-stage, cascading tax systems. For example, prior to 1964 in Luxembourg exports were exempt from taxation at the final production stage. Imports, however, were liable to the tax at only the nominal rate also. After 1964, relief was given to exports for taxes paid at earlier stages. Relative to imports, exports are therefore overcompensated. To the extent that relief for taxation at earlier stages exceeds or underestimates previous taxes, exports would be over or undercompensated.} \]
\[
[T] = \begin{bmatrix}
-\beta^1T_x^1x^1E_x^1 \\
0 \\
0 \\
0 \\
0 \\
0 \\
+T_x^1(1 - \beta^1)
\end{bmatrix}
\]

As one might expect, the solution for the dependent variables depends on whether $\beta^1 < 1$. If $\beta^1 > 1$, the situation is equivalent to a destination principle tax on exportables coupled with an export subsidy. If $\beta^1 < 1$, there are two possible interpretations. The situation could represent either an origin principle tax on exportables coupled with an export subsidy or a destination principle tax on exportables coupled with an export tax.

The model does not give unambiguous solutions for all variables.\(^\text{19}\)

The results for the two situations are:

<table>
<thead>
<tr>
<th></th>
<th>$\beta &gt; 1$</th>
<th>$\beta &lt; 1$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$dt$</td>
<td>-</td>
<td>?</td>
</tr>
<tr>
<td>$dR_x^1$</td>
<td>probably +</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>for $(g_L^1 - f^1_L) &gt; 0$</td>
<td>for $(g_L^1 - f^1_L) &gt; 0$</td>
</tr>
<tr>
<td>$dK^1_x$</td>
<td>?</td>
<td>-</td>
</tr>
<tr>
<td>$dL^1_x$</td>
<td>?</td>
<td>-</td>
</tr>
</tbody>
</table>

\(^{19}\) Where the solution is ambiguous a question mark is used to indicate the uncertainty. In these cases, the sign depends on complicated expressions in the parameters of the model which are not sufficiently informative to warrant further investigation.
\[ \begin{array}{c|c|c}
\beta > 1 & \beta < 1 \\
\hline
dR^2 & - & ? \\
& \text{for } (g_L^2 - f_L^2) > 0 \\
dk_x^2 & - & ? \\
dL_x^2 & - & ? \\
\end{array} \]

Although little can be said about the case of \( \beta_1 < 1 \), one may note that the closer is \( \beta_1 \) to unity, the more nearly the results are to those of a consumption tax. The closer \( \beta_1 \) is to zero, the more nearly the results are to a production tax.

5.3.4 A General Product Tax with Imperfect and Unequal Border Adjustment

Now what if the tax is general and the degree of adjustments is not only imperfect, but also unequal for the two product taxes (case 6)? That is,

\[ T_x^1 = T_y^1 = T_1 \ ; \]

\[ \alpha_1 \neq \beta_1 \ . \]

In this case the general product tax is neither a pure destination principle nor a pure origin principle tax, but may instead be thought of as a combination of a variety of taxes.\(^{20}\)

\(^{20}\)As noted (see footnote 17), the problem of inaccurate compensation probably arises primarily in cumulative, multi-stage product tax systems. For such taxes it is extremely difficult to estimate the amount of tax included in the value of the product. Indeed, an equal tax rate on all goods will not result in equal effective taxes if the degree of vertical integration is not the same for all products. Many of these taxes are being replaced by general value added taxes where adjustment is more accurate.
Depending upon the values of $a^1$ and $b^1$ a total of thirty possible tax combinations arise. Figure 5.1 is a matrix defining these possibilities. For example, suppose that $a^1 = 1$, and $b^1 = .5$. Assuming that $T^1_x = T^1_y = T^1$, this situation could represent a general destination principle product tax (DP) coupled with an export tax (ET). On the other hand, it could represent a general origin principle tax (OT) coupled with an export subsidy (ES) and an import tariff (IT). Other combinations of adjustment parameter values yield situations equivalent to the indicated combinations of export and import tariffs, export and import subsidies (IS), and general origin and destination principle product taxes.

Having recognized the resulting variety of equivalent taxes, the problem of unequal adjustment can be analyzed in the same manner as the preceding taxes. The exogenous $[T]$ vector may be written for this case as

$$\begin{bmatrix}
-x^1P^1x(\beta^1T^1_x - a^1T^1_y) \\
0 \\
0 \\
0 \\
0 \\
T^1_x(1 - \beta^1) - T^1_y(1 - a^1)
\end{bmatrix} = \begin{bmatrix}
-x^1P^1xT^1(\beta^1 - a^1) \\
0 \\
0 \\
0 \\
0 \\
T^1(a^1 - \beta^1)
\end{bmatrix}$$

The results of imposing a general product tax with unequal border adjustment may be summarized
<table>
<thead>
<tr>
<th>Value of $\beta^1$</th>
<th>$\beta^1 = 0$</th>
<th>$0 &lt; \beta^1 &lt; 1$</th>
<th>$\beta^1 = 1$</th>
<th>$\beta^1 &gt; 1$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\alpha^1 = 0$</td>
<td>OP</td>
<td>OP + ES</td>
<td>OP + ES</td>
<td>OP + ES</td>
</tr>
<tr>
<td></td>
<td>DP + ET + IS</td>
<td>DP + IS</td>
<td>DP + IS</td>
<td>DP + ES + IS</td>
</tr>
<tr>
<td>$0 &lt; \alpha^1 &lt; 1$</td>
<td>OP + IT</td>
<td>OP + IT + ES</td>
<td>OP + ES + IT</td>
<td>OP + ES + IT</td>
</tr>
<tr>
<td></td>
<td>DP + IS + ET</td>
<td>DP + IS + ET</td>
<td>DP + IS</td>
<td>DP + ES + IS</td>
</tr>
<tr>
<td>$\alpha^1 = 1$</td>
<td>OP + IT</td>
<td>OP + ES + IT</td>
<td>DP</td>
<td>OP + IT + ES</td>
</tr>
<tr>
<td></td>
<td>DP + ET</td>
<td>DP + ET</td>
<td></td>
<td>DP + ES</td>
</tr>
<tr>
<td>$\alpha^1 &gt; 1$</td>
<td>OP + IT</td>
<td>OP + IT + ES</td>
<td>OP + ES + IT</td>
<td>OP + ES + IT</td>
</tr>
<tr>
<td></td>
<td>DP + ET + IT</td>
<td>DP + IT + ET</td>
<td>DP + IT</td>
<td>DP + ES + IT</td>
</tr>
</tbody>
</table>

Figure 5.1 - Matrix of Equivalent Tax Combinations Arising from Imperfect Border Adjustment for a General Product Tax
\[
\begin{array}{c|c|c}
\alpha^1 > \beta^1 & \beta^1 > \alpha^1 \\
\hline
dt & + & - \\
dR^1 & - (g^1_L > f^1_L) & + (g^1_L > f^1_L) \\
dR^2 & + (g^2_L > f^2_L) & - (g^2_L > f^2_L) \\
dK^1_x & - & + \\
dL^1_x & - & + \\
dK^2_x & + & - \\
dL^2_x & + & \\
\end{array}
\]

If a greater adjustment is applied to imports than to exports \((\alpha^1 > \beta^1)\), imposition of the tax causes the terms of trade to improve unambiguously for country 1. Although the price of \(X\) rises relative to the price of \(Y\) in international markets, the opposite occurs from the point of view of producers in country 1. The change in relative international product prices is

\[
dt = T^1(\alpha^1 - \beta^1) \left[ \frac{x^1 \frac{x}{x} (s^1_L - f^1_L) (g^1_L - f^1_L) + 1}{z^1 (s^1_L + f^1_L)} \right] > 0.
\]

But producers in the taxing nation do not receive these prices. They are confronted with this ratio plus the amount of rebate on exports and less the tax on importables. That is, they face not \(dt\), but

\[
dt + T^1(\beta^1 - \alpha^1).
\]

Thus, from the point of view of producers in country 1, the change in relative product prices is

\[
dt + T^1(\beta^1 - \alpha^1) = 
\]
\[
\frac{\tau(a^1 - \beta^1)}{z(g^1_L - f^1_L)} \left[ \frac{x^1_f^1 r^1_L (g^1_L - f^1_L)(s^1_L - f^1_L) + 1}{s^{1}_{y} x^{1}_{y} g^{1}_{L} + s^{1}_{x} x^{1}_{x} f^{1}_{L}} \right] + \tau(\beta^1 - a^1) ;
\]

\[
\frac{\tau(a^1 - \beta^1)}{z(g^1_L - f^1_L)} \left[ \frac{-(g^1_L - f^1_L)(g^1_L - f^1_L)(s^2_{y} r^{2}_{y} g^{2}_{L} + s^{2}_{x} x^{2}_{x} f^{2}_{L})}{(g^2_L - f^2_L)(g^1_L - f^1_L)(s^{1}_{y} x^{1}_{y} g^{1}_{L} + s^{1}_{x} x^{1}_{x} f^{1}_{L})} \right] -
\]

\[
\frac{1}{s^{1}_{y} x^{1}_{y} g^{1}_{L} + s^{1}_{x} x^{1}_{x} f^{1}_{L}} \left[ \frac{(g^1_L - f^1_L)(g^1_L - f^1_L)(x^1_f^1 r^1_L)}{s^{1}_{y} x^{1}_{y} g^{1}_{L} + s^{1}_{x} x^{1}_{x} f^{1}_{L}} \right]
\]

which is unambiguously negative for \(a^1 > \beta^1\). Since this represents a decline in the relative price of \(X\), resources shift to \(Y\) production in the taxing nation. Relative factor prices fall if \(X\) is the relatively capital intensive industry. In country 2, producers face an increased relative price of \(X\) and the opposite shifts occur. Consumers in the taxing nation increase their consumption of \(X\) and reduce their consumption of \(Y\) since they face not merely \(dt\), but \(dt + \) the effects on relative prices of the tax and border adjustments which is negative for \(a^1 > \beta^1\). Consumers in the nontaxing country, facing the unadjusted change in relative product prices reduce their consumption of \(X\) and increase their consumption of \(Y\).

As one might expect, if \(\beta^1 > a^1\), the signs of all dependent variables are reversed. In this case, substitution of a neutral tax structure for a nonneutral tax structure leads to an improvement in its terms of trade for country 1. This could be accomplished by decreasing its rebate on exports or increasing its surcharge on imports until the two adjustments are equal. The tax change also results in a shift of resources out of exportable production and into importable
production in the taxing nation. Due to the substitution consumers in both countries substitute $Y$ for $X$ in their market basket since the relative price of $X$ rises.

Would an equal tax coupled with identical but unequal border adjustment in each country exactly offset? In this case

$$T^1_X = T^1_Y = T^2_X + T^2_Y = T,$$

$$\alpha^1 = \alpha^2 = \alpha,$$

$$\beta^1 = \beta^2 = \beta.$$

The exogenous vector becomes

$$[T] = \begin{bmatrix}
-T(\beta - \alpha)(X^1_{x}E^1_{x} + X^2_{x}E^2_{x}) \\
0 \\
0 \\
0 \\
0 \\
T(\alpha - \beta) \\
T(\alpha - \beta)
\end{bmatrix}$$

It can be shown that the sign of $d^{-1}_{76}$ is unambiguously positive. Thus, the addition of the same tax and border adjustments in country 2 will increase the positive change in the terms of trade if $\alpha$ is greater than $\beta$. If the adjustment for $X$ is greater than the adjustment for $Y$ ($\beta > \alpha$), then the negative change in the terms of trade would be similarly increased. In either case the tax combination is not neutral with respect to factor allocation and relative factor prices in the two countries. Thus, one country could not expect to offset a foreign tax of this sort by imposing the same tax. Obviously, it might be
possible to set \( \alpha^1 \neq \alpha^2 \) and \( \beta^1 \neq \beta^2 \) so that the two taxes would neutralize. This is now, however, a likely real world event and is not analyzed.

5.4 Summary

There is little of a general nature which can be said of the results of the product tax analysis. The reactions of the dependent variables do show some general tendencies. For example, a partial tax tends to cause factors of production to flow out of the taxed industry into the untaxed industry, regardless of whether the tax is levied under the origin principle or the destination principle. However, if the rebate on exports is greater than the tax, the tendency may be reversed. The excess rebate acts as a subsidy to exports and offsets at least somewhat the fall in the relative price of \( X \). This will offset, and perhaps reverse, the flow of productive factors out of the taxed industry.

For a general tax with unequal adjustment the results of a tax change depend on the degree of maladjustment. For example, if the adjustment on exports exceeds that on imports, the relative price of exportables falls. The effect is to make the general tax relatively less heavy on exportables. Effects of the same magnitude, but of different signs, could be expected from an origin principle tax on importables. Thus, the relatively greater adjustment on exports tends to make a general tax more like a consumption tax on exportables and a production tax on importables.
The only tax structure which is neutral with respect to the dependent variables of the system is a general product tax with equal adjustments. In this context it matters not a whit whether the origin principle or the destination principle is employed. Thus, a switch from the origin principle to the destination principle for existing product taxes would not neutralize a nonneutral tax, and it would change nothing for an existing neutral tax. In addition, matching nonneutral taxes in both countries do not offset, but rather augment. They are not neutral whether applied with border adjustments or not. The use of border tax adjustments for product taxes does not fair well in this light. From the point of view of economic efficiency, a bad product tax is a bad tax, with or without border adjustments.
CHAPTER VI

The Analysis of Factor Taxes

6.1 Introduction

Let us now focus our attention on factor taxes. The analysis first considers both partial and general capital taxes, with and without adjustments to the prices of traded commodities. Then a more recent proposal for adjustment to the earnings of capital is studied. Thus, there are five cases.\(^1\)

<table>
<thead>
<tr>
<th>Case</th>
<th>Tax</th>
</tr>
</thead>
<tbody>
<tr>
<td>(7)</td>
<td>(T^1_{Kx}) - tax on capital used in production of (X(\lambda^1 = 0));</td>
</tr>
<tr>
<td>(8)</td>
<td>(T^1_{Kx} = T^1_{Ky} = T^1_K) - tax on capital used in production ((\lambda^1 = \theta^1 = 0));</td>
</tr>
<tr>
<td>(9)</td>
<td>(T^1_{Kx}) - tax on capital used in production of (X) with border adjustment applied ((\lambda^1 &gt; 0));</td>
</tr>
<tr>
<td>(10)</td>
<td>(T^1_{Kx} = T^1_{Ky} = T^1_K) - tax on capital used in production with border adjustment applied ((\lambda^1 &gt; 0; \theta &gt; 0));</td>
</tr>
<tr>
<td>(11)</td>
<td>(T^1_K) or (T^1_{Kx}) - adjustment to earnings of capital.</td>
</tr>
</tbody>
</table>

\(^1\)The analysis considers only taxes on capital and omits any discussion of taxes on labor's earnings. With the equivalence propositions (see Chapter III) the results for labor taxes can be determined without further analysis. For example, a tax on all labor's earnings is equivalent to general product tax and a negative general capital tax. Similarly, a tax on labor's earnings in one industry is equivalent to a tax on that product and a negative partial capital tax. From a practical point of view, this is an acceptable approach since most of the controversies concerning international treatment of domestic factor taxes have been concerned with profits taxes. Only limited attention has been devoted to taxes on labor's earnings, such as payroll taxes.
6.2 Neutral Factor Taxes

Again, let us ask if any of cases (7) - (10) are neutral with respect to the dependent variables of the system. No capital tax leaves all the variables of the system unchanged. There is none for which the exogenous vector is a null vector, and there is none for which the solution of the system results in all zero values for the dependent variables.

There are, however, two taxes which affect only one dependent variable of the system and are neutral in accordance with our criteria. They are general taxes on capital used in production of X and Y without border adjustments (case 8) and the same tax with equal border adjustments (case 10 where $\lambda^1 = \theta^1 > 0$). Substitution of either of these taxes for a neutral product tax yields for the exogenous $[T]$ vector

$$[T] = \begin{bmatrix} 0 \\ 0 \\ 0 \\ -S^1 T^1_x \\ -S^1 T^1_y \\ 0 \\ T^1_K(g^1_L - f^1_L) \end{bmatrix}.$$  

Since the exogenous vector is the same for both taxes, the solution of the system is the same for both taxes. Solving for the dependent variables gives

$$dt = dR^2 = dK^2_x = dK^2_y = dL^1_x = dL^2_x = 0,$$

and

$$dR^1 = -T^1_K.$$
All variables are unaffected except relative factor prices in the taxing country. Either tax is neutral with respect to real production and consumption patterns. The introduction of the tax on capital simply reduces the return to capital relative to the return to labor by the amount of the tax. If the tax is levied at an equal rate on all capital in all uses without border adjustments, relative product prices (the terms of trade) do not change. Competitive pressure from goods produced in the nontaxing nation prevents any change in product price structure in the taxing nation. Capital cannot, therefore, escape the tax by changes in the product price structure. Also, since the tax applies to capital in all of its domestic uses, and since capital is immobile between nations, capital cannot escape the tax by moving to another use. Thus, the return to capital must fall relative to the wage of labor in all of its uses by the amount of the tax, and there is no inducement for either factor to change its employment.²

If the same tax is levied, and if equal border adjustments are also applied, the effects on the dependent variables are exactly the same. The application of border adjustments for the tax changes nothing in real terms. Just as there was no difference between a general product tax under the origin and destination principles, there is no difference between a tax on capital in all of its uses with and

²Absolute product price levels may, of course, change in either nation. However, since no internal change has occurred within the nontaxing nation, there is little reason to expect that its product prices would change. The most likely result then would be that the taxing nation's absolute product prices would be held constant by external competition. The change in relative factor prices would probably be accomplished through lower absolute returns to capital in the taxing nation.

It should be noted that a tax on all earnings of both capital and labor would result in a null \([T]\) vector. In this case, relative factor earnings would remain unchanged.
without border adjustments. In either case, a general capital tax results only in a fall in the earnings of capital relative to the wage of labor. The effect of the adjustment to product prices for the tax would be only a proportional movement in absolute product prices.\(^3\) Since both factors of production would share in this change in the value of the products in accordance with their initial shares, the earnings of capital would still fall relatively by the amount of the tax.

Since both taxes have the same effects on the system, substitution of one tax for the other would have no effect on the system. The application of equal border adjustments for an existing tax on capital in all of its uses would have no effect on the system since this change is equivalent to removal of a case (8) tax and imposition of a case (10) tax.\(^4\) The substitution of any neutral product tax for any of these factor taxes, as has been suggested for balance of trade purposes, would have one effect. The relative return to capital would rise. Depending on the movements of absolute prices, economic units would instead bear the tax in their roles as either producers or consumers.

It is noteworthy that the addition of border adjustments for existing general capital taxes would not improve the relative earnings of capital, whereas substitution of a general product tax would. Thus,

\(^3\)In this case one might expect that the application of border adjustments would result in a proportional rise in absolute product prices in the taxing nation with no change in relative product prices.

\(^4\)The addition of border adjustments for existing taxes is equivalent to substituting a tax with border adjustments for an equal tax without them. In the model, this is depicted by substituting into the \([T]\) vector both negative terms for the tax which is dropped and positive terms for the same tax with border adjustments. The sum of these terms yields the \([T]\) vector describing the policy change.
if one expects that profitability of exporting would be improved by application of border tax adjustments to a general capital tax, the expectation would be suspect. On the other hand, a shift to a general product tax, with or without border adjustments, would improve the relative earnings of capital. The case for applying border adjustments for an existing profits tax is considerably less appealing in light of this result. For a general tax, they would not matter.

What would be the effects of one nation taking retaliatory actions in response to a change in tax policy by the other nation? Suppose that both nations employ general capital taxes with or without border adjustments (case 8 and case 10 with \( \lambda = 0 \) in both countries) rather than neutral product taxes. In either case, the exogenous vector is the same. Solving for the dependent variable gives

\[ dt = dK_1^X = dL_1^X = dK_2^X = dL_2^X = 0 \, , \]

\[ dR^1 = -T^1_K \, , \]

and

\[ dR^2 = -T^2_K \, . \]

The policy changes affect only relative factor prices. In each country the price of capital falls relative to the wage of labor by the amount of the tax. The conclusion holds even if \( T^1_K \neq T^2_K \). Just as a purely domestic change of this type affects nothing in real terms, neither does a concurrent retaliatory action in the second nation. There are no real effects to retaliate against. There are no real effects of retaliation.

Suppose next that first one nation and then the other nation decide to apply border adjustments to their existing general taxes on
capital. This is equivalent to each nation substituting a case (10) tax for a case (8) tax. Since this substitution by any single country has no effect on neutrality, substitutions in both nations would have no effect. Indeed, none of the dependent variables would be affected by the substitution. The result holds even if the tax rates in the two nations are not equal.

To summarize, there are two neutral capital taxes. A general tax with the same border adjustment (zero or nonzero) applied to both goods is neutral with respect to all variables except relative factor prices. Imposition of any of these taxes lowers the relative return of capital. Any policy change among these taxes has no effect on any of the dependent variables of the model. Substitution of a completely neutral product tax for the capital taxes would have no effect on real production or consumption, but it would improve the relative earnings of capital.

6.3 Nonneutral Factor Taxes

6.3.1 A Tax on Capital Used in Production of X without Border Adjustment

What effects can be expected from the nonneutral factor taxes? Consider first a tax on capital used in production of X without any border adjustments (case 7). Substitution of $T_{KX}^1$ for any neutral tax yields the following exogenous vector:
\[
[T] = \begin{bmatrix}
0 \\
0 \\
0 \\
-S_{x}^{1} f_{x}^{1} \\
0 \\
0 \\
T_{x}^{1} f_{x}^{1}
\end{bmatrix}
\]

The system gives definite answers for all variables except for relative factor prices, which depend on the initial factor shares.

The solutions are

\[\frac{d}{dt} = \frac{T_{x}^{1}}{Z(g_{L}^{1} - f_{L}^{1})(S_{x}^{1} f_{x}^{1} + S_{y}^{1} g_{L}^{1} f_{L}^{1})} > 0;\]

\[dR^{1} < 0 \text{ for } g_{L}^{1} > f_{L}^{1}; \]

\[? \text{ for } g_{L}^{1} < f_{L}^{1}; \]

\[dR^{2} > 0 \text{ for } g_{L}^{2} > f_{L}^{2}; \]

\[< 0 \text{ for } g_{L}^{2} < f_{L}^{2}; \]

\[dK_{x}^{1} < 0; \]

\[dL_{x}^{1} < 0; \]

\[dK_{x}^{2} > 0; \]

and

\[dL_{x}^{2} > 0.\]
A tax in country 1 on capital used in production of its exportable results in an improvement in its terms of trade. The tax on only capital used in X production, however, induces capital and labor to shift from X production to Y production. If X is the more capital intense good in country 1, the relative price of capital falls in order to induce Y producers to employ additional capital and labor in the ratio in which they expelled from X production. If, however, Y is the more capital intense good, the effect of the tax on relative factor prices is ambiguous. Normally, one would expect the relative price of capital to rise with the flow of factors into the more capital intense Y industry. However, X producers face not the change in factor prices net of tax as represented by dR$^1$, but rather the change in factor prices plus the tax as represented by dR$^1 + T_K^1$. Consequently, they will choose to lower their capital to labor ratio so long as dR$^1 > -T_K^1$. Therefore, it is possible that relative factor prices net of tax may fall while both capital and labor flow to the Y industry.

With the production of X reduced in country 1, and the output of Y increased, the relative price of X rises. In country 2, factors flow into X production, somewhat offsetting the reduced supply of X in country 1. If X is the more capital intense good in country 2 ($g_L^2 > f_L^2$), the relative price of capital rises. It falls if Y is the more capital intense good.

It has been implied that a factor tax in one nation would offset the trade effects of equal factor taxes in its trading
partners. Although the argument is primarily concerned with effects on the balance of trade, let us ask if the situation satisfies the neutrality criteria of this paper. Suppose that two nations employ taxes on capital used in production of $X$ ($T_{Kx}^1 = T_{Kx}^2 = T_{Kx}$) rather than neutral taxes. The exogenous vector in this case is

$$[T] = \begin{bmatrix} 0 \\ -s_{x^2}^2 T_{Kx} \\ 0 \\ -s_{x^1}^1 T_{Kx} \\ 0 \\ T_{Kx}^2 f_K \\ T_{Kx}^1 f_K \end{bmatrix}.$$ 

Solution of the system gives

$$\frac{dt}{s} = T_{Kx} (s_{L} - f_{L}) \left[ \frac{s_{x^2}^2 f_{L} f_K^2 + s_{x^2}^2 f_{L} f_K^2 + 1 f_{L} 1 f_K^1}{(s_{L}^2 - f_{L}^2)(s_{L}^2 - f_{L}^2)} \right] \left[ \frac{s_{x}^2 f_{L} f_K^2 + s_{x}^2 f_{L} f_K^2 + 1 f_{L} 1 f_K^1}{(s_{L}^2 - f_{L}^2)(s_{L}^2 - f_{L}^2)} \right],$$

---

5This is the implicit reasoning that the United States might gain little by employing border adjustments for its corporation income tax. It is contended that, since other nations also use this tax at nearly equal amounts and might retaliate by also employing border adjustments, the United States would not improve its competitive advantage.
which is unambiguously positive. Thus, the two equal taxes do not offset. The terms of trade improve for the nation whose production of exports involves taxed capital. Indeed, the addition of $T^2_{Kx}$ merely augments the effect of $T^1_{Kx}$ by a factor of

$$\frac{T_{Kx}(g^1_L - f^1_L)}{Z(s^L_y + s^L_x + f^1_L)} \left[ \frac{s^2_{XK} \tilde{f}^2_L g^2_K + s^2_{YK} g^2_Y \phi^2_L}{(g^2_L - \tilde{f}^2_L)(g^2_L - f^2_L)} \right].$$

The changes in the remaining dependent variables would be similarly heightened.

Finally, what would be the result of country 1's granting an export rebate for an existing tax on capital used in production of X? Since this is equivalent to substituting a case (9) tax for a case (7) tax, appropriate positive and negative terms should be inserted into the $[T]$ vector for the respective taxes. The $[T]$ vector becomes

$$[T] = \begin{bmatrix} -X^1_{E_x} \lambda^1_{Kx} \\ 0 \\ 0 \\ +s^1_{Kx} - s^1_{X_{Kx}} \\ 0 \\ 0 \\ -T^1_{Kx} \tilde{f}^1_K + T^1_{Kx} f^1_K - T^1_{Kx} \lambda^1_L \end{bmatrix} = \begin{bmatrix} -X^1_{E_x} \lambda^1_{Kx} \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ -T^1_{Kx} \lambda^1_L \end{bmatrix}. $$

Solution of the system results in the following signs for changes in the dependent variables:
\[ dt < 0 ; \]
\[ dR^1 > 0 \quad \text{for} \quad g^1_L > f^1_L ; \]
\[ < 0 \quad \text{for} \quad g^1_L < f^1_L ; \]
\[ dR^2 < 0 \quad \text{for} \quad g^2_L > f^2_L ; \]
\[ > 0 \quad \text{for} \quad g^2_L < f^2_L ; \]
\[ dK^1 \pi > 0 ; \]
\[ dL^1_\pi > 0 ; \]
\[ dK^2 \pi < 0 ; \]
\[ dL^2_\pi < 0 . \]

As one might expect, the effects of granting the rebate on exports reverses the effects of the tax. The terms of trade deteriorate for country 1. Factors of production shift to exportable production in both the taxing nation and the nontaxing nation. Relative factor prices adjust according to initial factor shares in each nation. The larger is the adjustment parameter, the greater will be the offsetting effects of the rebate. These results hold even if the border adjustment is set equal to the additional cost per unit of output which is due to the tax.

Intuitively, the rebate initially tends to raise the return to X production since its effect is to raise the price received by X producers on export sales. This in turn induces an initial rise in the relative domestic price of X. Since the rebate is applied to the price of X, rather than directly to the earnings of capital employed in X production, both factors share in the increased return. Both capital and labor thus shift from Y to X production. The increased supply of X tends to lower the relative price of X in international markets.
(though not necessarily in domestic markets), and in the nontaxing nation factors shift to Y production. These adjustments occur regardless of the size of the rebate. While they are opposite to the effects of the tax alone, they clearly do little to neutralize those effects.

6.3.2 A Tax on Capital Used in Production of X with Border Adjustment Applied

The results of the substitution just discussed preview the results of employing a tax on capital used in production of X with an export rebate (case 9) rather than a neutral tax. In this case the exogenous vector is

\[
[T] = \begin{bmatrix}
-x^1\epsilon^1_x \lambda^1 t^1_{Kx} \\
0 \\
0 \\
-s^1 t^1_{Kx} x^1_{Kx} \\
0 \\
0 \\
+t^1_{Kx} (f^1_K - \lambda^1)
\end{bmatrix}
\]

Solving the system for the change in the terms of trade gives

\[
dt = \frac{t^1_{Kx}}{Z(s^1_{y^1}y^1_e^1 L + s^1_{x^1}x^1 L) (g^1_L - t^1_L)} \begin{bmatrix}
-x^1\epsilon^1_x \lambda^1 (g^1_L - t^1_L) (g^1_L - t^1_L) \\
\end{bmatrix}
\]

By inspection \( dt < 0 \) so long as the adjustment parameter is greater than the initial shares of capital in production of both X and Y. Thus,
if the taxing nation sets the export rebate per unit of output equal
to the tax per unit of capital employed in producing that output (λ = 1),
the terms of trade worsen. However, if λ₁ < g₁^L or f₁^L, the sign of dt
is ambiguous and depends upon the relative sizes of initial factor
shares, XE₁^L, S₁^L X, S₁^L Y, and λ₁. If, for example, the rebate is set
equal to the additional cost per unit of output due to the tax (λ₁ =
f₁^L in this case) then the sign of dt depends on initial factor shares.
If X is the relatively capital intense good (λ₁ = f₁^L > g₁^L), then dt is
negative. If X is the more labor intense good, the sign of dt is am-
biguous. In general, the smaller is λ₁, the more likely the sign of
dt is ambiguous.

The solutions for the remaining variables are also largely
ambiguous. For example, in the taxing country imposition of the tax
results in

\[ dR₁ = \frac{T₁^{Kx}}{Z (g₁^L - f₁^L) (S₁^L x' x^L + S₁^L y' y^L)} \left[ -x₁^L dL^L \lambda₁ (g₁^L - f₁^L) - S₁^L k₁ f₁^L \right. \\
+ \left. \frac{(f₁^L - λ₁) (S₁^L x' x^L + S₁^L y' y^L) [1 - Z (g₁^L - f₁^L)]}{(g₁^L - f₁^L)} \right] \]

The sign of \( dR₁ \) is unambiguous and negative only if both \( g₁^L > f₁^L \) and
\( f₁^L > λ₁ \). Recall that if \( f₁^L > λ₁ \), then the sign of dt is ambiguous.
Thus, only if \( f₁^K = λ₁ \) and \( f₁^K > g₁^L \) will both dt and \( dR₁ \) have definite
signs. That is,

\[ dt < 0 \]

and

\[ dR₁ < 0 \]
The signs of $dK^1_x$ and $dL^1_x$ are not definite, however, even if these two conditions are satisfied.

In the nontaxing nation the results are also ambiguous. Factors will flow from one industry to the other according to the change in the terms of trade. Just as was $dt < 0$ when $\lambda^1 \geq f^1_K$ and $g^1_K$, it can be shown that

$$dK^2_x < 0,$$

and

$$dL^2_x < 0$$

for $\lambda^1 \geq f^1_K$ and $g^1_K$. Since the price of $X$ falls relative to the price of $Y$ in this case, factors would shift to $Y$ production in the nontaxing nation.

Relative factor price changes in country 2 are even less definite. Solving for $dR^2$ gives

$$dR^2 = \frac{T^1_{Kx}}{Z(g^1_L - f^1_L)(g^2_L - f^2_L)(s^1_{x}y y^1_{L} + s^{1}_{x} K^1 L)}$$

$$\left[-\lambda^1 g^1_X - f^1_L + s^1_{x} K^1 L (g^1_L - f^1_L) + s^{1}_{y} y y^1_{L} (f^1_K - f^1_L)\right].$$

Note that if $\lambda^1 < g^1_K$ or $f^1_K$, the sign of $dR^2$ is indefinite. However, if $\lambda^1 \geq g^1_K$ and $f^1_K$, the sign of $dR^2$ is opposite to the sign of $(g^2_L - f^2_L)$. Capital and labor would shift to $Y$ production in country 2, thereby lowering the relative price of capital if $Y$ is the less capital intense good.

What if both countries employ the same case (9) tax rather than neutral taxes? Do the two taxes have offsetting effects? Again, the
system yields many ambiguous solutions. However, one may conclude that in general the two taxes would not have offsetting effects. It can be shown that if

$$\lambda_i < \frac{f_i}{k}$$

and

$$e_i > \frac{f_i}{L} \quad (i = 1, 2),$$

then

$$dt < 0$$

unambiguously. This result is quite similar to that for a tax in only one country. Again, the tax in the second nation may well augment, rather than offset, the tax in the first nation.

6.3.3 A Tax on Capital Used in Production with Unequal Border Adjustment

Suppose that country 1 employs a tax on all capital used in production and applies unequal border adjustments for the tax. This is a case (10) tax with

$$\tau_1 = \tau_1 = \tau_1 = \tau_1,$$

$$0 < \lambda_1, \theta_1,$$

$$\lambda_1 \neq \theta_1.$$

The exogenous vector is

$$[T] = \begin{bmatrix} -X_{1} E_{X} T_{K}^{l} (\lambda_{1} - \theta_{1}) \\ 0 \\ 0 \\ -S_{X}^{l} T_{K} \\ -S_{X}^{l} T_{K} \\ 0 \\ T_{K} [(e_{1} - f_{1}) + (\theta_{1} - \lambda_{1})] \end{bmatrix}.$$
The system gives unambiguous solutions for all dependent variables except relative factor prices in the taxing nation. The change in the international terms of trade is

\[
\frac{dt}{Z\left(g_{L}^{1} - f_{L}^{1}\right)\left(b_{L}^{1} \cdot g_{L}^{1} + c_{L}^{1} f_{L}^{1}\right)}
\]

\[
\left[\frac{x^{1}E^{1}}{x_{L}^{1} - f_{L}^{1}} \left(g_{L}^{1} - f_{L}^{1}\right) + \frac{y^{1}K^{1}}{y_{L}^{1} \cdot g_{L}^{1} + c^{1} f_{L}^{1}} \right].
\]

The sign of \(dt\) varies directly with the sign of the term \((\theta_{1}^{1} - \lambda_{1}^{1})\). Thus,

\[
dt > 0 \quad \text{for } \theta_{1}^{1} > \lambda_{1}^{1},
\]

and

\[
dt < 0 \quad \text{for } \theta_{1}^{1} < \lambda_{1}^{1}.
\]

The signs of the remaining dependent variables are

\[
dR^{1} = ?;
\]

\[
dK_{x}^{1} \text{ and } dL_{x}^{1} < 0 \quad \text{for } \theta_{1}^{1} > \lambda_{1}^{1};
\]

\[
> 0 \quad \text{for } \theta_{1}^{1} < \lambda_{1}^{1};
\]

\[
dR^{2} > 0 \quad \text{when } (\theta_{1}^{1} - \lambda_{1}^{1}) \text{ and } (g_{L}^{2} - f_{L}^{2}) \text{ have the same sign};
\]

\[
< 0 \quad \text{when } (\theta_{1}^{1} - \lambda_{1}^{1}) \text{ and } (g_{L}^{2} - f_{L}^{2}) \text{ have opposite signs};
\]

\[
dK_{x}^{2} \text{ and } dL_{x}^{2} > 0 \quad \text{for } \theta_{1}^{1} > \lambda_{1}^{1};
\]

\[
< 0 \quad \text{for } \theta_{1}^{1} < \lambda_{1}^{1}.
\]

The differential effects of the tax depend in all determinate cases on the relative values of the adjustment parameters. For example, if the taxing nation adjusts more for its exports than for its imports \((\theta_{1}^{1} < \lambda_{1}^{1})\),
the price of its exportable falls relative to the price of its importable in international markets.

Although the sign of $dR^1$ cannot be determined from the model, the direction of factor movements in country 1, however, can be ascertained. Producers in the taxing nation respond to $dR^1 + T^1_K$, rather than to net changes in relative factor prices. Solving for $dR^1 + T^1_K$ reveals that

$$dR^1 + T^1_K = - \left[ \frac{T^1_K(\beta^1 - \lambda^1)}{Z(S^1_y g^1_L + S^1_x f^1_L)} \right] \left[ \frac{S^2_y g^2_L + S^2_x f^2_L}{(g^2_L - f^2_L)(g^2_L - f^2_L)} \right] + x^2 E^2_x .$$

If both $(\beta^1 - \lambda^1)$ and $(g^1_L - f^1_L)$ have the same sign, then $dR^1 + T^1_K$ is negative. If these expressions have opposite signs, then $dR^1 + T^1_K$ is positive. This can be restated. If relatively more adjustment is made to the price of the more labor intensive good, then $dR^1 + T^1_K$ is negative. If more adjustment is applied to the price of the capital intensive good, then $dR^1 + T^1_K$ is positive.

Substitution of this expression for $dR^1 + T^1_K$ into the subset of equations (4.7a), (4.8a), (4.11a) and (4.12a) and solving for $dK^1_X$ and $dL^1_X$ gives

$$dK^1_X = T^1_K \left[ \frac{f^1_s (S^1_y g^1_L + S^1_x f^1_L)(\lambda^1 - \theta^1)}{Z(g^1_L - f^1_L)(S^1_y g^1_L + S^1_x f^1_L)} \right] \left[ \frac{S^2_y g^2_L + S^2_x f^2_L}{(g^2_L - f^2_L)(g^2_L - f^2_L)} \right] + x^2 E^2_x ,$$

and

$$dL^1_X = T^1_K \left[ \frac{f^1_s (S^1_y g^1_L + S^1_x f^1_L)(\lambda^1 - \theta^1)}{Z(g^1_L - f^1_L)(S^1_y g^1_L + S^1_x f^1_L)} \right] \left[ \frac{S^2_y g^2_L + S^2_x f^2_L}{(g^2_L - f^2_L)(g^2_L - f^2_L)} \right] + x^2 E^2_x .$$
The signs of $dK_x^1$ and $dL_x^1$ are opposite to the sign of the expression $\lambda^1 - \lambda^1$ and, therefore, opposite to the sign of $dt$. Suppose that relatively more adjustment is applied to imports than to exports ($\theta^1 > \lambda^1$), and that the importable is the labor intensive good ($g^1_L > g^1_L$). Since the import surcharge exceeds the export rebate, producers will receive more inclusive of adjustments from sales of $Y$ than from sales of $X$. Thus, they shift resources from $X$ production to $Y$ production. With the fall in the supply of $X$, the relative price of $X$ rises in international markets. Producers of $X$ in country 2 thus shift resources from $Y$ to $X$ production. If $X$ is the capital intensive good in country 2, the relative price of capital rises in order to attract the necessary capital from the $Y$ industry ($dR^2 > 0$).

Consider a particular case of unequal adjustment for a general capital tax. Suppose that the surtax and rebate are equal to the additional cost of the products which is due to the tax. Thus,

$$\lambda^1 = r^1_K,$$

and

$$\theta^1 = g^1_K.$$ 

Assume in addition that these border adjustments are instituted for an already existing general capital tax. This would represent a country's imposing border adjustments for an existing capital tax, either as a result of renegotiation of the GATT or unilaterally. The exogenous vector for this substitution is
\[
[T] = \begin{bmatrix}
X_1E_1 \pi_1 (g_K^1 - f_K^1) \\
0 \\
0 \\
0 \\
0 \\
0 \\
T_K(g_K^1 - f_K^1)
\end{bmatrix}
\]

The solution for the dependent variables gives the following directions of change:

\[
\begin{array}{c|c|c}
\text{\(g_1^1 = g_K^1 > f_K^1 = \lambda^1\)} & & \text{\(g_1^1 = g_K^1 < f_K^1 = \lambda^1\)} \\
\hline
\text{\(d_t\)} & + & - \\
\text{\(dR^1\)} & + & + \\
\text{\(dK_X^1\)} & - & + \\
\text{\(dL_X^1\)} & - & + \\
\text{\(dR^2\)} & + \text{ for } g_L^2 > f_L^2 & - \text{ for } g_L^2 > f_L^2 \\
& - \text{ for } g_L^2 < f_L^2 & + \text{ for } g_L^2 < f_L^2 \\
\text{\(dK_X^2\)} & + & - \\
\text{\(dL_X^2\)} & + & - \\
\end{array}
\]

The results of the substitution are not neutral in accordance with this study's criteria. Since from the earlier analysis we know that a general capital tax without border adjustments changes nothing in real terms, it is not surprising that application of unequal border adjustments for the same tax would be nonneutral. Yet, this adjustment has been proposed. The idea behind the proposal seems to be that if the border adjustment alters the price of a product by the amount of
cost disadvantage induced by the factor tax, then the alleged, tax induced, competitive disadvantages will be eliminated. The model does not support the contention. The proposal would not merely offset disadvantages. It would instead introduce distortions into the economies.

The distortions arise because of the influence of unequal adjustments on demand and consumer behavior. Unequal adjustments change relative prices as seen by consumers and consequently consumer demands. This in turn leads to production changes. Also, the contention implicitly assumes that all of the adjustment accrues to the taxed factor and none to the untaxed factor. Since border adjustments are made to the product's price, and not directly to the taxed factors earnings, both factors, not just the taxed factor, share in the adjustment.

In general, the proposal enhances the relative advantage of the taxing nation in its relatively capital intense good. For example, if the export (X) is relatively capital intense, its greater adjustment \((g^1 < \lambda^1)\) forces down its relative price in international markets. Foreign producers then shift resources to production of Y, while foreign consumers want more X. Producers and consumers in the taxing nation, however, face the price ratio \(dt - T_K(g^1_K - f^1_K)\). It can be shown that the sign of this ratio is always the same as the sign of \((f^1_K - g^1_K)\). Thus, if X is capital intense, domestic producers shift resources to production of X. Domestic consumers, on the other hand, want less X. Finally, this proposed adjustment unambiguously raises the relative return to capital net of the tax in the taxing nation. If this were the object of the policy change, it would be accomplished at the cost of introducing distortions into the system.
Suppose that both countries simultaneously choose to impose case (10) taxes. Will the effects of their actions offset? Assuming that the tax rates and adjustment parameters for the same product are equal, the policies will not offset. The change in the terms of trade is

$$\Delta t = T_k(\theta - \lambda)$$

Again, the tax change would not merely offset.

6.4 Adjustments to the Earnings of Capital

The border adjustments for capital taxes discussed thus far are analogous to border adjustments for product taxes. That is, the adjustment is made to the traded product's price, rather than to the taxed factor's earnings. If it is desired that producers be compensated for competitive disadvantages in international markets induced by factor taxes, then an adjustment to the taxed factor's earnings may appear to be a more effective approach.\(^6\)

One such adjustment has recently been proposed. The 1969 Trade Bill (H.R. 18970) in the United States Congress contained an amendment which proposed that corporate income taxes on profits arising from export sales be postponed so long as the profits are reinvested in export-related activities. This proposal, commonly referred to as the

\[^6\] This is best considered as an adjustment for short run competitive disadvantages since in this model a general capital tax induces no competitive disadvantage. It might also be considered as an attempt to offset the longer run distortions of a tax on capital employed in only one industry or of any capital tax with internationally mobile factors.
DISC, and the entire Trade Bill was rejected by the Congress. Its implications, however, are worthy of interest.

The model can be interpreted to analyze the DISC proposal (case 11). Assume that we are concerned only with taxes on capital's earnings in country 1. Consider initially only the addition of a DISC adjustment for existing capital taxes. This would correspond to the proposed legislation. Note that the DISC adjustment is, in effect, an export subsidy without an accompanying import surcharge. If the adjustment could be applied perfectly, the subsidy per unit of exports would equal the tax rate times the percentage of an export's price which is accounted for by profits.\(^7\) In terms of the model, the percentage of an export's price which accrues to capital in country 1 is

\[ \frac{r_{lK}^{1}}{p_{x}^{1}}. \]

The subsidy per unit of export would be

\[ \frac{T_{Kx}^{1}r_{lK}^{1}}{p_{x}^{1}} = T_{Kx}^{1}r_{lK}^{1}, \]

and the total subsidy would be \( T_{Kx}^{1}r_{lK}^{1}(x - x^{1}) \). The subsidy per unit of capital employed in the exportable industry therefore would be

\[ \frac{T_{Kx}^{1}(x - x^{1})}{K_{x}^{1}} = \frac{T_{Kx}^{1}(x^{1} - x^{1})}{x^{1}} = T_{Kx}^{1}(1 - \frac{x^{1}}{x}). \]

\(^7\)As is well known, the percentage of sales and price which is accounted for by profits is difficult to determine and varies from industry to industry and firm to firm. The DISC proposal recognizing this problem arbitrarily allowed four percent of sales to constitute tax-free income.
In interpreting the model, the effects of a DISC adjustment on the production and consumption relationships is different from a product tax type border adjustment. With the DISC adjustment consumers face no differences between domestic and foreign prices of goods since there are no direct adjustments to product prices. The price of a good is the same to a consumer whether it is produced domestically or in another country. Alternatively, the price of a good is the same to consumers in both countries. Thus, the DISC adjustment does not directly affect demand relationships. There is no adjustment argument in equations (4.1a) and (4.2a) of Chapter IV.

Producers, however, are directly affected. From the producer's point of view, each export sale yields a higher net price than does an import sale since the tax on capital employed in exportable production is postponed. Alternatively, with the DISC adjustment, exportable producers would be willing to accept a lower gross price for the exportable in foreign markets than in domestic markets. The foreign and domestic prices as seen by producers will differ by the amount of the subsidy, or postponed tax, per unit of exports. That is, they differ by an amount equal to \( f_{KX}^1 T_{KX}^1 \) or \( f_{K}^1 T_{K}^1 \), depending on whether the capital tax applies to only one or both industries. This difference is reflected as an argument in the product/factor price relationship depicted by equation (4.5a). For example, since the adjustment is made only for exports, the adjustment enters the equation in the same manner as would an export rebate. Thus, equation (4.5a) becomes

\[
\frac{\Delta t}{\Delta t} = dR_1^1 (g^1_L - f^1_L) + T_{K}^1 (f_{K}^1 - m^1) - T_{K}^1 y K^1,
\]
where $\mu_1 = f_1^L / K$ for the case of perfect adjustment.\(^8\)

The DISC proposal, unlike the product tax type adjustments, would also enter into the factor substitution relationship of industry $X$—equation (4.7a). The subsidy to only capital in the exportable industry would induce a substitution effect in that industry. The subsidy would somewhat offset the capital tax and would induce a higher capital to labor ratio in the $X$ industry than would obtain in its absence. Since there is no subsidy to the $Y$ industry, there is no analogous effect in the $Y$ industry. Entering the subsidy per unit of capital as an argument in equation (4.7a) gives

$$\frac{dK_x^1}{K_x^1} - \frac{dL_x^1}{L_x^1} = -S_x^1 \left[ dR^1 + \frac{T_{Kx}^1}{K_x} - \frac{T_{Lx}^1}{L_x} \right].$$

None of the remaining equations of the model are affected by the DISC adjustment. Similarly, the [D] matrix and its inverse are unchanged.

Assuming that the DISC adjustment is applied to existing capital taxes, the [T] vector becomes for partial capital tax,

$$[T] = \begin{bmatrix}
0 \\
0 \\
0 \\
0 \\
-s_x^1 & 1 & 0 & 0 & 0 \\
T_{Kx}^1 & 0 & 0 & 0 & 0
\end{bmatrix}$$

\(^8\)If the arbitrary DISC adjustment of .04 were employed, the equation would become

$$dt = dR^1(\hat{g}_L^1 - f_L^1) + T_{Kx}^1 f_K^1 - .04 - T_{Kx}^1 f_K^1.$$
With the exception of different tax rates (\(T_K^1\) rather than \(T_K^1\)), the \([T]\) vector would be the same for addition of the DISC to a general capital tax. Solving the model for the effects of the DISC adjustment on the terms of trade gives:

\[
\begin{align*}
\frac{dt}{Z(g_L^1 - f_L^1)(S_y^1 f_L^1 + S_x^1 L^1 f_L^1)} &= -S_x^1 K^1 f_L^1 (1 - \frac{X^1}{x^1}) - \\
&\quad -S_y^1 f_L^1 (L^1 K^1 - S_x^1 L^1 K^1 X^1) 
\end{align*}
\]

which is unambiguously negative.

The signs of the solutions for the remaining variables are

\[
\begin{align*}
\text{d}R^1 &> 0 \quad \text{for} \quad g_L^1 > f_L^1 ; \\
? &\quad \text{for} \quad g_L^1 < f_L^1 ; \\
\text{d}R^2 &< 0 \quad \text{for} \quad g_L^2 > f_L^2 ; \\
\text{d}K^1_x &> 0 \quad \text{for} \quad g_L^1 > f_L^1 ; \\
? &\quad \text{for} \quad g_L^1 < f_L^1 ; \\
\text{d}L^1_x &? \\
\text{d}K^2_x &< 0 ; \\
\text{d}L^2_x &< 0 .
\end{align*}
\]

The signs of relative factor prices and factor flows in the taxing nation are not readily determined from the model. If \(X\) is the capital
intense industry, the introduction of the DISC adjustment induces
capital to flow into the X industry. This flow into the X industry,
together with the subsidy, raises the return to capital relative to
labor's return. If X is the more labor intense industry, however,
the effects on relative factor prices and factor flows cannot be
determined from the reduced form matrix system.

In country 2, the effects are unambiguous. The fall in the
relative price of X induces capital and labor to shift from X to Y
production. If Y is capital intense, the relative return to capital
rises in country 2. The fall in production of X in country 2, com-
bined with the knowledge that demand for X rises in both countries
[as seen in equations (4.1a) and (4.2a)], implies that in equilibrium
production of X must rise in country 1. Thus, despite the ambiguous
solutions of the model, at least one factor must flow from Y to X
production in country 1. It is still not possible, however, to deter-
mine the movements of capital and labor separately. For example, it
is possible that capital could flow into the X industry and labor into
the Y industry. This might happen, for example, if the effect of the
subsidy to capital employed in X production outweighs the effect of
the fall in the relative price of X.

This section thus far has considered only the impact of adding
a DISC adjustment for existing capital taxes, either partial or gen-
eral. The impact of the addition is clearly not neutral in accord-
ance with this study's criteria. If the adjustment is for a general
capital tax, it would introduce distortions into an otherwise distor-
tion-free setting. For a partial capital tax, however, the addition
of the adjustment may offset distortions originally induced by the imposition of the tax itself. To determine this, one must compare the impact of introducing the tax with the impact of adding the adjustment to the tax.\(^9\)

Alternatively, the model may simply be solved for the effects of introducing a tax on capital employed in \(X\) production coupled with a DISC adjustment. The \([T]\) vector for this combination is

\[
[T] = \begin{bmatrix}
0 \\
0 \\
0 \\
-S_{X}^{1}X_{L}^{\frac{1}{1}}X_{L}^{1} \\
0 \\
0 \\
0
\end{bmatrix}
\]

Solving for the change in the terms of trade yields

\[
\frac{dt}{\ell} = -\frac{S_{X}^{1}X_{L}^{\frac{1}{1}}X_{L}^{1}T_{KX}}{Z(S_{X}^{1}X_{L}^{\frac{1}{1}}g_{L}^{1} + S_{X}^{1}X_{L}^{\frac{1}{1}}f_{L}^{1})}.
\]

The sign of \(dt\) is opposite to the sign of \((g_{L}^{1} - f_{L}^{1})\). Thus, if \(X\) is the more capital intense industry, the relative price of \(X\) will fall. Solving for the change in relative factor prices in the taxing nation reveals that

\[\text{\footnotesize 9See section 6.3.1 for the impact of introducing a partial capital tax without an adjustment into the model.}\]
\[ dR^1 = \frac{-s^1_{x}l^1_{x}y^1_{x}L^1_{x}L_{x}^1}{Z(g^1_{L} - g^1_{y})(s^1_{y}y^1_{y}g^1_{y}L_{y}^1 + s^1_{x}x^1_{x}L_{x}^1)}, \]

which is unambiguously negative. Thus, not only does the DISC adjustment fail to neutralize the effects of the partial capital tax on trade (since \( d\tau \) is nonzero), it ensures that the relative price of capital will fall in the taxing nation. In contrast, imposition of this tax without a DISC adjustment has an ambiguous effect on relative factor prices when \( X \) is the more labor intensive industry. Thus, in the context of this model, the DISC adjustment is not only nonneutral, it may also be detrimental to the relative earnings of capital in the taxing nation.  

6.5 Summary

As was the case with product taxes, there is little of a general nature which can be said about the analysis of factor taxes. It is notable that in the context of the model a general capital tax is neutral with or without equal border adjustments for the tax. Indeed, even relative factor prices in the taxing nation are not affected by equal border adjustments for a general capital tax.

\[ ^{10}\text{It can be shown if an analogous adjustment were also applied to the earnings of capital in the Y industry, the adjustments would not be neutral whether applied with a general or a partial capital tax. In addition, it would not simply raise the relative return to capital by the amount of a general capital tax times the percentage of output (or consumption) which enter international trade. Since the DISC does not propose adjustments in both industries, no analysis of this possibility is presented.} \]
Partial capital (or labor) taxes, like partial product taxes, are nonneutral with or without border adjustments. This is true regardless of the size of the adjustment. The larger the adjustment, however, the more likely is a deterioration in the terms of trade for the taxing nation, or alternatively, the less the improvement. In addition, a general capital tax is nonneutral if unequal border adjustments are applied to exports and imports. In this case, the direction of induced changes in consumption and production patterns depend solely on the relative adjustments. No nonneutral tax in one country can be offset by a similar tax in the second country.

The fundamental flaw in proposals to employ product tax type border adjustments for factor taxes is simple. An adjustment to the price of the product will not accrue to only one factor of production. In the model both factors will share in the price increase. Indeed, it is not even necessarily true that the addition of border adjustments to a partial capital tax will raise the relative price received by producers of the taxed industry. The analysis has also shown, however, that a recently proposed subsidy to export earnings is nonneutral and may be detrimental to the relative earnings of capital.

The results of the analysis of taxes, both product and factor, superficially appear inconclusive. Such is not the case on second glance. There are within the context of the model strong implications for the current controversies over the GATT and tax harmonization. The next, and final, chapter summarizes these implications.
CHAPTER VII

Summary of Findings and Policy Implications

7.1 Introduction

This study has concentrated on several variations of three basic proposed changes in domestic tax systems and their application to international transactions. These proposed changes are: that the GATT should be renegotiated to permit border tax adjustments for factor taxes; that the United States should apply border adjustments for certain factor taxes (especially the corporation income tax) with or without renegotiation of the GATT; that nations which are relatively heavy users of factor taxes (especially the United States) would benefit by shifting to product taxes, such as a value added tax.

The historical and conceptual underpinnings of these proposals have been reviewed and in some cases challenged. A neoclassical, two-country, two-factor, two-good, general equilibrium model of international trade has been developed for a theoretical analysis of the proposals. Each variation has been analyzed with regard to its implications for economic efficiency in the world economy. In particular, the analysis has sought to ascertain the effects of the proposed changes in domestic tax systems and the rules for their international treatment with respect to international and domestic production, consumption, and trading patterns.
7.2 Summary of Findings

The study of the background of the GATT revealed that the internal taxation provisions were never intended to define the treatment of domestic tax systems in international transactions. Their purpose was to limit the application of compensating export rebates and import surcharges for selective, domestic excise taxes in order to prevent the subsidization or protection of particular industries. The underlying rationale was entirely in terms of implicit, partial equilibrium analysis. The provisions were not written to apply to factor taxes because such taxes had not been employed for either protection or subsidization. Thus, the GATT provisions were not conceived to be a set of border tax adjustments for domestic tax systems. They were not designed to rectify tax-induced changes in national trade balances. The controversy surrounding these provisions, therefore, appears to center around an empty economic box.

A review of public finance and international trade theory emphasized the similarity of relevant fundamental concepts in these fields. For example, tax incidence and comparative advantage are both affected by tax-induced changes in relative product and factor prices which may not be offset by compensating monetary adjustments. Due to their long run impact on production, consumption, and trading patterns, these relative price changes are likely to be more important than the short run effects of taxes on absolute prices and trade balances. Tax-induced changes in absolute product prices were noted to be an unreliable indicator of either tax shifting or the effects of taxes on trading patterns.
The influence of the benefits from government expenditures was shown to be largely irrelevant and certainly less important from an efficiency viewpoint than has previously been thought.

The review of concepts concluded that the objective of any set of rules for the international treatment of domestic tax systems should be to promote the neutrality of taxes with respect to production, consumption, and trading patterns. One nation should not be permitted by international agreement to improve its position at the expense of other nations. Thus, the rules should permit only border adjustments which would effectively neutralize domestic tax systems. Where this is not possible, nations employing nonneutral tax structures should be encouraged to alter their tax structure so as to eliminate the distortions which they induce.

The theoretical analysis of the various proposals and tax systems found that any general product tax with equal border adjustments for exports and imports is neutral in the long run, static equilibrium context of this study's model. As other analyses have found, a general tax on all products is neutral if levied under either the origin or the destination principle. In addition, a general product tax is neutral if border adjustments are imperfect but equal for both exports and imports. Imposition of any of these three systems would promote optimum production, consumption, and trade patterns. A shift to any of these systems would tend to eliminate any tax-induced distortions resulting from the old tax system.

All partial product taxes are nonneutral regardless of whether they are levied under the destination or the origin principle.
General taxes with unequal adjustments for exports and imports are nonneutral. These taxes induce various effects on production and consumption, depending upon the relative sizes of the adjustments. No nonneutral product tax can be exactly offset by imposition of a similar tax in the second country. It is possible, for example, that such a policy might well worsen the situation resulting from the imposition of the first country's tax.

Imposition of a partial, origin principle tax on commodity X causes the relative price of X to rise inclusive of the tax. Output of X in the nontaxing nation rises, while consumption of X falls in both nations. Output of X in the taxing nation falls, however, since the relative price of X net of the tax, which is the price received by producers, falls. If X is the taxing nations exportable, the imposition of this tax causes production in each country to shift away from the commodity in which it has a comparative advantage. Substitution of a neutral tax structure for a partial, origin principle tax on the exportable would, therefore, tend to increase the exploitation of comparative advantage. On the other hand, if X were the taxing nation's importable, imposition of this tax would increase its relative advantage in its exportables and increase its exports of the exportable. In this case, the level of trade would rise. Although welfare might increase for the taxing nation, it would unambiguously fall for the world. Any gains accruing to an individual nation would be more than offset by the excess burden arising from the
partial tax. The model in this study does not include the loss arising from the excess burden and cannot be used to determine the net gain or loss for an individual nation.

A partial, destination principle tax on X results in a lower relative price, greater consumption, and reduced output of X in the nontaxing nation. In the taxing nation, the relative price of X inclusive of the tax rises, and the tax exclusive price falls. Both consumption and production of X fall. If the rebate for a tax on the exportable is not perfect, the effects of imposition depend on the size of the rebate. The smaller the adjustment, the more nearly the tax has the same results as does an origin principle tax.

Substitution of a neutral tax structure for this tax would increase the exploitation of comparative advantage if X were the taxing nation's exportable. If an origin principle tax on X is converted to the destination principle by applying an export rebate, the relative price of X falls in the nontaxing nation, leading to a decline in output and an increase in consumption. In the taxing nation, consumption falls, but output rises since the rebate to X producers offsets the decline in the relative price of X.

If the tax on products is general, but the adjustments are not equal for exports and imports, the effects of the tax depend on which adjustment is larger. A total of 28 possible equivalent tax schemes arise. However, as long as the degree of adjustment for exports exceeds that for imports, the relative price of the exportable falls in the nontaxing nation. Thus, consumption rises, and production falls in the nontaxing nation. In the taxing nation output of the
exportable rises, and consumption falls since the adjusted relative price of the exportable rises. Merely equalizing the adjustments for exports and imports would reverse these distortions and result in a neutral tax scheme.

The solutions of the model for factor taxes were much the same. A tax on all capital used in production is neutral with respect to real consumption and production. The same tax with equal border adjustments for both exports and imports is also neutral. The only effect of either tax is to reduce the return to capital relative to the return to labor by the amount of the tax. Relative product prices are invariant under either tax. If the rebate is not equal to the surcharge, however, distortions arise. No partial factor taxes are neutral, with or without border adjustment. The effect of a non-neutral tax in one country is not likely to be offset by a similar tax in the second country. Indeed, the effects of the two taxes would probably augment rather than offset.

Since a general tax on all capital has the same effects whether it is levied with equal or with no border adjustments, the addition of border adjustments for a general capital tax would have no real effect on trade. Substitution of a general product tax for a general capital tax, however, would raise the return to capital relative to labor. Retaliatory action by another nation involving a general capital tax with equal border adjustments would have no effect other than to lower the relative earnings of capital in that nation by the amount of the tax.
Imposition of a tax on only capital used in production of X has much the same effects as does an origin principle product tax on X. The relative price of X rises, but production of X falls in the taxing nation due to the influence of the tax on capital faced by X producers. Output of X rises in the nontaxing nation. Consumption of X falls in both nations. These effects would be heightened, rather than offset, if a trading partner imposed a similar tax. Substitution of any general product or capital tax would reverse and neutralize the real distortions in the system.

If the same partial capital tax were imposed and a border adjustment applied, the results are largely ambiguous. In general, the effects depend on the size of the adjustment relative to the size of initial factor intensities in each industry. However, if a border adjustment is applied for an already existing tax on capital used in X production, the results are unambiguous. Granting the rebate tends to offset the effect of the tax itself. The relative price of X falls to producers and consumers in the nontaxing nation, causing output of X to fall and consumption of X to increase. The rebate reverses this effect in the taxing nation, and consumption falls while output rises. Although the rebate reverses the effects of the tax, it does not neutralize them.

A general capital tax with unequal border adjustments is not neutral. The induced distortions in factor allocation and consumption depend primarily on the relative sizes of the adjustments. For example, if surtaxes and rebates are applied for an existing tax,
and if they are set equal to the (unequal) additional costs of the product resulting from the tax, the adjustments would introduce distortions into the system. Merely equalizing the adjustments would eliminate the distortions.

Finally, the proposal to postpone taxes on the earnings of capital employed in production of the exportable when the earnings arise from export sales, is not neutral. The conclusion holds for both general and partial capital taxes. Even worse, it is not clear that the proposal would raise the relative return to capital.

7.3 Implications for Public Policy

7.3.1 A Caveat

It is perhaps worthwhile that an analysis of the sort employed in this study be accompanied by a precautionary caveat. No theoretical analysis can include all of the factors which are relevant to a particular issue. The present model is no exception. Some of the more important limitations of the analysis should be clearly understood before policy implications are stated.  

The analysis adapts and applies the traditional international trade theory model to a current policy problem. Consequently, it involves all of the well-known limitations inherent in that model. The model is neoclassical and at best imperfectly descriptive of a world in which competition is seldom perfect and prices are not completely

---

1 This caveat is in no sense an apology for shortcomings of the analysis. It is rather a recognition of several important factors which could modify the results of the analysis, which deserve additional research, and which were beyond the scope of this study.
flexible. The assumptions concerning factor mobility are open to question. No consideration is given to flows of financial capital—it is an international trade model and not an international finance model. In addition, a comparative statics model ignores the adjustment path by which an economy moves from one equilibrium position to another. The effects of savings and investment are not included. Thus, the model sheds no light upon the growth and development of an economy. The labor/leisure choice is not included. Tax policy can both affect these factors and be affected by them.

The taxes of the model themselves are not always readily equated to real world taxes. For example, it is not apparent that a corporate income tax could be represented by either a general or partial capital tax in the model. To apply these with certainly would require knowledge, not only of the relative capital intensity of exportables and importables, but also of the percentage of incorporated capital used in production of the two goods. A similar problem arises when services as well as goods are considered. A partial product tax in the model might approximate a value added or sales tax which does not apply to services, whereas a general tax in the model might better depict a tax which does apply to services. Also, the two-good approach has no provision for non-traded goods. The inclusion of a third good would surely modify at least the magnitude, if not the signs, of many of the results of the analysis. Also, real world taxes are seldom imposed only on either exportables or

---

2Even if absolute prices were rigid downward, the relative prices in the model could still be flexible. Also, over time, differing rates of inflation between nations is quite consistent with an assumption of flexible prices. The results of the analysis are, of course, completely applicable to a world of flexible exchange rates.
importables, or on all products equally. Factor taxes are seldom imposed on factors employed in only one industry. An obvious empirical question, which this analysis makes no attempt to answer, is whether a given tax, such as the corporation income tax, or border adjustment applies more heavily to exportables or importables.

Finally, the assumptions of the model overlook the immediate impacts of changes in tax policy which have given rise to some of the proposals studied. For example, under fixed exchange rates temporary disequilibria do develop in nations' current accounts, but do not in the present analysis. These effects probably deserve additional study. However, this analysis rejects the notion that fundamental changes in tax structures or the rules for their international treatment should be based on short run balance of payments effects. It is assumed that such changes should be evaluated on welfare and efficiency grounds.

The same simplicity which gives rise to most of these problems is perhaps the signal advantage of the analysis. Indeed, if a tax system creates distortions in this model's setting, it is not likely to be neutral in a more complicated setting. In addition, no complication which might reasonably be expected is likely to offset entirely the tendencies described by the analysis. Thus, with the caveat that inclusion of even the simplest additional factors could alter at least the magnitude of many of the conclusions, it seems reasonable to apply the results of the analysis to the current controversies.
7.3.2 Implications for Public Policy

The implications of this study for public policy divide into two areas. First, there are the implications for the proposals that the United States should undertake various corrective actions to eliminate the alleged trade disadvantage resulting from its use of the nonrebatable corporation income tax. Second, there are implications for proposals that the GATT be renegotiated.

Consider the proposal that the United States apply border adjustments for the corporation income tax, either unilaterally or as a result of GATT renegotiation. If this tax were represented in the model by a general capital tax without border adjustments, nothing would be changed by the application of equal adjustments in this long run, static equilibrium context. Substitution between the two taxes in the model changes nothing. Capital's earnings (relative to labor) would not be increased by the adjustment. Thus, the model does not support contentions that the application of border adjustments for this tax would rectify the alleged disadvantage of U. S. producers arising from the tax.

If the adjustments for a general capital tax were keyed to tax-induced additional costs, however, and rebates and surcharges were not equal, then the relative earnings of capital would increase with the addition of border adjustments. To the extent that U. S. producers and capital owners represent the same group, the relative disadvantage would be relieved. However, it would be relieved at the cost of introducing distortions into the economy solely because
of the addition of the unequal border adjustments. If the usual assumption that U. S. exports are relatively capital intensive is correct, then production of exportables would increase. If exports were relatively labor intensive, the opposite results would obtain.

If the corporation income tax is better represented by a partial tax on capital used in X production, the application of border adjustments would result in increased output of X. It would not, however, necessarily improve the relative earnings of capital. If the taxed industry is relatively labor intense, the earnings of capital relative to labor's earnings would fall. Thus, in the absence of knowledge about the relative capital intensity of exportables and importables, the imposition of border adjustments might adversely affect the relative earnings of capital. The policy could have effects exactly opposite to those desired. In any case, the addition of the rebate would not eliminate the distortions induced by this tax. With or without border adjustments, this tax is not neutral with respect to real consumption, production, and trade patterns.

What are the implications of the analysis for suggestions that the United States substitute a general value added tax for the corporation income tax? Replacing any of the factor tax systems of the model with a general product tax, under the origin or the destination principle, either would not distort an existing neutrality or it would reduce existing distortions. Also, it would probably have the desired effect of raising the relative return to capital.
However, since the corporation income tax is surely better represented by a partial capital tax in the model, is it possible that the relative return to capital could fall. Nevertheless, even in this case the substitution would tend to eliminate distortions resulting from the tax structure.

Either the application of border adjustments or the shift to a destination principle general product tax would almost certainly result in some short run advantage for the United States' balance of payments. There would be a short run tendency for the price of American exports to fall relative to their foreign competition and for the price of American imports to rise relative to their domestic competition. Alternatively, the absolute return to American capital might rise relative to foreign capital.

From the point of view of the United States, therefore, a shift to a destination principle, general value added tax is probably the more advantageous policy change under the existing GATT provisions. It would provide short run effects similar to those resulting from the application of border adjustments for the corporation income tax. In addition, it is more likely to raise the relative return to capital. It would eliminate tax-induced distortions, whereas some of the cases of border adjustments for capital taxes would not promote neutrality.

Consider the proposal that the GATT should be renegotiated. It is not desirable to restrict our attention to only renegotiation to permit border adjustments for factor taxes. The probe into the GATT's background indicated clearly that the provisions as currently written constitute a set of adjustments for domestic tax systems
not by intent, but only by default and only because their original purposes have been forgotten or overlooked. Any renegotiation should consider a range of alternative provisions which would truly constitute an adjustment for domestic tax systems and which should be written so as to promote neutrality of domestic tax systems with regard to consumption, production, and trade. From this aspect, the results of the analysis have considerable significance.

Perhaps the most important result of the analysis is that border adjustments do not promote neutrality in the context of this model. Ignoring all second best considerations, the model implies that not even one tax which is nonneutral in the absence of border adjustments is neutral if levied with border adjustments. In most cases, consumption patterns and factor allocation differ between a tax with border adjustments and the same tax without adjustments, but the addition of adjustments does not eliminate distortions—it merely changes them. This implies that the proposed changes to the GATT itself would not promote neutrality. Indeed, to permit border adjustments for factor taxes, in particular the corporate income tax, would be more likely to foster continued use of the same tax but with border adjustments. Thus, to the extent that the corporate income tax is represented by a partial capital tax in the model, this proposed change in the GATT would permit border adjustments for a non-neutral tax and probably perpetuate its use and its distorting effects.

One overriding implication arises from the analysis. It is the basic structure of a nation's tax system which may lead to distortions. To reiterate, the application of border adjustments does not eliminate
the effects on production, consumption, and trade patterns of a non-neutral tax system in either the domestic or the international economy. Thus, it makes little sense in the context of this study to codify or sanction their use. If there is a valid justification for use of border adjustments, it must be based upon either extremely short run considerations or on their implications for growth and development in the much longer run. 3

Based on the static equilibrium context of this study, one must conclude that any change in the existing GATT provisions might be directed toward eliminating permanent border adjustments for domestic

---

3 One might contend, for example, that in the short run a general product tax levied under the destination principle would lead to fewer transitional changes than would the same tax under the origin principle. Price, wage, profit, and employment adjustments might be dampened, if not eliminated.

This argument can also apply to tax substitutions. For example, there has been concern that a country might substitute general, rebatable taxes for general, nonrebatable taxes in order to gain a short run advantage in its trade account. A general value added tax might be substituted for both a corporation profits tax and a payroll tax, such as a social security tax. Indeed, such a substitution probably would involve a short run advantage, but it would not necessarily be acceptable in accordance with the criteria of this study. If both the profits tax and the payrolls tax were general, they would be roughly equivalent to a value added tax, and little or no improvement in efficiency would result from the substitution. If, however, either or both taxes were not general (for example, the profits tax were represented by $T_{Kx}$ in the model) then the substitution would be acceptable since it would probably improve economic efficiency. See the comments in the text concerning possible short run uses of border adjustments.

A somewhat different argument is that variable border adjustments could be employed, independent of tax changes, as a substitute for exchange rate variations for combating balance of payments problems. The criteria of this study has explicitly rejected such use of border adjustments. The efficiency implications of such a policy with taxes that are not completely general could be undesirable. In addition, the proposal ignores the capital account which is frequently the more important aspect of many nations' balance of payments difficulties.
tax systems, with the possible exception of isolated excise taxes which would not have repercussions in other markets. In addition, no impelling arguments arise from this model for any new schemes dealing with the international treatment of domestic tax systems. The analysis implies, therefore, that any attempt to renegotiate the GATT could begin by noting the misuse and misinterpretation of the existing provisions. It should seek to limit border tax adjustments to selective excises which affect only a few and isolated industries. Border adjustments for all broadly based taxes should be eliminated since they accomplish nothing in a long run static equilibrium context, and since they provide a tempting and possibly distorting relief from short run balance of payments difficulties. Nor should adjustments be permitted for numerous excises which are in effect broadly based product taxes. The precise approach to altering existing provisions must be based on other (probably short run) considerations, but a gradual phasing out of border adjustments over time would doubtless be the most which would be politically feasible. This suggests, for example, that a ceiling on existing border adjustments which gradually falls to zero would be a supportable policy proposal. This proposal means that existing, broadly based product taxes would be converted over time to the origin principle and that there would continue to be no adjustments for factor taxes.

If, however, it is deemed desirable to adjust also for alleged short run trade disadvantages, the proposal could be expanded to include temporary and automatically declining adjustments for subsequent impositions of new taxes, rate increases in existing taxes, and substitutions
between taxes. If such adjustments were employed, they should be limited to the expected (or observed) change in absolute prices resulting from the tax change and should be reduced periodically until no adjustment is applied. In practice this would be applied primarily to rate increases or impositions of new factor and product taxes and substitutions between factor and product taxes for which absolute price effects were expected or observed.⁴

This proposal might lead to a more sensible approach to the problem. Individual nations could adopt whatever taxation policies are desirable from domestic considerations. Faced with a provision such as just proposed, nations should find it advantageous to adopt neutral tax structures, but would have the temporary use of border adjustments to buffer short run effects not included in this model. If the temporary effects persist past the period of time permitted for border adjustments, other policy variables, such as the exchange rate, are available to correct trade imbalances. This approach would recognize the inappropriateness of using tax changes for short run balance of payments objectives. Domestic taxation policies could be more effectively employed to achieve other goals, such as efficient resource allocation, full employment, or a desired income distribution.

⁴Since destination principle product taxes would be eliminated by the falling ceiling on existing taxes, there would be no question of future substitutions involving a destination principle tax, and all new product taxes would eventually be levied under the origin principle.
7.4 Suggestions for Additional Research

The results and technique of this study's analysis suggest several areas in which additional research should be fruitful. Perhaps the most obvious is the effect of the various tax schemes and their international treatment on the flows of factors between nations. The results of the factor tax analysis, for example, indicate that a general capital tax is borne exclusively by capital in the taxing nation. Its reduced return relative to that of labor suggests that such a tax would provide a significant incentive for capital to flow to a nation with a lower tax rate even in a world of flexible absolute prices or exchange rates. Unless certain additional assumptions are made concerning factor flows and their response to international price differences, the model developed in this study is underdetermined with internationally mobile factors.

Another important area deserving additional research is the effect of tax changes and structures on the relative rates of growth of factors. This should reveal new knowledge about how trade patterns change over time. For example, if all factors grow at the same rate, then relative factor endowments would not change and would not alter the pattern of comparative advantage. The model's results, however, indicate that different rates of capital taxes would alter relative returns to capital between nations and might therefore be expected to affect relative growth rates. Closely related to this would be additional work into the effects of taxes on investment goods and the absence of taxes on leisure. The addition of third goods to the analysis would doubtless alter the magnitude, if not the direction,
of tax-induced changes in the patterns of production, consumption, and trade.

Other possible areas for additional study should include the effects of competitive imperfections in the economies and the existence of economies of scale in production, as might be expected in developing economies. Finally, there is at least one area of research which has been pursued and which the model indicates is not relevant. That is, the ratio of tax burdens to gross national product for any particular nation appears to be a spurious measure of the impact of a nation's tax structure on its trade. In the context of this model it is of no importance.

Finally, the model developed in this study is applicable to numerous areas other than the GATT provisions. It can be adapted to the analysis of international tax incidence, for example, in the field of public finance. Similarly, it can be used to investigate more thoroughly the effects of alternative taxes on comparative advantage, welfare gains and losses for the two countries, and taxes as a basis of trade. The range of unasked or unanswered questions in the area of international effects of national taxes is quite broad. The model in this study provides one technique of analysis for many of these questions.
APPENDIX

The matrix \([D]\) was inverted by performing a series of elementary column operations. Where convenient certain terms have been grouped together in order to simplify the expressions for the elements of the inverted matrix. The following definitions and solutions have been useful:

\[
E = x^2 E^2_x + x^2 E^2_x
\]

\[
Z = \frac{1}{g_L - f_L^1} + \left[ \frac{g_L - f_L^1}{(g_L - f_L^1)(g_L - f_L^2)} \right] \left[ \frac{2 K^2}{y^2 g_L} + \frac{2 K^2}{x^2 L} \right] + \left[ \frac{1}{g_L - f_L^1} \right] \left[ \frac{1,1,1}{y^2 g_L} + \frac{1,1,1}{x^2 L} \right]
\]

\[
1 - Z (g_L - f_L^1) = -\frac{(g_L - f_L^1)(g_L - f_L^2)}{(g_L - f_L^2)(g_L - f_L^2)} \left[ \frac{2 K^2}{y^2 g_L} + \frac{2 K^2}{x^2 L} \right] - \left[ \frac{1}{g_L - f_L^1} \right] \left[ \frac{1,1,1}{y^2 g_L} + \frac{1,1,1}{x^2 L} \right]
\]

\[
\frac{1}{Z} = \frac{(g_L - f_L^1)(g_L - f_L^1)(g_L - f_L^2)(g_L - f_L^2)}{(g_L - f_L^2)(g_L - f_L^2)(x^1,1,1/L} + \frac{1,1,1}{y^2 g_L} + \frac{1,1,1}{x^2 L} \right) + E \frac{(g_L - f_L^1)(g_L - f_L^1)}{(g_L - f_L^1)(g_L - f_L^2)} (g_L - f_L^2)
\]

The elements of the inverted matrix, \([D]^{-1}\), are presented in the following seven pages. Each page contains the seven elements of one column of the inverse. The elements of columns 1, 4, 5, and 7 have been somewhat more simplified than the elements of columns 2, 3, and 6, since they were used more frequently.
<table>
<thead>
<tr>
<th>Row</th>
<th>Element</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>(\frac{1}{Z(g_{L}^{1}-f_{L}^{1})}\left[\frac{(g_{L}^{1}-f_{L}^{1})(g_{L}^{1}-f_{L}^{1})(s_{y}^{2}g_{y}^{2}f_{L}^{2} + s_{x}^{2}g_{x}^{2}f_{L}^{2})}{(g_{L}^{2}-f_{L}^{2})(g_{L}^{2}-f_{L}^{2})(s_{y}^{1}g_{y}^{1} + s_{x}^{1}g_{x}^{1})}\right])</td>
</tr>
<tr>
<td>2</td>
<td>(\frac{1}{Z(g_{L}^{1}-f_{L}^{1})}\left[\frac{(g_{L}^{1}-f_{L}^{1})(g_{L}^{1}-f_{L}^{1})(s_{y}^{2}g_{y}^{2}f_{L}^{2} + s_{x}^{2}g_{x}^{2}f_{L}^{2})}{(g_{L}^{2}-f_{L}^{2})(g_{L}^{2}-f_{L}^{2})(s_{y}^{1}g_{y}^{1} + s_{x}^{1}g_{x}^{1})}\right])</td>
</tr>
<tr>
<td>3</td>
<td>(\frac{1}{Z(g_{L}^{1}-f_{L}^{1})}\left[\frac{-s_{y}^{1}g_{y}^{1}f_{L}^{1} - s_{x}^{1}g_{x}^{1}f_{L}^{1}}{-s_{y}^{1}g_{y}^{1}f_{L}^{1} - s_{x}^{1}g_{x}^{1}f_{L}^{1}}\right])</td>
</tr>
<tr>
<td>4</td>
<td>(\frac{1}{Z(g_{L}^{1}-f_{L}^{1})}\left[\frac{-s_{x}^{1}g_{x}^{1}f_{L}^{1} - s_{x}^{1}g_{x}^{1}f_{L}^{1}}{-s_{x}^{1}g_{x}^{1}f_{L}^{1} - s_{x}^{1}g_{x}^{1}f_{L}^{1}}\right])</td>
</tr>
<tr>
<td>5</td>
<td>(\frac{g_{L}^{1}-f_{L}^{1}}{Z(g_{L}^{2}-f_{L}^{2})(s_{y}^{1}g_{y}^{1} + s_{x}^{1}g_{x}^{1})})</td>
</tr>
<tr>
<td>6</td>
<td>(\frac{1}{Z(s_{y}^{1}g_{y}^{1} + s_{x}^{1}g_{x}^{1})})</td>
</tr>
<tr>
<td>7</td>
<td>(\frac{1}{Z(s_{y}^{1}g_{y}^{1} + s_{x}^{1}g_{x}^{1})})</td>
</tr>
</tbody>
</table>
\[
\begin{align*}
(1) & \quad \frac{K^2_{xL} \cdot f^2_{L}}{Z(g^2_{L} - f^2_{L})} \left[ -z(g^2_{L} - f^2_{L}) \left( s_{y}^1 k_{y}^1 g_{L} + s_{x}^1 k_{x}^1 f_{L} \right) - Ef^2_{L}(g^1_{L} - f^1_{L})(g^2_{L} - f^2_{L}) \right] + \\
& \quad \frac{(g^1_{L} - f^1_{L})(s_{y}^1 k_{y}^1 g_{L})}{(g^2_{L} - f^2_{L})(s_{y}^1 k_{y}^1 g_{L} + s_{x}^1 k_{x}^1 f_{L})} - \frac{f^2_{L}}{(g^1_{L} - f^1_{L})} \\
(2) & \quad \frac{K^2_{xL} \cdot f^2_{L}}{Z(g^2_{L} - f^2_{L})} \left[ z(g^2_{L} - f^2_{L}) \left( s_{y}^1 k_{y}^1 g_{L} + s_{x}^1 k_{x}^1 f_{L} \right) - Ef^2_{L}(g^1_{L} - f^1_{L})(g^2_{L} - f^2_{L}) \right] - \\
& \quad \frac{(g^1_{L} - f^1_{L})(s_{y}^1 k_{y}^1 g_{L})}{(g^2_{L} - f^2_{L})(s_{y}^1 k_{y}^1 g_{L} + s_{x}^1 k_{x}^1 f_{L})} - \frac{f^2_{L}}{(g^1_{L} - f^1_{L})} \\
(3) & \quad \frac{K^2_{xL} \cdot f^2_{L}}{Z(g^2_{L} - f^2_{L})} \left[ \frac{s_{y}^1 k_{y}^1 f_{L}^1 g_{L} + s_{x}^1 k_{x}^1 f_{L}^1 g_{L}}{(g^1_{L} - f^1_{L})(s_{y}^1 k_{y}^1 g_{L} + s_{x}^1 k_{x}^1 f_{L})} \right] \\
(4) & \quad \frac{K^2_{xL} \cdot f^2_{L}}{Z(g^2_{L} - f^2_{L})} \left[ \frac{s_{x}^1 f_{L}^1 g_{L} + s_{y}^1 k_{y}^1 f_{L}^1 g_{L}}{(g^1_{L} - f^1_{L})(s_{y}^1 k_{y}^1 g_{L} + s_{x}^1 k_{x}^1 f_{L})} \right] \\
(5) & \quad \frac{K^2_{xL} \cdot f^2_{L}(g^1_{L} - f^1_{L})}{Z(g^2_{L} - f^2_{L})(g^2_{L} - f^2_{L})(s_{y}^1 k_{y}^1 g_{L} + s_{x}^1 k_{x}^1 f_{L})} \\
(6) & \quad \frac{K^2_{xL} \cdot f^2_{L}}{Z(g^2_{L} - f^2_{L})(s_{y}^1 k_{y}^1 g_{L} + s_{x}^1 k_{x}^1 f_{L})} \\
(7) & \quad \frac{K^2_{xL} \cdot f^2_{L}(g^1_{L} - f^1_{L})}{Z(g^2_{L} - f^2_{L})(s_{y}^1 k_{y}^1 g_{L} + s_{x}^1 k_{x}^1 f_{L})}
\end{align*}
\]
\[
\begin{align*}
\text{Row} & & \text{Element} \\
1 & & \frac{K_{S_{L}}^{2} S_{L}^{1-f_{L}^{1}}}{Z(g_{L}^{2-f_{L}^{2}})} \left[ -\frac{E f_{L}^{2}(g_{L}^{1-f_{L}^{1}}(g_{L}^{1-f_{L}^{1}})(g_{L}^{1-f_{L}^{1}})(g_{L}^{1-f_{L}^{1}})(g_{L}^{1-f_{L}^{1}})}{x x L} + \frac{S_{x}^{2} K_{L}^{2} f_{L}^{2} (g_{L}^{1-f_{L}^{1}})}{x x L} \right] - \frac{f_{L}^{2}}{g_{L}^{1-f_{L}^{1}}} \\
2 & & \frac{K_{y y L}^{2}}{Z(g_{L}^{2-f_{L}^{2}})} \left[ -\frac{E f_{L}^{2}(g_{L}^{1-f_{L}^{1}})(g_{L}^{1-f_{L}^{1}})}{y y L} - \frac{S_{x}^{2} K_{L}^{2} f_{L}^{2} (g_{L}^{1-f_{L}^{1}})}{x x L} \right] - \frac{f_{L}^{2}}{g_{L}^{1-f_{L}^{1}}} \\
3 & & \frac{K_{y y L}^{2}}{Z(g_{L}^{2-f_{L}^{2}})} \left[ \frac{S_{y}^{1} K_{L}^{1} g_{L}^{1-f_{L}^{1}}}{y y L} \right] \left[ \frac{S_{y}^{1} K_{L}^{1} g_{L}^{1-f_{L}^{1}}}{y y L} + \frac{S_{x}^{1} K_{L}^{1} f_{L}^{1}}{x x L} \right] \\
4 & & \frac{\frac{S_{x}^{1} K_{L}^{1} f_{L}^{1}}{y y L} + \frac{S_{y}^{1} K_{L}^{1} g_{L}^{1-f_{L}^{1}}}{y y L}}{x x L} \left[ \frac{S_{y}^{1} K_{L}^{1} g_{L}^{1-f_{L}^{1}}}{y y L} + \frac{S_{x}^{1} K_{L}^{1} f_{L}^{1}}{x x L} \right] \\
5 & & \frac{K_{y y L}^{2} (g_{L}^{1-f_{L}^{1}})}{Z(g_{L}^{2-f_{L}^{2}})(g_{L}^{2-f_{L}^{2}})} \left[ \frac{S_{y}^{1} K_{L}^{1} g_{L}^{1-f_{L}^{1}}}{y y L} + \frac{S_{x}^{1} K_{L}^{1} f_{L}^{1}}{x x L} \right] \\
6 & & \frac{K_{y y L}^{2}}{Z(g_{L}^{2-f_{L}^{2}})} \left[ \frac{S_{y}^{1} K_{L}^{1} g_{L}^{1-f_{L}^{1}}}{y y L} + \frac{S_{x}^{1} K_{L}^{1} f_{L}^{1}}{x x L} \right] \\
7 & & \frac{K_{y y L}^{2} (g_{L}^{1-f_{L}^{1}})}{Z(g_{L}^{2-f_{L}^{2}})(g_{L}^{2-f_{L}^{2}})} \left[ \frac{S_{y}^{1} K_{L}^{1} g_{L}^{1-f_{L}^{1}}}{y y L} + \frac{S_{x}^{1} K_{L}^{1} f_{L}^{1}}{x x L} \right]
\end{align*}
\]
\[ \begin{align*}
\text{(1)} & \quad \frac{K_{xL}^{1} f_{L}^{2} g_{L}^{2} (s_{y}^{2} K_{y}^{2} + s_{x}^{2} K_{x}^{2})}{z(g_{L}^{2} - f_{L}^{2}) (g_{L}^{2} - f_{L}^{2}) (s_{x}^{2} K_{x}^{1} s_{y}^{1} g_{L}^{1} + s_{x}^{1} K_{x}^{1} f_{L}^{1})} \\
\text{(2)} & \quad \frac{K_{xL}^{1} f_{L}^{2} (s_{y}^{2} K_{y}^{2} g_{L}^{2} + s_{x}^{2} K_{x}^{2} f_{L}^{2})}{z(g_{L}^{2} - f_{L}^{2}) (g_{L}^{2} - f_{L}^{2}) (s_{y}^{2} K_{y}^{1} s_{x}^{1} g_{L}^{1} + s_{x}^{1} K_{x}^{1} f_{L}^{1})} \\
\text{(3)} & \quad \frac{K_{xL}^{1} f_{L}^{2} f_{L}^{1}}{g_{L}^{2} - f_{L}^{2}} \left[ \frac{1}{z(g_{L}^{2} - f_{L}^{2})} - \frac{1}{z(g_{L}^{2} - f_{L}^{2})} \right] - \frac{K_{xL}^{1} f_{L}^{2}}{z(g_{L}^{2} - f_{L}^{2})} (-s_{x}^{1} K_{x}^{1} f_{L}^{1} - s_{y}^{1} K_{y}^{1} f_{L}^{1}) \\
\text{(4)} & \quad \frac{K_{xL}^{1} f_{L}^{2} f_{L}^{1}}{g_{L}^{2} - f_{L}^{2}} \left[ \frac{1}{z(g_{L}^{2} - f_{L}^{2})} - \frac{1}{z(g_{L}^{2} - f_{L}^{2})} \right] + \frac{K_{xL}^{1} f_{L}^{2}}{z(g_{L}^{2} - f_{L}^{2})} (-s_{x}^{1} K_{x}^{1} f_{L}^{1} - s_{y}^{1} K_{y}^{1} f_{L}^{1}) \\
\text{(5)} & \quad \frac{+K_{xL}^{1} f_{L}^{2}}{z(g_{L}^{2} - f_{L}^{2}) (+s_{y}^{1} K_{y}^{1} f_{L}^{1} + s_{x}^{1} K_{x}^{1} f_{L}^{1})} \\
\text{(6)} & \quad \frac{+K_{xL}^{1} f_{L}^{2}}{z(g_{L}^{2} - f_{L}^{2}) (+s_{y}^{1} K_{y}^{1} f_{L}^{1} + s_{x}^{1} K_{x}^{1} f_{L}^{1})} \\
\text{(7)} & \quad \frac{+K_{xL}^{1} f_{L}^{2}}{z(s_{y}^{1} K_{y}^{1} f_{L}^{1} + s_{x}^{1} K_{x}^{1} f_{L}^{1})} \\
\end{align*} \]
Row | Element
--- | ---
1 | \[
\frac{k_{y}^{1.1}k_{x}^{2.2}k_{L}^{1.2}}{z(g_{L}^{2.2} - f_{L}^{2.2})(g_{L}^{2.2} - f_{L}^{2.2})(s_{y}^{1.1}k_{y}^{1.1} + s_{x}^{1.1}k_{x}^{1.1})} \left[ s_{y}^{2}k_{y}^{2} + s_{x}^{2}k_{x}^{2} \right]
\]
2 | \[
\frac{k_{y}^{1.1}k_{L}^{1.1}}{z(g_{L}^{2.2} - f_{L}^{2.2})(g_{L}^{2.2} - f_{L}^{2.2})(s_{y}^{1.1}k_{y}^{1.1} + s_{x}^{1.1}k_{x}^{1.1})} \left[ s_{y}^{2}k_{y}^{2}g_{L}^{2} + s_{x}^{2}k_{x}^{2}g_{L}^{2} \right]
\]
3 | \[
\frac{k_{y}^{1.1}k_{L}^{1.1}}{z(g_{L}^{1.1} - f_{L}^{1.1})(g_{L}^{1.1} - f_{L}^{1.1})} \left[ 1 - z(g_{L}^{1.1} - f_{L}^{1.1}) \right] + \frac{s_{x}^{1.1}k_{x}^{1.1}}{z(g_{L}^{1.1} - f_{L}^{1.1})(+s_{y}^{1.1}k_{y}^{1.1}+s_{x}^{1.1}k_{x}^{1.1})} \left[ \frac{k_{y}^{1.1}}{z(g_{L}^{1.1} - f_{L}^{1.1})(+s_{y}^{1.1}k_{y}^{1.1}+s_{x}^{1.1}k_{x}^{1.1})} \right]
\]
4 | \[
\frac{k_{y}^{1.1}k_{L}^{1.1}}{z(g_{L}^{1.1} - f_{L}^{1.1})(g_{L}^{1.1} - f_{L}^{1.1})} \left[ 1 - z(g_{L}^{1.1} - f_{L}^{1.1}) \right] - \frac{s_{x}^{1.1}k_{x}^{1.1}}{z(g_{L}^{1.1} - f_{L}^{1.1})(+s_{y}^{1.1}k_{y}^{1.1}+s_{x}^{1.1}k_{x}^{1.1})} \left[ \frac{k_{y}^{1.1}}{z(g_{L}^{1.1} - f_{L}^{1.1})(+s_{y}^{1.1}k_{y}^{1.1}+s_{x}^{1.1}k_{x}^{1.1})} \right]
\]
5 | \[
\frac{s_{y}^{1.1}k_{y}^{1.1}k_{L}^{1.1}}{z(g_{L}^{2.2} - f_{L}^{2.2})(s_{y}^{1.1}k_{y}^{1.1} + s_{x}^{1.1}k_{x}^{1.1})}
\]
6 | \[
\frac{s_{y}^{1.1}k_{y}^{1.1}}{z(g_{L}^{1.1} - f_{L}^{1.1})(s_{y}^{1.1}k_{y}^{1.1} + s_{x}^{1.1}k_{x}^{1.1})}
\]
7 | \[
\frac{k_{y}^{1.1}}{z(s_{y}^{1.1}k_{y}^{1.1} + s_{x}^{1.1}k_{x}^{1.1})}
\]
Row | Element
--- | ---
1 | $\left[ \frac{-s_{y}^{2}k_{y}^{2}f_{y}^{2} - s_{x}^{2}k_{x}^{2}f_{x}^{2}}{z(g_{L}^{-2}f_{L}^{2})(g_{L}^{-2}f_{L}^{2})} \right] \left[ \frac{E(g_{L}^{-1}f_{L}^{1})(g_{L}^{-1}f_{L}^{1}) + s_{y}^{1}k_{y}^{1}g_{y}^{1} + s_{x}^{1}k_{x}^{1}f_{x}^{1}}{(s_{y}^{1}k_{y}^{1}g_{y}^{1} + s_{x}^{1}k_{x}^{1}f_{x}^{1})(g_{L}^{-1}f_{L}^{1})} \right]$
2 | $\left[ \frac{-s_{y}^{2}k_{y}^{2}f_{y}^{2} - s_{x}^{2}k_{x}^{2}f_{x}^{2}}{z(g_{L}^{-2}f_{L}^{2})(g_{L}^{-2}f_{L}^{2})} \right] \left[ \frac{E(g_{L}^{-1}f_{L}^{1})(g_{L}^{-1}f_{L}^{1}) + s_{y}^{1}k_{y}^{1}g_{y}^{1} + s_{x}^{1}k_{x}^{1}f_{x}^{1}}{(s_{y}^{1}k_{y}^{1}g_{y}^{1} + s_{x}^{1}k_{x}^{1}f_{x}^{1})(g_{L}^{-1}f_{L}^{1})} \right]$
3 | $\left[ \frac{s_{y}^{2}k_{y}^{2}f_{y}^{2} + s_{x}^{2}k_{x}^{2}f_{x}^{2}}{z(g_{L}^{-2}f_{L}^{2})(g_{L}^{-2}f_{L}^{2})} \right] \left[ \frac{s_{y}^{1}k_{y}^{1}g_{y}^{1} + s_{x}^{1}k_{x}^{1}g_{x}^{1}}{(s_{y}^{1}k_{y}^{1}g_{y}^{1} + s_{x}^{1}k_{x}^{1}g_{x}^{1})(g_{L}^{-1}f_{L}^{1})} \right]$
4 | $\left[ \frac{s_{y}^{2}k_{y}^{2}f_{y}^{2} + s_{x}^{2}k_{x}^{2}f_{x}^{2}}{z(g_{L}^{-2}f_{L}^{2})(g_{L}^{-2}f_{L}^{2})} \right] \left[ \frac{s_{y}^{1}k_{y}^{1}g_{y}^{1} + s_{x}^{1}k_{x}^{1}g_{x}^{1}}{(s_{y}^{1}k_{y}^{1}g_{y}^{1} + s_{x}^{1}k_{x}^{1}g_{x}^{1})(g_{L}^{-1}f_{L}^{1})} \right]$
5 | $\left[ \frac{-E(g_{L}^{-1}f_{L}^{1})(g_{L}^{-1}f_{L}^{1}) + s_{y}^{1}k_{y}^{1}g_{y}^{1} + s_{x}^{1}k_{x}^{1}f_{x}^{1}}{z(g_{L}^{-1}f_{L}^{1})(g_{L}^{-2}f_{L}^{2})(s_{y}^{1}k_{y}^{1}g_{y}^{1} + s_{x}^{1}k_{x}^{1}f_{x}^{1})} \right]$
6 | $\left[ \frac{s_{y}^{2}k_{y}^{2}f_{y}^{2} + s_{x}^{2}k_{x}^{2}f_{x}^{2}}{z(g_{L}^{-2}f_{L}^{2})(g_{L}^{-2}f_{L}^{2})} \right] \left[ \frac{s_{y}^{1}k_{y}^{1}g_{y}^{1} + s_{x}^{1}k_{x}^{1}g_{x}^{1}}{(s_{y}^{1}k_{y}^{1}g_{y}^{1} + s_{x}^{1}k_{x}^{1}g_{x}^{1})(g_{L}^{-1}f_{L}^{1})} \right]$
7 | $\left[ \frac{g_{L}^{-1}f_{L}^{1}}{z(g_{L}^{-2}f_{L}^{2})(g_{L}^{-2}f_{L}^{2})} \right] \left[ \frac{s_{y}^{2}k_{y}^{2}f_{y}^{2} + s_{x}^{2}k_{x}^{2}f_{x}^{2}}{z(g_{L}^{-2}f_{L}^{2})(g_{L}^{-2}f_{L}^{2})} \right] \left[ \frac{s_{y}^{1}k_{y}^{1}g_{y}^{1} + s_{x}^{1}k_{x}^{1}g_{x}^{1}}{(s_{y}^{1}k_{y}^{1}g_{y}^{1} + s_{x}^{1}k_{x}^{1}g_{x}^{1})(g_{L}^{-1}f_{L}^{1})} \right]$


<table>
<thead>
<tr>
<th>Row</th>
<th>Element</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>$\frac{f_1^2 g_1^2 (s_{xy}^2 + s_{xy}^2)}{z(g_{L}^1 - f_{L}^1) (g_{L}^2 - f_{L}^2) (g_{L}^2 - f_{L}^2)}$</td>
</tr>
<tr>
<td>(2)</td>
<td>$\frac{s_{xy}^2 g_{K}^2 + s_{xy}^2 g_{K}^2}{z(g_{L}^1 - f_{L}^1) (g_{L}^2 - f_{L}^2) (g_{L}^2 - f_{L}^2)}$</td>
</tr>
<tr>
<td>(3)</td>
<td>$\left[ \frac{1}{z(g_{L}^1 - f_{L}^1)} \right] \left[ \frac{1 - z(g_{L}^1 - f_{L}^1)}{(g_{L}^1 - f_{L}^1) (g_{L}^1 - f_{L}^1)} \right] \left[ s_{xy}^1 x_{xy}^1 g_{L}^1 y_{xy}^1 g_{L}^1 + s_{xy}^1 x_{xy}^1 g_{L}^1 y_{xy}^1 g_{L}^1 \right]$</td>
</tr>
<tr>
<td>(4)</td>
<td>$\left[ \frac{1}{z(g_{L}^1 - f_{L}^1)} \right] \left[ \frac{1 - z(g_{L}^1 - f_{L}^1)}{(g_{L}^1 - f_{L}^1) (g_{L}^1 - f_{L}^1)} \right] \left[ s_{xy}^1 x_{xy}^1 g_{K}^1 y_{xy}^1 g_{L}^1 + s_{xy}^1 x_{xy}^1 g_{K}^1 y_{xy}^1 g_{L}^1 \right]$</td>
</tr>
<tr>
<td>(5)</td>
<td>$\frac{1}{z(g_{L}^1 - f_{L}^1) (g_{L}^2 - f_{L}^2)}$</td>
</tr>
<tr>
<td>(6)</td>
<td>$\frac{1 - z(g_{L}^1 - f_{L}^1)}{z(g_{L}^1 - f_{L}^1) (g_{L}^1 - f_{L}^1)}$</td>
</tr>
<tr>
<td>(7)</td>
<td>$\frac{1}{z(g_{L}^1 - f_{L}^1)}$</td>
</tr>
</tbody>
</table>
BIBLIOGRAPHY


