# TRADE LIBERALIZATION IN THE CHEMICAL INDUSTRY: THE IMPACT ON THE UNITED STATES

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# PREFACE

The debate between those espousing the gains from free trade and those concerned with protecting domestic industries has had a long history. Although international trade negotiations under the auspices of GATT have made much progress toward the goal of free trade, formidable problems remain for future negotiations of trade agreements. This study estimates the economic impact of trade liberalization for the United States chemical industry.

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| | |
|---|---|
| d | a change in the variable which follows |
| D | quantity of domestic demand |
| $D_D$ | domestic demand |
| $D_M$ | import demand function |
| $D_X$ | export demand exclusive of tariff |
| $D_{X,t}$ | export demand inclusive of tariff |
| L | number of jobs (employees) |
| M | quantity of imports (without subscript: U. S.; subscript "i": country "i:" subscript "w:" world) |
| P | initial duty-free price |
| P' | commodity price inclusive of tariff, i. e., P' = P + T |
| $P_o$ | price resultant from tariff elimination |
| Q | quantity of domestic output |
| s | a fraction |
| S | quantity of domestic supply |
| $S_D$ | domestic supply function |
| $S_M$ | import supply exclusive of tariff |
| $S_{M,t}$ | import supply inclusive of tariff |
| $S_X$ | export supply |
| $S_{xxx,i}$ | quantity of output for SITC category xxx by country "i" |
| t | ad valorem tariff or tariff equivalent |
| t* | average of foreign ad valorem tariffs, levied on a c. i. f. basis |
| t** | f. o. b. equivalent of the foreign tariff average |

| | |
|---|---|
| $T$ | per-unit value of tariff, i. e., $T = tP$ |
| $V_D$ | value of domestic demand |
| $V_M$ | value of imports |
| $V_S$ | value of domestic supply |
| $V_{S_{xxx,i}}$ | value of country "i"'s shipments of SITC category xxx |
| $V_X$ | value of exports |
| $W_M$ | social welfare, as traditionally measured, for the import market |
| $W_X$ | social welfare, as traditionally measured, for the export market |
| $X$ | quantity of exports (without subscript: U. S.; subscript "i"; country "i"; subscript "w": world) |
| $\varepsilon_D$ | price elasticity of U. S. domestic supply |
| $\varepsilon_M$ | price elasticity of the rest-of-the-world's supply of imports into the U. S. |
| $\varepsilon_X$ | price elasticity of U. S. supply of exports to the rest-of-the-world |
| $\varepsilon_{Xi}$ | price elasticity of export supply from country "i" (from the world, "w") |
| $\eta_D$ | price elasticity of U. S. domestic demand |
| $\eta_M$ | price elasticity of U. S. demand for imports |
| $\eta_{Mi}$ | price elasticity of the demand for imports in country "i" (in the world, "w") |
| $\eta_X$ | price elasticity of the rest-of-the world's demand for U. S. exports |
| * | superscript to indicate a long-run elasticity |
| --- | used in tables when the necessary data is not available |
| ... | used in tables when category not applicable |

# CHAPTER I

## INTRODUCTION

The gains from free world trade have been demonstrated and vigorously espoused by economists for centuries both in scholarly journals and popular literature. Indeed, the existence of the General Agreement on Tariffs and Trade (GATT) rests on this premise. Still the public and its political representatives jump quickly and easily onto the protectionist bandwagon as the solution to many problems. Are politicians so naive? Are economists that ignored -- or that ignorant? One suggested explanation for the divergence between theory and policy is that the gains from free trade are long-run gains whereas politicians have short-run time horizons and ignore any gains from freer trade that might be achieved by their policy-making but occur after the next election. Another suggested explanation is that economists assume that all adjustments to changes in the parameters of the model are instantaneous and ignore any transitional dislocations.

The GATT negotiations have been continuing for many years and have made much progress toward the ideal of free trade. The emphasis has been on the visible barriers to trade -- tariffs -- and the approach has been multilateral and multisectoral. With successful tariff reductions, attention now shifts toward the wide array of nontariff barriers, which have become relatively more important. In an attempt to cope with these more formidable problems, GATT now is tending toward sectoral negotiations.

The chemical industry posed just such a formidable problem for the Kennedy Round of GATT and was treated as a sector separate from the general negotiations in an effort to retain chemicals as negotiable products. The great controversy over the chemical sector arose because of the United States' American Selling Price System of valuation for certain chemical products.

The chemical sector is not insignificant in its importance in world trade. The sector ranks fourth in OECD exports, accounting for 10 percent of OECD industrial exports, and ranks sixth in OECD imports with 8 percent of imports.[1] Imports of chemicals are an important factor in the economies of the major industrial countries of the world. For the U. S., the European Economic Community (EEC), the U. K., Canada, and Japan, chemical imports ranked, respectively, as the eighth, fifth, fifth, fourth, and sixth largest import sectors in 1970.[2] Chemical products form the third largest category of U. S. sector exports.[3] These five countries account for over 85 percent of world chemical exports and 75 percent of world chemical imports.[4]

The present study examines the economic impact that would follow the elimination of tariffs on internationally traded products of the chemical industry. One purpose of the study is to estimate the probable changes in price, quantity, and value of trade for the United States. These estimates then permit the computation of the effects on the social welfare for the U. S., which includes both the present-value of the flow of long-term gains from the expansion of trade and the present-value of the costs resulting from temporary labor dislocations.

The analysis is conducted on the most disaggregated level feasible given the data. The study employs data for the 63 product subgroups

contained within the chemical industry as defined by the Standard International Trade Classification, Revised (SITC). The countries included in the study are the five major chemical trading countries (the U. S., the EEC, the U. K., Japan and Canada) and the other countries of the GATT Tariff Study (Austria, Denmark, Finland, Norway, Sweden, and Switzerland).[5] The trade data are for 1972 which is the first year the concessions of the Kennedy Round were fully in effect and before the British entry into the EEC.

This subject is important in two respects. Previous studies of similar purpose are at a high level of aggregation and, thereby, obscure much of the variation which occurs within such broadly-defined categories. Furthermore, most of the studies analyze either the price and trade effects, the labor market effects, or the trade and welfare effects, ignoring or assuming the remaining effects.[6] Second, the sectoral approach to trade negotiations is likely to become more prevalent in future negotiations. Faced with the problem of quantifying and negotiating non-tariff barriers, future trade sessions will more than likely discover the increasing necessity of separating problem sectors from the general trade negotiations, as has been already experienced in the Kennedy Round for five industries.

The subsequent chapters of this study cover the following topics. Chapter II establishes the context for the study. It outlines the structure and behavior of the chemical industry and discusses the history of tariffs levied on chemicals and of the American Selling Price system. In addition, the chapter summarizes the nontariff barriers to chemical trade and reviews the history of U. S. participation in trade negotiations focusing especially on the Kennedy Round. It also

discusses briefly the Trade Expansion Act of 1962, including the impact on the chemical industry of its provisions for domestic relief from import competition, and the negotiating authority of the Trade Act of 1974. Chapter III begins with a survey of the previous studies which serve as a foundation for the analysis of the study. The chapter then presents the theoretical model utilized for the study. The model is composed of four parts. The first three are static, partial equilibrium analyses of the U. S. import and export markets and their respective labor markets. The fourth part of the model considers the net social welfare effects as flows and discounts them over the selected time horizons. Chapter IV concerns the data used in the study, exposing the problems of their collection and adjustment preparatory to use. Chapter V presents the empirical results. The model of the effects of tariff elimination is applied to two different sets of data: one assumes the existing tariffs are those resulting from the Kennedy Round including the elimination of ASP; the other assumes post-Kennedy Round tariffs with the continued existence of ASP. For each scenario the effects of free trade are estimated in terms of changes in prices, trade volume, employment, and social welfare. Comparison of the results for each scenario provides a measure of the impact of the Supplemental Agreement on Chemicals had it been approved. Chapter VI provides a brief summary of and the conclusions for the study.

## ENDNOTES

[1]United States Tariff Commission, "Major Industrial Sectors: Tariffs and Other Trade Barriers," Part III of Trade Barriers, TC Publication 665 (Washington, D. C., 1974), p. 181.

[2]Ibid.

[3]Ibid.

[4]Ibid., p. 183.

[5]The Contracting Parties to the General Agreement on Tariffs and Trade, Basic Documentation for Tariff Study: Summary Table No. 1 -- Tariff and Trade Summaries by BTN Headings (Geneva, July, 1970). Hereafter referred to as GATT Tariff Study. The "other" countries of the study are the member nations of EFTA less Portugal and plus Finland.

[6]The other studies are: Bela Balassa, Trade Liberalization among Industrial Countries (New York, 1967); Robert E. Baldwin and John H. Mutti, "Policy Problems in the Adjustment Process (U. S.)," (unpublished paper); Craig R. MacPhee, Restrictions on International Trade in Steel (Lexington, Mass., 1974); and Stephen P. Magee, "The Welfare Effects of Restrictions on U. S. Trade," Brookings Paper on Economic Activity, No. 3 (1972). Only the Magee study estimates all the effects, but is at an aggregated level.

# CHAPTER II

# THE FRAMEWORK

## Introduction

This chapter establishes the background for the study. The initial presentation, which describes the character of the chemical industry, is followed by a discussion of some facets of the barriers faced by trade in the chemical industry and the negotiations concerning such barriers.

## The Chemical Industry

Although industry boundaries are often determined by substitutability-in-use of the industry's output, the chemical industry is delineated on the basis of common industrial inputs. In either case, the definition of an industry is neither as evident nor as clear-cut as one might surmise initially. This is particularly true for the chemical industry for which the definitions vary greatly. The firms of the industry all use the techniques basic to chemical technology and move easily from supplying one product to supplying another. Chemical companies often extend into fields outside the industry, non-chemical firms frequently enter the industry in one or a few product markets, and chemical products are often competitive-in-use with products in other fields. The industry definition used throughout this study is the chemical section defined by the United Nations' SITC, Revised classification system.[1]

The chemical industry in the United States is composed of several very large chemical companies which are diversified into many of the industry's component sectors, a multitude of smaller specialized companies, and, for particular fields, non-chemical companies which have diversified.[2] The sub-sectors are especially indistinct in delineation; whatever the boundary, shifting subgroups of these giants, often accompanied by some relatively specialized smaller firms, create a predominantly oligopolistic industry structure for each subindustry.

The interdependence of the firms in an oligopolistic structure tends to establish a policy of peaceful coexistence with recognition of spheres of influence. This is evidenced by the chemical industry's policy of market extension via joint ventures and purchase of established small firms rather than new entry into other subindustries. The industry's oligopolistic structure reflects more than a non-competitive market extension policy. Many markets are too limited to support more than one firm. Continuous processing for the production of most chemical products implies large economies of scale. Further economies to a large scale accrue because of the massive research and innovative efforts which are essential to the viability of a firm in the chemical industry.[3]

Kahn describes the pricing of the chemical industry's output as "orderly" with little competitive response to short-run fluctuations in demand. The technology which applies chemical science to industry yields output which is often both an intermediate and a finished product for the firm; and large firms market inputs among themselves often at discount prices to maintain good relations. In addition to an oligopolistic market structure, the combination of relatively large proportions of

fixed costs and the prevalence of joint products and/or useable by-products presents pricing problems sufficient enough in themselves to encourage prices that are unresponsive to changes in demand.

On the other hand, such oligopolistic structure and behavior is modified by technological non-price competition. The versatility of technology implies an omnipresent possibility of potential entry into existing markets and of the development of new market opportunities.

In comparison with U. S. firms, the foreign chemical producers are similarly large in size and advanced in research capabilities, and are, therefore, a competitive factor for the chemical industry in the United States. Since World War II, the magnitude of foreign trade in chemicals began a long-term expansion and the chemical companies of the world developed an international outlook.[4] The internationalization of the chemical industry became particularly pronounced during the 1960s. American companies began to invest abroad on a large scale by establishing foreign plants, engaging in joint ventures, or licensing products or processes to a foreign manufacturer. Total sales by U. S. plants abroad grew more rapidly in that decade than did U. S. exports; additionally, about half of U. S. exports were through foreign affiliates. Foreign manufacturers also invested directly in the United States, especially in the field of dye manufacturing and ethical drugs. Backman estimates that in 1968, U. S. direct investment abroad approximated $6.0 billion and foreign direct investment in U. S. plants equalled $2.5 billion.[5]

The cause and effect relationship between monopoly power and technological progress is not clarified for the chemical industry. As Kahn notes:

> It is not possible to give our present system of organization a clean bill of health simply because it has been progressive; in modern science it is difficult not to progress, whatever the system of organization. The only meaningful bench mark against which to test achievements of the American industry is the potential inherent in chemical technology; but that potential is unknowable. . . .
>
> In fact, by the supreme test, the ability to meet rival producers in open competition, the chemical industry is by the admission of its own spokesman not an outstanding example of the superiority of American enterprise. They are among the leading advocates of high tariffs to protect themselves from the products of 'cheap foreign labor.' Yet in other American industries, where labor costs are an even higher proportion of total costs than in the chemical, the disadvantage of high wage rates is more than offset by labor's high productivity. . . . [I]t is by no means clear that the chemical industry, with its typically high capital-labor ratios and far larger exports than imports, can offer such a defense for most of the high protection it enjoys.[6]

## Trade Barriers for Chemicals

Tariffs have a long history in the United States' chemical industry beginning with tariffs on gunpowder and indigo which were levied in 1789.[7] Tariff duties were increased and tariff coverage of chemical products expanded during the 1800s; however, the organic chemical industry remained at an embryonic level. World War I severed the U. S. source of coal-tar dyes (benzenoid organic chemicals) from Germany. The Emergency Tariff of 1916 provided increased duties for a 5-year period, after which rates were to be reduced annually. The industry grew rapidly but the end of the war threatened potential price-cutting by the German chemical cartel. In order to secure the development of the infant chemical industry in the U. S., of which coal-tar dyes were an important part, and because of the crucial role played by coal-tar dyes in the national defense, the consensus favored industry protection. Until a

permanent law could be enacted, Congress imposed a six-month embargo on imports of products produced domestically (the Dye and Chemical Control Act of 1921).[8]

Prior to 1922, the usual basis of valuation of an import good for customs duties was the selling price of the good in the exporting country; however, the post-war economies abroad were very unstable with currency depreciations and rapid price fluctuations. The situation made a system of valuation based on the more stable and easily determined U. S. price very attractive. The Tariff Act of 1922 (the Fordney-McCumber Tariff) embodied such an alternative system for coal-tar products only.[9] This method of customs valuation is referred to as the American Selling Price (ASP) system.

The American Selling Price (ASP) method of valuation provides that imports of the ASP designated products which are competitive with U. S. production face tariffs levied on the value determined by the wholesale price of the comparable U. S. product and that imports of such products which are not competitive with U. S. products face tariffs levied on the United States value.[10] Thus, ASP has also been called the "flexible tariff" because the amount of duty levied varies with the price of the competitive U. S. product regardless of the constancy of the foreign price of the imported good.

During the 1920s ASP was extended to various other products; the Smoot-Hawley Tariff Act of 1930 repealed these extensions, but retained the ASP system for benzenoid (coal-tar) products and the possibility of ASP designation for other goods.[11] During the 1930s ASP was applied by proclamation to four other types of imports: rubber-soled footwear and binoculars (1933), boiled baby clams packed in their own juices (1934),

and wool-knit gloves worth less than $1.75 a dozen (1936); the application of ASP to binoculars was held invalid by the courts in 1935. The Reciprocal Trade Agreements Act of 1934 and the subsequent Trade Acts provided that ASP could not be extended to any good on which duty reduction had occurred. Because U. S. trade policy since 1934 has been to progressively lower tariff barriers, the possibility of extensions of ASP to additional products is limited.[12]

Of the four types of commodities subject to ASP only the imports of benzenoid chemicals are of significant magnitude.[13] In 1967, ASP valuation was applied to $43.1 million of benzenoid chemical imports that were competitive with U. S. production. Total imports of benzenoid chemicals eligible for ASP valuation that year were $82.6 million, which equalled 8.6 percent of the value of U. S. imports of chemicals and related products ($963 million). It should be noted that the ASP system of valuation for customs duties does not include all benzenoid chemicals. Three groups of benzenoid chemicals are not covered by the ASP provision: benzenoid crudes, which enter duty-free; benzenoid elastomers (synthetic rubbers), which account for 10 to 15 percent of total benzenoid sales; and most benzenoid chemicals originating from natural animal or vegetable products.[14]

Benzenoid chemicals today differ from those of the 1920s in both source and form. No longer are benzenoids derived from coal-tars and primarily composed of dye products. Dyes are less than 10 percent of U. S. benzenoid sales; and the benzenoids now are derived from petroleum and natural gas. Benzenoid chemicals include a great variety of products which are categorized into ten major product groups: intermediates (including rubber-processing chemicals), dyes (including azoics), pigments,

medicinal chemicals, flavor and perfume materials, plastics and resins, plasticizers, surface-active agents, pesticides and agricultural chemicals, and miscellaneous chemicals.[15] However, none of these benzenoid groups form a separate or distinct industry group.

The U. S. tariffs at the three-digit level range from 26.5 percent on Synthetic organic dyestuffs, natural indigo and color lakes (SITC 531) to 0.7 percent on Manufactured fertilizers (SITC 561).[16] The unweighted average of the three-digit tariff averages equals 8.1 percent. The largest U. S. import sector at the three-digit level is Organic chemicals (SITC 512) for which the tariff is 11.0 percent on $509 million of f. o. b. imports in 1972.

The average of the foreign tariffs faced by U. S. exports in each three-digit SITC group ranges from 13.9 percent on Plastic materials, regenerated cellulose and artificial resins (SITC 581) to 2.8 percent on Radioactive and associated materials (SITC 515). The largest export sector is Organic chemicals (SITC 512) with 1972 exports of $1103 million and incurs foreign tariffs which average 12.5 percent. The unweighted average of the three-digit foreign tariff averages equal 9.2 percent levied on U. S. exports.

A tariff rate applied under the ASP system of valuation understates the true tariff in cases where the American selling price of the comparable domestic good exceeds the foreign price of the import. This is the tariff effect of the ASP system.[17]

Grubel and Johnson estimate a true tariff average for benzenoid intermediates (the only type of benzenoid for which they had price data). That is, they compute

> ...an average nominal tariff rate, which when applied to foreign prices would yield the same tariff revenue as does the current nominal rate applied to American selling price. The relationship of nominal tariff (NT), true tariff (TT), foreign price (FP), and American selling price (ASP) is shown in the following equation:
>
> $$TT = \frac{NT \times ASP}{FP}.$$ [18]

Their results show that the nominal tariff average which ranges, depending upon the averaging technique used, from 23.9 to 26.4 percent is equivalent to a true tariff which lies between 40.9 and 53.2 percent.[19]

In addition to the tariff effect, ASP involves a nontariff effect resulting from the complexities, uncertainties and delays of its administration. A foreign exporter cannot ascertain in advance whether the product will be subject to ASP, i. e., be determined to be competitive, or what the ASP will be. Whereas the Tariff Schedules of the United States Annotated listed in 1964 sixty-nine groups of chemicals eligible for ASP, the actual number of differentiated products imported equalled 2,943 items for each of which customs officials had to determine the competitive status.[20] It is interesting to consider the bureaucracy required to administer determinations of competitive status on the 750,000 commercial products that are potentially subject to ASP.[21]

The nontariff effects of the ASP system are well-described in the testimony of Ambassador William M. Roth, Special Representative for the Kennedy Round (1964-1967) of trade negotiations within the General Agreement on Tariffs and Trade (GATT):

> This broad language [of the ASP statute] inevitably creates problems in administration and in equity. It, in effect, assumes that there is necessarily a single price for each chemical and one which can be determined with certainty and accuracy by Customs officials. It implicitly assumes that list prices, where they exist, will be equal

to prices at which goods are actually sold and, where they do not exist, that Customs will be readily able to obtain the necessary data.

These assumptions are not realistic. They do not allow for the desirability of determining whether quoted price is a reasonable one -- a problem which may arise in the case, for example, where the domestic article, often patented, is neither offered nor sold as an intermediate product, but rather is made by a single or a few integrated producers who use the articles from it. In the latter case, the price for the intermediate may well be established at a level which deters any prospective purchasers of a similar import from importing. Yet this is, under the present statute, the proper basis for valuation.

The 'willing to receive' provision of the statute further means that an importer may bring chemicals to the United States under the impression that there is no domestic production, only to learn that an American manufacturer does produce them not commercially but entirely for his own, internal use. If this manufacturer states to Customs that he 'would be willing to receive an offer' and then quotes his price, even though no commercial transactions have actually occurred at that price, it also becomes the basis for duty.

This feature of the statute permits situations where domestic firms have the potential for manipulating prices to deter and even eliminate any import competition. This has, in fact, happened. As a result, in order to anticipate these effects, importers often bring in very small samples, solely in order to establish the magnitude of the protective duty. This practice is one of the explanations why our trade statistics show that imports do, indeed, enter over fairly astronomical rates.

Still another difficulty with ASP concerns the alternative valuation base which applies when a benzenoid chemical is found not to be competitive with a domestic product. In this situation the statute provides that a 'United States value' will be determined and used as the basis for valuation. This essentially requires working back from the quoted wholesale price of the import in the United States market, deducting all necessary expenses and markups incurred in its importation, to arrive at an equivalent of an export value for the chemical. This, too, is time-consuming and often leads to controversial results. Certain shipments have been under consideration for as much as 8 years while the matter was being litigated through the courts.[22]

Although nontariff barriers are not specifically the subject of

analysis for this study, the discussion of the nontariff barrier effects of ASP invites some mention of other such barriers to trade in chemicals.[23] A survey of complaints concerning trade barriers faced by chemicals contains the greatest number of complaints involving quantitative limitations and licensing provisions. These complaints most frequently cite Japan for use of quotas on pharmaceutical products and unclassified chemicals. Pharmaceutical products are also the main product for which extremely rigid requirements serve as an effective embargo in the countries of Japan, France and the United States or for which actual embargoes on competitive imports exist (Norway, Finland, Italy, and others). Six complaints against the U. S. and three complaints against Japan are registered regarding restrictive licensing practices.

A large proportion of the over 100 complaints involving customs procedures pertain to the U. S. ASP system of customs valuation. Japan, the U. S., and South American countries are each mentioned in two or more complaints regarding excessive and complex documentation requirements. And many countries are cited for unreasonable restrictions on the importation of chemical and pharmaceutical samples.

In reference to standards for chemical products, the most frequently mentioned category is pharmaceuticals. Application of domestic standards for pharmaceuticals (rather than acceptance of the exporting country's standards) by the United States, Japan, Canada and the EEC is a common complaint because of the delay involved in the repetition of testing; pharmaceutical imports into many countries involve stringent registration, labelling and clearance requirements which are cited as barriers.

U. S. producers are the source of many complaints against Japan

and the EEC and, to a lesser extent, the U. K. concerning their provision of governmental export assistance. Complaints regarding "buy national" policies, especially for pharmaceuticals, cite the U. K., Japan, France, and other European countries.

Other complaints of trade barriers to chemicals cite price controls, particularly used for pharmaceuticals, border taxes, and restrictive business practices (including government sanctioned cartels) and various other practices.

## The United States' Participation in Trade Negotiations

The reduction in the volume of international trade initiated by the high tariffs of the U. S. Smoot-Hawley Tariff was further accentuated in 1933 by the worldwide Depression.[24] The 1934 Trade Agreements Act reversed the trend of U. S. protectionist policy. It granted the President the power to reduce tariffs within limits. Any reductions, which were limited by statute to a maximum percentage, were to be matched by reciprocal reductions by the other negotiating nation and were not to cause any serious injury to U. S. industry. Tariff negotiations of this era were conducted on a bilateral basis, primarily on narrowly defined products for which one nation was the principal supplier; the purpose of such narrow definitions of negotiable items was to prevent the extension of benefits to any other countries under the most-favored-nation (mfn) provision for which there was no reciprocity.

In 1944 the Bretton Woods agreement established the International Monetary Fund (IMF) and the International Bank for Reconstruction and Development (IBRD).[25] During this period of international economic

cooperation, efforts also were being made both to achieve an international accord on trade liberalization and to establish an International Trade Organization (ITO) for the administration of trade policy. After lengthy conferences, agreement was achieved in early 1948 on a final version of that Organization's charter; the charter was never ratified by the signatories and ITO did not come into existence. Meanwhile, parallel discussions did result in the agreement upon an international trade treaty, the General Agreement on Tariffs and Trade (GATT), which was signed in October 1947 with the intention of its absorption into ITO. The next year the treaty's rules of trade policy and negotiated tariff concessions became effective. Although the ITO was never established, GATT has survived to the present day as a loose type of organization. GATT now has over sixty member countries and is affiliated with the United Nations. In addition to its major activity of trade barrier negotiations, GATT has established a set of rules concerning trade relations, permissible deviations from the ideal of free trade, and a framework for the administration of such rules and the reconciliation of conflicts.

The first tariff negotiating session of GATT occurred in 1947 in Geneva. It was a multilateral conference among twenty-three participating countries for mutual tariff reductions on an item-by-item basis. The negotiations were actually conducted on a bilateral basis between principal suppliers with the lists of proposed reductions circulated to the other parties. The first round of negotiations was followed by five more rounds which have been completed to date.[26] The first round of GATT achieved significant results. Subsequent negotiating sessions, until the

Kennedy Round, had lesser results, reflecting more limited objectives and less political incentive for tariff reductions.[27]

The United States' participation in the Kennedy Round of GATT was authorized by the Trade Expansion Act of 1962 (TEA), which granted the President new and broad authority to enter trade agreements with other nations. The legislation was unusually detailed because of the incorporation of several types of authority for negotiation, the inclusion of administrative details for trade agreements program, and the establishment of relief procedures for domestic economic injuries resulting from the trade agreements.[28] Primarily, the TEA gave the President a five-year grant of authority to reduce by a maximum of 50 percent tariff rates exceeding 5 percent (with the exception of certain goods) and to eliminate duties on items with tariff rates below 5 percent. The major impetus to TEA's passage was the successful development of the European Common Market (EEC), emphasized at that time by British application for EEC membership.

Although the contracting parties to GATT tentatively decided to hold a new round of negotiations in November 1962, the Kennedy Round officially opened one and one-half years later, with the actual negotiations beginning six months later. Before the actual negotiations concerning the industrial sectors could begin, the basis for negotiation first had to be decided. The EEC desired the negotiations to be on the basis of "disparities" among national tariffs on specific items.[29] The U. S. and other major participants wanted the negotiations based on a linear approach, i. e., equal percentage reductions in all participants' tariffs. The issue was never explicitly settled and remained to haunt the actual negotiations as a potentially explosive issue.

Without a victory on the disparities issue, the EEC came to the industrial negotiations with a large list of exceptions to negotiable products. Efforts made by other participants to reduce this list were tempered to a degree by the fear of resurrecting the disparities issue. Certain groups of products were so troublesome that they posed a threat to all negotiations. For although the specific difficulties varied, in each case a major participant had made any worthwhile concessions conditional upon obtaining a specified concession from one or more of its negotiating partners. In this context, the Director-General of GATT advanced the idea of separate sectoral negotiations for five major problem areas: steel, pulp and paper, aluminum, textiles, and chemicals. Despite some fears that special deals would result, it is generally believed that the approach was necessary and advantageous.

In the case of chemicals, the U. S., because of its ASP system of valuation for certain chemicals, was the center of attack by the EEC and U. K. The U. S. offer of a 50 percent reduction in chemical tariffs was rejected by the EEC and U. K.; for them, only an offer by the U. S. to abolish ASP would transform chemical products into negotiable items. Because the combination of ASP elimination and a 50 percent rate reduction exceeded the authority of the Trade Expansion Act, a deadlock existed which continued for the majority of the Kennedy Round.

The European emphasis on ASP was essentially for tactical purposes.[30] Of the four ASP items only benzenoid chemicals were of any significance to Europe (primarily Germany), and that significance was of limited economic importance. In fact, in overall world trade terms, ASP is relatively insignificant, with the possible exception of dyes and intermediates. The tactical emphasis soon elevated European emotions and

ASP became a highly symbolic issue in Europe in late 1966, imbuing it with a bargaining value exceeding the value of benefits from its removal.

Rather than risk Congressional approval over the entire result of the chemical negotiations, the U. S. offered that a chemical settlement be made in two "packages": one which would utilize the negotiating authority of the TEA, while retaining the ASP system, and a second ASP-oriented package which would require Congressional approval to change the basis for customs valuation by eliminating ASP. During 1966 and early 1967, the two-package approach was resisted. Faced with a June 30, 1967 expiration date for the U. S. negotiating authority granted by the TEA, much activity, including several nearly ruinous crises, occurred in May and June. Both Europe and the U. S. had greater interest in obtaining some compromise concessions rather than permitting any deadlocks to cause the failure of the Kennedy Round. On June 30th itself, the negotiated settlement was finalized with the chemical sector agreement separated into two packages.[31]

The Kennedy Round concessions can be summarized as reductions averaging 43 percent by the United States on imports of $325 million in exchange for tariff reductions by the EEC, U. K., Japan and Switzerland which average 26 percent on $890 million of imports from the U. S.[32] It also included reductions by other countries. The ASP package, was negotiated only among the major chemical trading nations: the United States, the U. K., EEC, Japan and Switzerland. It recognized, and required reciprocity on, both the tariff and nontariff effects of ASP and, because it eliminated ASP, required Congressional approval in the United States. The concessions of the separate ASP agreement consist of: in

the case of the United States, the conversion of duties based on ASP to normal bases of valuation and an average reduction in tariffs of five percent; in the case of the EEC, elimination of the discrimination against U. S. automobiles contained in the provisions of its road tax system and a 26 percent average reduction in tariffs; in the case of the United Kingdom, an average tariff reduction of 22 percent and a reduction of the preferential tariff margin on tobacco imports; Switzerland agreed to modify its regulations on canned fruit imports; and Japan agreed to make all its tariff concessions in the Kennedy Round package.

Implementation of the ASP package was included in the Trade Expansion Act of 1968. The House Ways and Means Committee held extensive public hearings on the bill.[33] Much of the testimony was by industry and trade association spokesmen, including the Synthetic Organic Chemical Manufactures Association (SOCMA) representing 74 manufacturers of benzenoid chemicals who account for 80 percent of U. S. benzenoid production and the Manufacturing Chemists Association (MCA) representing a broader group of chemical firms. The overall industry response to the ASP package before Congress was negative. As Evans notes:

> [T]he United States chemical industry as a whole stood to gain from this conditional chemical package a much deeper reduction in the post-Kennedy Round tariffs impeding its exports than in the tariffs protecting its domestic markets. Furthermore, after these reductions, the resulting level of the chemical tariffs of the United States would remain substantially higher than those faced by its principal chemical exports. For an industry which, as indicated by its net export position, is well able to meet foreign competition in most products, this would have seemed to be an attractive exchange. But industries, like governments, are often prisoners of the positions they have taken in the past, and almost as soon as the results of the Kennedy Round became known, spokesmen for the chemical industry as a whole declared their opposition to congressional approval of the ASP Agreement.[34]

The two trade associations strongly objected to the elimination

of ASP; they argued that ASP is the best way to ensure an equalization of U. S. production costs with those of Europe and Japan and that such equalization is necessary for the survival of the U. S. benzenoid chemical industry.[35] SOCMA officials presented five specific arguments concerning the U. S. industry's need of the ASP system: (1) the molecular structure of benzenoid chemical is such that a production process results in a series of benzenoid coproducts with differing demands, and, hence, the importation of a key income-producing coproduct may make the entire series unprofitable; (2) benzenoid prices vary among foreign countries and cannot be "counted on" when a tariff rate is decided; (3) some benzenoids (in fact, less than 7 percent of total U. S. benzenoid production) are made by "batch" processes which entail higher labor costs and place U. S. producers at a competitive disadvantage; (4) foreign producers face weaker antitrust laws than U. S. firms and, as a result, have more monopoly power in their domestic markets and often operate cartels; and (5) any reduction of protection would reduce research in the field of benzenoid chemicals, particularly limiting advances in synthetic fibers and dyes.

No decision was made on the legislation and the bill died in committee. The ASP package was included again in the Trade Act of 1970 submitted to Congress. The House Ways and Means Committee initially eliminated the ASP package. And, although it did finally reincorporate an ASP provision, its form was altered from the negotiated ASP package of the Kennedy Round. The provision in the legislation granted the President the authority to remove ASP if he is certain that the foreign countries' offers warrant it and gave Congress the power to veto any Presidential action within sixty days.

As previously mentioned, the Trade Expansion Act of 1962 (TEA) established relief procedures for industries, firms or groups of workers significantly harmed by trade agreement concessions. These procedures specify that, following an investigation and an affirmative finding by the Tariff Commission, relief for an industry may be in the form of increased tariffs, import restrictions or marketing agreements; assistance to firms may be technical aid, financial help or tax benefits; whereas, groups of workers may receive compensation for their unemployment, job training, or relocation allowances.

Between the fiscal years 1963 to 1975 during which the provisions of the TEA were in effect, there were a total of twenty-nine industry cases, sixty-eight firm cases and 263 worker cases investigated.[36] Over the 12-year period, the trend of industry cases per year was relatively stable, whereas the year 1971 marked a dramatic increase in firm and worker investigations. Eighty-five percent of the 68 firm cases were filed after that year. Of the 263 worker cases, ninety-two percent were filed between 1971 and 1975. The affirmative and tied determinations represented 31 percent of the industry investigations, 41 percent of the firm cases, and 36 percent of the worker cases. The firms and workers of the shoe industry constituted the majority of the cases.[37] Throughout this time period, the chemical industry requested only one firm investigation and one investigation on behalf of a group of workers; both received negative determinations.[38]

The President's negotiation authority under TEA, which was the foundation of U. S. participation in the Kennedy Round of GATT, expired July 1, 1967. The trade agreements legislation of major importance to succeed TEA was the Trade Act of 1974.[39] Among its many substantive

provisions, the Trade Act granted the President new authority for the five years beginning 1975 to enter into international trade agreements. The authorized tariff modifications permit both increases and decreases in duties. Under the Trade Act of 1974, the Executive may:

> ...eliminate such duties which did not exceed 5 percent; reduce by up to 60 percent duties which exceeded 5 percent; and proclaim increases in or imposition of duties up to the higher of either 50 percent above the Tariff Schedules of the United States (TSUS) column 2 rate or 20 percent ad valorem (percentage points) above the TSUS column 1 rate.[40]

In addition, the Trade Act included provisions for relief in cases where domestic industries, firms or groups of workers are being substantially injured by import competition as a consequence of trade agreement concessions. The legislation made significant changes in the administrative procedures by removing firm and worker cases from the jurisdiction of the Tariff Commission; furthermore, it altered the criteria to be met for industry cases.[41]

## Summary

This chapter sets the scene for the study. It begins with an outline of the structure and behavior of the chemical industry. The Standard International Trade Classification, Revised is the definition of the chemical industry used in this study. The industrial structure within both the United States and industrialized foreign countries is oligopolistic; however, the industry is international in scope. Competition, which can be intense, is predominantly of the non-price variety.

The chapter also discusses trade barriers incurred by chemicals. Trade barriers for chemicals have a long history in the United States, having begun in the 18th century. In 1972, the ad valorem equivalents

of the U. S. tariffs on chemicals averaged 8.1 percent. The most controversial aspect of U. S. trade barriers to chemical imports is the American Selling Price (ASP) method of valuation, often called the "flexible tariff." A tariff rate applied under ASP understates the true tariff in cases where the American selling price of a comparable domestic good exceeds the price of the import. In view of the market power existent in oligopolistic market structures, the importance of the potential for ASP's "flexible tariff" to become a complete barrier to trade is tempered by the limited applicability of ASP in terms of trade volume. In addition to this tariff effect, ASP incorporates the non-tariff effects of uncertainty and complex administration. Other non-tariff barriers applicable to chemical trade throughout the world are briefly summarized and most frequently cite the pharmaceutical group within the chemical industry.

The chapter finishes with a review of U. S. participation in trade negotiations, primarily focusing upon the important role ASP played in the Kennedy Round of negotiations under the General Agreement on Tariffs and Trade (GATT). In general, tariffs have been reduced since the passage of the Trade Agreements Act of 1934. Beginning in the mid-1940s, GATT has been the organization for the negotiating sessions. The most recently completed session, the Kennedy Round (1964-1967), was particularly successful in its final outcome. The session itself, however, was replete with problems, among which the chemical industry and the U. S. ASP system loomed large. The chemical industry was separated from the general negotiations as a special problem sector and the chemical concessions were made in two packages, the so-called Kennedy Round concessions and the Supplemental Agreement on Chemicals. Only the former

package became effective.

The Trade Expansion Act of 1962, which authorized U. S. participation in the Kennedy Round, also established relief procedures for industries, firms or groups of workers injured by import competition resulting from trade concessions. This study's review of the investigations finds that the chemical industry has rarely requested assistance and has not received any assistance from these provisions.

The most recent U. S. trade agreements legislation of major significance is the Trade Act of 1974. It includes authorization for the President to enter into new trade agreements between 1975 and 1979 and to reduce most tariff duties by up to 60 percent. Therefore, this study, which considers the effect of the elimination of the post-Kennedy Round tariff duties (the second scenario), overstates the maximum impact of any results from the current round of GATT which is now commencing.

ENDNOTES

[1]The United Nations' SITC, Revised classifies all commodities involved in international trade. It contains 1,312 basic items (being indicated by a five-digit SITC number) which permit exact correspondence with the BTN [The Brussels Tariff Nomenclature (BTN) groups articles for customs purposes according to the material of which they are made]. These items are aggregated into 625 subgroups (four-digit SITC), which are in turn summarized into 177 groups (three-digit SITC). The three-digit SITC groups are portions of 56 SITC divisions (two-digit SITC) which can be further consolidated into 10 sections (one-digit SITC). The section "Chemicals" (SITC 5) is one of these 10 broad economic categories. It is composed of the divisions Chemical Elements and Compounds; Mineral Tar and Crude Chemicals From Coal, Petroleum and Natural Gas; Dyeing, Tanning and Coloring Materials; Medicinal and Pharmaceutical Products; Essential Oils and Perfume Materials, Toilet, Polishing and Cleansing Preparations; Fertilizers, Manufactured; Explosives and Pyrotechnic Products; Plastic Materials, Regenerated Cellulose and Artificial Resins; and Chemical Materials and Products, not elsewhere classified. United Nations, Department of Economic and Social Affairs, "Standard International Trade Classification, Revised," Statistical Papers, Series M., No. 34 (New York, 1961).

[2]The discussion of the U. S. chemical industry's structure, conduct and performance extracts primarily from A. E. Kahn, "The Chemical Industry," The Structure of American Industry: Some Case Studies, ed. Walter Adams (3rd ed., New York, 1961).

[3]The economies of scale and incentives to vertical and horizontal extension from research were demonstrated early by the pre-World War I German chemical industry. "German superiority in synthesis of coal tar dyes laid the basis for leadership in synthesis of perfumes, flavorings, drugs, explosives, and ammonia as well. Highly diversified, integrated companies were the agencies and outcome of this development." Ibid., p. 242.

[4]The discussion of the international aspects of the global chemical industry derives from Jules Backman, The Economics of the Chemical Industry (Washington, D. C., February, 1970).

[5]Ibid., pp. 285, 298.

[6]Kahn, pp. 266-267.

[7]The history of tariffs and ASP for the U. S. chemical industry draws from discussions in (1) Backman; (2) Thomas B. Curtis and John Robert Vastine, The Kennedy Round and the Future of American Trade (New

York, 1971); and (3) United States House of Representatives, Committee on Ways and Means, Hearings on Foreign Trade and Tariff Proposals (Washington, D. C., 1968), pp. 463-528.

[8]Backman, p. 262.

[9]The House version of the bill applied ASP to all imports but the Senate version limited ASP to coal-tar products with the possibility of extensions to other products by Presidential proclamation. Curtis and Vastine, p. 103.

[10]"Section 402(e) of the Tariff Act of 1930 describes ASP as follows: 'For the purpose of this section, the American Selling Price of any article produced in the United States shall be the price, including the cost of all containers and coverings of whatever nature and all other expenses incidental to placing the article in condition packed ready for delivery, at which such article is freely sold or, in the absence of sales, offered for sale for domestic consumption in the principal market of the United States, in the ordinary course of trade and in the usual wholesale quantities, or the price that the manufacturer, producer, or owner would have received or was willing to receive for such article when sold for domestic consumption in the ordinary course of trade and in the usual wholesale quantities, at the time of the exportation of the imported article.'" Curtis and Vastine, pp. 94-95.

The United States value used for customs' valuation is the price at which the imported merchandise is offered for sale in the principal market in the United States, less duty, transportation costs, insurance, commissions and other expenses and an allowance for profit. Backman, p. 279.

[11]The Smoot-Hawley Tariff Act established a total of nine methods of customs valuation; and although it raised many tariffs, it did not change the duties on coal-tar intermediates, dyes and chemicals generally.

[12]At the time of the Kennedy Round, 400 of 6000 tariff items remained eligible to receive an extension of ASP coverage.

[13]In 1964, the foreign invoice value of imports of canned clams eligible for ASP equalled $0.4 million, of which half were competitive and valued on the basis of ASP. The 20 percent nominal duty on canned clams was determined to be the equivalent of a 57 percent tariff under conventional valuation methods. The 1964 value of imports of rubber-soled footwear was $16.9 million of which $13.4 million was determined to be competitive and valued in terms of ASP; the ad valorem equivalent of the 20 percent ASP tariff on imports of rubber-soled footwear was 58 percent. Imports of wool knit gloves eligible for ASP have been nil for years. For benzenoid chemicals, $23 million of $49 million of imports were determined competitive and subject to ASP in 1964.

[14]U. S. House, Hearings, p. 490. In his testimony, William M. Roth additionally notes that "chemicals which are not benzenoid in structure but which at an earlier stage of manufacture were derived in whole or in part from a benzenoid product are subject to ASP."

[15]Ibid., pp. 492-493.

[16]The tariff data presented in this discussion are the 1972 rates resultant from the concessions of the Kennedy Round negotiations only, without ratification of the Supplemental Agreement on chemicals, i. e., the tariff data of the second scenario of this study. See Chapter V for a complete presentation of the tariffs for both scenarios.

[17]The Congressional debate over the original ASP legislation illustrates that the proponents of ASP recognized it as a method to levy with an apparently "reasonable" nominal tariff the exorbitantly high duty necessary to eliminate any difference between U. S. and foreign costs of production. Curtis and Vastine, p. 104.

[18]H. G. Grubel and H. G. Johnson, "Nominal Tariff Rates and United States Valuation Practices: Two Case Studies," Review of Economics and Statistics, XLIX (1967), pp. 138-142.

[19]Ibid., p. 140. Kelly cites a study by the Tariff Commission which finds that ASP, on average, doubles the duties that would be collected under normal valuation methods. In some instances, ASP results in a lower duty because U. S. prices are lower than foreign prices. The conversion of ASP nominal rates in a study by the Tariff Commission reveals that the 40 percent nominal average rate on a particular group of dyes has an ad valorem equivalent tariff of 172 percent. This ad valorem equivalent tariff average, once referred to as the "Mont Blanc" of the U. S. tariff schedule, received much notoriety during the Kennedy Round. In actuality, this "Mont Blanc" is an average of the converted rates on eleven dyes of which some are as high as 300 percent. W. B. Kelly, "Nontariff Barriers," in Bela Balassa and Associates, Studies in Trade Liberalization (Baltimore, Md., 1967), p. 291.

[20]Grubel and Johnson, p. 138. In the case of dyes, for example, imports of dyes unfamiliar to Customs officials must undergo extensive laboratory testing to determine their competitive status, including their solution strength (because tariffs are levied on the basis of specific solution strengths), before entry into the U. S. is permitted.

[21]U. S. House, Hearings, p. 473.

[22]Ibid., pp. 472-473.

[23]The discussion of nontariff barriers derives from a study and survey reported in U. S. Tariff Commission, "Major Industrial Product Sectors: Tariffs and Other Trade Barriers," pp. 188-205.

[24]The following discussion of the trade negotiations derives primarily from: Curtis and Vastine; John W. Evans, The Kennedy Round in American Trade Policy (Cambridge, Mass., 1971); and Leland B. Yeager, International Monetary Relations (New York, 1966).

[25]Yeager, p. 347. The agreement, signed in 1944, was ratified by a sufficient number of countries to establish the organization by the end of 1945.

[26]The dates and places of the six sessions of completed GATT negotiations are: 1947 in Geneva; 1949, Annecy; 1951, Torquay; 1956, Geneva; 1960-1962, Geneva (the Dillon Round); and 1964-1967, Geneva (the Kennedy Round).

[27]The average tariff reductions by the United States in the six completed sessions of negotiations under GATT are 18.9 percent, 1.9 percent, 3.0 percent, 2.4 percent, 4.0 percent, and 35.0 percent (excluding the ASP package concessions), respectively. Evans, pp. 12, 283.

[28]U. S. Tariff Commission, Operation of the Trade Agreements Program, 15th Report, July 1962-June 1962 (TC Publication 147), (Washington, D. C., 1965), p. 2.

[29]The first such European proposal was called a policy of "ecretement," i. e., taking the crest off [any relatively high national tariffs]. Curtis and Vastine, p. 82.

[30]The EEC saw ASP as a weakness of U. S. tariff policy and its emphasis as a counterweight to U. S. pressure on the EEC for its Common Agricultural Policy (CAP).

[31]The two separate agreements for the chemical sector are explicated in Appendix A.

[32]U. S. House, Hearings, pp. 502-503; the base year for this data is 1964.

[33]The statements of the public witnesses at the Committee's hearings concerning chemicals are in U.S. House, Hearings, pp. 4483-4810. A summary of the industry opposition expressed at the hearings and the legislative outcome is contained in Curtis and Vastine, pp. 122-126.

[34]Evans, p. 286.

[35]The speciousness of their argument lies in the fact that trade is based primarily on cost differences; hence, the accomplishment of cost equalization, if possible under the flexible tariff of ASP, would eliminate all foreign trade. Kelly in Balassa and Associates, p. 291.

[36]U. S. International Trade Commission, Annual Report 1975 (Washington, D. C., 1976), pp. 11-12.

[37]Michael R. Edgmand and Tracy W. Murray, "Full Employment, Trade Expansion, and Adjustment Assistance," Southern Economic Journal, XXXVI (1970), pp. 404-424; U. S. International Trade Commission, Annual Report 1975, pp. 11-12; and U. S. Tariff Commission, Annual Report of the United States Tariff Commission (Washington, D. C., Years 1970 - 1974).

[38]In 1964, Industrial Biochemicals, Inc. of Edison, New Jersey, a manufacturer of sodium gluconate, filed a petition as a firm for an investigation which was negatively determined; and in 1974, the request for assistance to the employees of GAF Corporation's plant in Linden, New Jersey (synthetic organic dyes and pigments) was denied.

[39]United States Code: Congressional and Administrative News, 93rd Congress--Second Session, 1974 (St. Paul, Minn., 1975), pp. 2290-2407. Public Law 93-618; 88 Stat 1978; referred to as Trade Act of 1974, approved January 3, 1975, pp. 2293-2294:

> The purposes of this Act are, through trade agreements affording mutual benefits--
>
> (1) to foster the economic growth of and full employment in the United States and to strengthen economic relations between the United States and foreign countries through open and nondiscriminatory world trade;
>
> (2) to harmonize, reduce, and eliminate barriers to trade on a basis which assures substantially equivalent competitive opportunities for the commerce of the United States;
>
> (3) to establish fairness and equity in international trading relations, including reform of the General Agreement on Tariffs and Trade;
>
> (4) to provide adequate procedures to safeguard American industry and labor against unfair or injurious import competition and to assist industries, firms, workers and communities to adjust to changes in international trade flows;
>
> (5) to open up market opportunities for United States commerce in nonmarket economies; and,
>
> (6) to provide fair and reasonable access to products of less developed countries in the United States market.

[40]United States International Trade Commission, Operation of the Trade Agreements Program, 26th Report, 1974 (USITC Publication 765), (Washington, D. C. , 1976).

[41] U. S. International Trade Commission, Annual Report 1975, p. 11.

# CHAPTER III

# THEORETICAL ANALYSIS

## Survey of Previous Studies

The approach of this paper is based on the traditional static, partial-equilibrium model for tariff analysis. Several previous studies serve as the genesis for this study's application of the model. These studies are reviewed briefly in this section.

Balassa, in collaboration with several other economists, examines the economic and political effects of alternative arrangements for trade policy among the industrialized nations of the world.[1] He first presents the economic and political setting for various trade arrangements and then analyzes the trade barriers existing in 1960. He then uses the traditional partial-equilibrium model to estimate the static effects of different forms of trade liberalization.[2]

The static effects analyzed are the direct (changes in imports, exports, and welfare), the indirect ("feedback" from nonindustrialized countries), and the discriminatory (trade diversion) effects. The analysis is based on 1960 (pre-Kennedy Round) data at the three-digit SITC level; however, the only results presented are aggregated into two groups--industrial materials and manufactured goods. He uses Ball and Marwah's import demand elasticities for the U. S. adjusted upwards, and then derives elasticities for the rest of the industrialized world.[3] The estimates of the direct effects of a 50 percent tariff cut are made under

two sets of alternative assumptions: one is that export prices are constant in all countries so that the tariff changes are fully reflected in the import prices; the alternative assumes Europe's export prices rise by one-third the tariff reduction by the rest of the world, with all other countries' export prices remaining constant. Balassa estimates for Manufactured goods and Industrial materials that the direct effects under either alternative would be an expansion of U. S. exports to the other industrial countries in an amount of $1.666 billion. U. S. import expansion totals an estimated $1.655 billion for the first alternative and $1.898 billion for the second alternative. Thus, the direct effects on the U. S. trade balance are +$11 million and - $232 million for the two respective alternatives. The welfare gains from the direct effects of a 50 percent tariff reduction are $71 million under the first variant and $108 million under the second variant for the U. S. Balassa completes his book with a discussion of the possible consequences of trade liberalization on the broadening of markets and on capital flows.

The study by MacPhee of trade restrictions in the steel industry quantifies both tariff and non-tariff barriers and then uses a partial equilibrium model to obtain estimates of their restrictive effects for the major steel-trading countries.[4] He does not estimate welfare effects or the effects in the export market. Although the discussion and quantification of the nontariff barriers form the major part of the book, the portions contributing to this study are the algebraic formulations of the price and quantity effects of tariff removal and of the elasticity relationships. These are described below as they are used in the analytical framework.

Kreinin has discussed the importance of this type of analysis.

> A cut in our tariff rates may or may not result in an equivalent decline in import prices. In all probability only part of the reduction would be passed on to the U. S. consumer, the remainder being reaped by foreign suppliers in the form of higher export prices. The division of the total gain between the foreign producer and the domestic consumer would depend on the relative elasticities of import demand and export supply. . . .
>
> Despite the importance of the problem . . ., it is usually overlooked in studies concerning the impact of our Trade Agreements Program.[5]

The Baldwin and Mutti paper examines the policy problems of adjustment to trade liberalization for several import-competing industries in the United States.[6] They discuss at length the various aspects of the costs of tariff removal. The empirical portion of their study measures the gains from and costs of tariff removal by the U. S. in five industries.[7] Their model, the standard partial-equilibrium framework, is used to estimate "the net direct gain or loss in welfare from reducing the tariff which is defined as the present value of the shaded areas i. e., the net consumer welfare gain -- determined by discounting the sum over some appropriate time period and at some appropriate interest rate -- minus the present value of the loss of productive output during the transitional period."[8] The result is a range of estimates of the net direct gain (loss) in each industry. The range of estimates is due to the lack of disaggregated elasticity estimates at the time of their study; this void causes them to choose to use "a range to represent plausible elasticities for our five industries."[9] It should be noted that they assume the price change from tariff removal equals the full amount of the tariff and that they consider only the United States import market. Citing just one set of their findings, namely, that which assumes an elasticity of import demand equal to 2.0 and an elasticity of domestic supply equal to 0.09, Baldwin and Mutti estimate that the net

welfare effect equals $18.0 million for chemicals, defined as U. S. input-output industry (27). This discounted figure is composed of $24.678 million of benefits and $6.678 million of costs from labor dislocation, determined by using a five-year time horizon for the benefits, a nine-week labor unemployment duration, and a 10 percent discount rate.

The major contribution of the Baldwin and Mutti paper to both the literature and to this study is the methodology of estimating the cost of tariff removal. The cost results from the transitional dislocation of the factors of production used in producing the domestic import-competing commodities. These costs are estimated using labor as a proxy for all the factors of production. The methodology as it is used in this study is described in detail in the subsequent section on resource dislocation.

Magee's paper provides estimates of the welfare effects in the United States of restrictions on trade for broad product classes.[10] He, too, utilizes the traditional framework for his analysis and assumes constant foreign prices for U. S. importables. Following a general discussion of free trade, government restrictions and the Burke-Hartke bill, he applies the model to obtain both short-run and long-run estimates of the gains from the removal both of U. S. restrictions on its imports and of foreign restrictions on U. S. exports. The welfare gains are treated as perpetual annual flows which grow larger through time because long-run elasticities generally exceed those of the short-run. The annual flows are then discounted to obtain present values of the gains from trade liberalization.

Magee also follows Baldwin and Mutti and explicitly recognizes the

cost flow from transitional resource dislocation. Since his consideration for analysis is that of long-run efficiency of a full-employment economy, he measures resource dislocation resulting from the long-run changes in domestic production.

Magee estimates, assuming a 10 percent discount rate and a five-year time horizon, that the U. S. welfare gain from the increase in directly competitive imports into the U. S. and the increase in exports of manufactured goods, both net of labor dislocation costs, is $2.6 billion. For total imports and total exports his estimate increases to $30.7 billion.

The present study particularly benefitted from Magee's analysis of the U. S. export market, which is commonly forgotten in similar studies, and by his distinction of the long-run and short-run estimates.

Lastly, mention should be made of another study with similar objectives but completely different methodology. This study by Jondrow, Devine, Jacobson, Katz and O'Neill estimates the effects of removing U. S. restrictions on steel imports, including the quota.[11] The authors estimate from an econometric model of the steel industry, using 1956 to 1974 time series data, the effects of free trade in terms of the change in domestic prices and production, the change in employment, the earnings losses of the displaced workers, and the net gain to society. The effects are estimated for two time periods: 1969-1973 and 1974-1978.

## The Static Model

The economic impact of reducing trade barriers affects the United States economy in a multitude of ways. The static model for this study focuses on three major aspects of the total effect. They are the direct

effects in the chemical import markets, the chemical export markets, and the transitional resource adjustments.

## The Import Market

The global reduction of barriers to chemical imports, in general, will lower the prices of chemical imports into the United States. The lower prices of imported chemicals will cause some shifting of purchases from domestically manufactured chemicals toward the now less expensive competitive import. Hence, imports increase and domestic production usually is reduced.[12]

This generalized statement assumes that each chemical commodity that is imported into the United States also is produced domestically. Such an assumption is unlikely to be warranted for every individual chemical import; however, the relatively disaggregated level of the present study still maintains a substantial degree of aggregation and gives substance to such an assumption for each chemical category analyzed. It is also assumed that the imported and the domestically produced chemical commodity are perfect substitutes.

Consider the elimination of a tariff barrier which is stated in terms of an ad valorem rate equivalent to its restrictiveness. The elimination of the trade barrier will cause the U. S. price of the import to fall. Only in the case of a perfectly elastic supply of imports to the United States will the amount of the price fall be equal to the absolute height of the barrier and result in a new price equal to the initial duty-free world price. In the more general case, the trade barrier elimination will result in a higher duty-free world price.[13] This increase in the duty-free world price received by the foreign suppliers

limits the price fall in the United States. Thus, the price of the import in the United States will fall by only a fraction of the per-unit value of the barrier removed.

This more general case is illustrated by the United States' import market in Figure 1(a) where P is the original duty-free price, P' the initial U. S. price of the import and M the initial quantity of imports. With trade barrier removal, the import price in the U. S. will fall to $P_o$. This fall is only a fraction, "s," of the absolute amount of the barrier, and equals $(P' - P_o) = sT = stP$, where T is the per-unit value of the tariff and t is the ad valorem tariff rate.[14] The percentage change (negative) in the import price $(\frac{dP'}{P+T})$ for the United States equals:

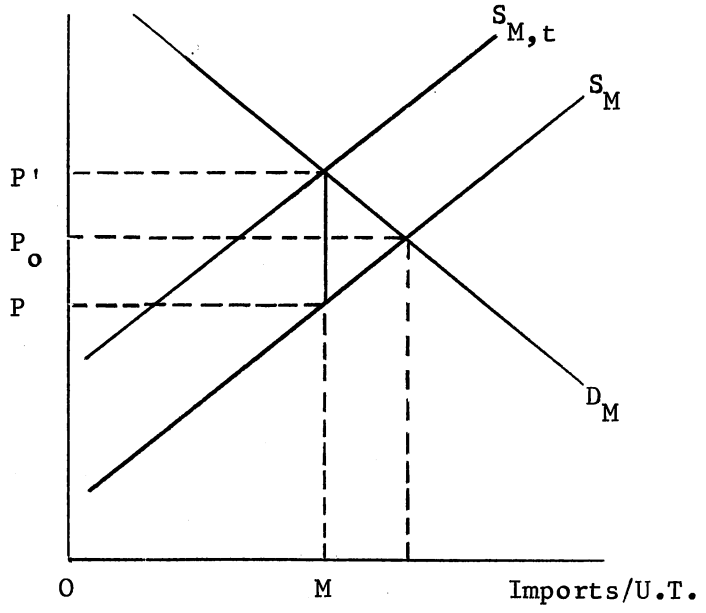
$$\frac{dP'}{P+T} = \frac{st}{1+t} = \frac{t\varepsilon_M}{\eta_M - \varepsilon_M - t\varepsilon_M} \quad , (3.1)$$

and the percentage increase in the original duty-free price received by foreign suppliers $(\frac{dP}{P})$ is:[15]

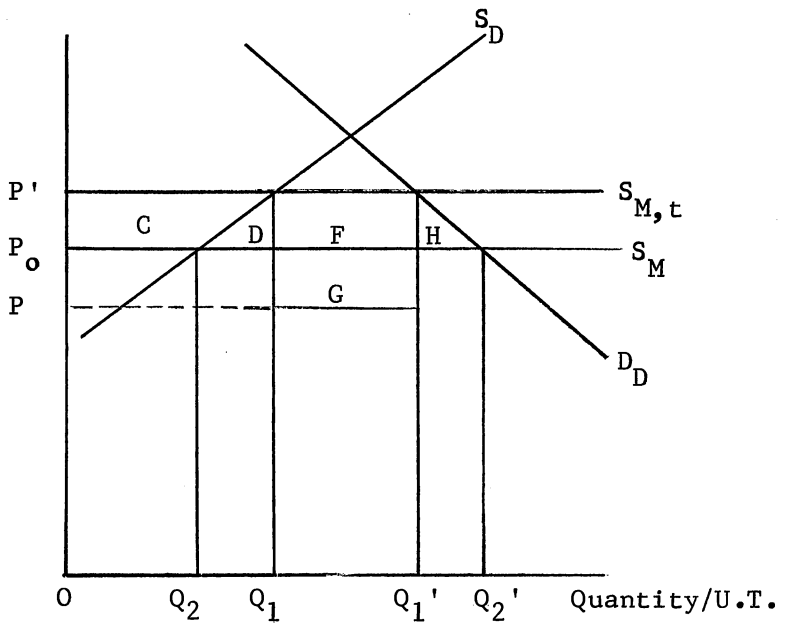
$$\frac{dP}{P} = (1 - s)t = \frac{t\eta_M}{\eta_M - \varepsilon_M - t\varepsilon_M} \quad , (3.2)$$

where $\eta_M$ is the price elasticity of U. S. import demand and $\varepsilon_M$ is the price elasticity of the supply of U. S. imports.

The consequences of trade barrier changes in a static, partial equilibrium analysis are illustrated by use of the domestic market as shown in Figure 1(b).[16] The reduction of the U. S. price of the import from P' to $P_o$ causes a movement along the domestic demand curve and an increase in consumption of the product from $Q_1'$ to $Q_2'$. The new lower import price $P_o$ is the maximum price at which domestic producers can sell their product and, thereby, reduces domestic production from $Q_1$ to




(A)




(B)

Figure 1. Graphic Analysis for Imported Commodity (A) U.S. Import Market; (B) U.S. Domestic Market

$Q_2$. It is this production cutback that creates the transitional release of productive resources which is discussed in a later section. With no quantitative restrictions on imports, the discrepancy between the quantity demanded and that supplied domestically is filled by imports. Thus, imports increase from M, i. e., $Q_1Q_1'$, to $Q_2Q_2'$.

The elimination of trade barriers has implications also for the national welfare. Consumer surplus is increased, as illustrated by the sum of the areas C, D, F, and H; however, parts of the gain are merely transfers to the consumer sector from other sectors of the economy. Area C is the loss in producer surplus as the domestic producers are forced to lower their price to match the now lower import price. Furthermore, in the case of tariff elimination the government sector loses tariff revenue in the amount represented by the sum of the areas F and G.[17] The welfare effect ($W_M$) of trade barrier removal is shown D + H - G in the case of tariffs.

Quantification of the magnitudes of the effects is obtained from relationships utilizing the previously calculated percentage decline in the U. S. import price and various elasticity estimates. The percentage change in imports ($\frac{dM}{M}$) is:[18]

$$\frac{dM}{M} = \eta_M \frac{dP'}{P+T} = \frac{\eta_M t\varepsilon_M}{\eta_M - \varepsilon_M - t\varepsilon_M} \quad ; (3.3)$$

and the change in the duty-free value of imports ($dV_M$) equals:[19]

$$dV_M = V_M \left[ \frac{dP}{P} + \frac{dM}{M} + \frac{dP}{P} \frac{dM}{M} \right] \quad (3.4)$$

And the change in welfare ($dW_M$) of the importing country from tariff elimination is:[20]

$$dW_M = \tfrac{1}{2} \left(\frac{dP'}{P+T}\right)^2 \cdot \eta_M \cdot V_M \cdot (1+t) - \left(\frac{dP}{P} \cdot V_M\right). \qquad (3.5)$$

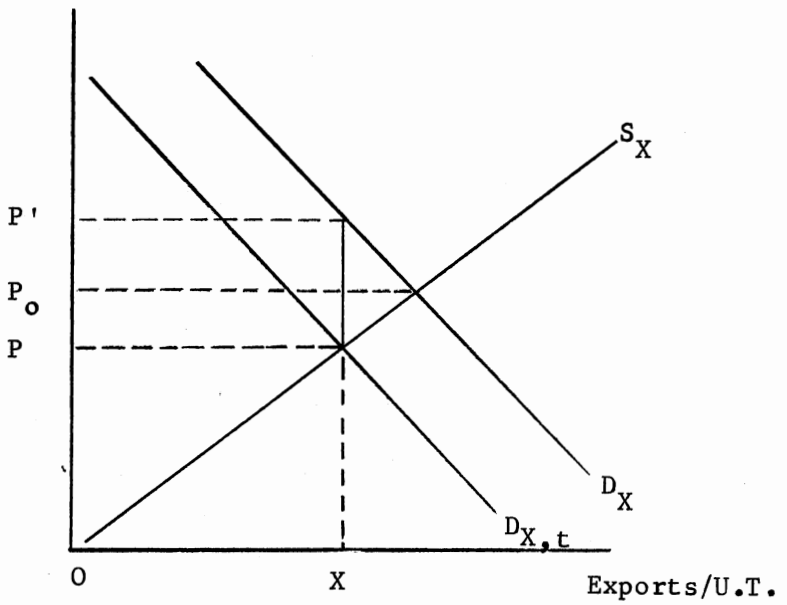
The Export Market

The analysis for the United States export market is analagous to that for imports. The elimination of foreign trade barriers lowers the prices paid by the rest-of-the-world for United States exports. Initially and temporarily the price fall is from P' to P in Figure 2(a). The lower foreign price is viewed as causing an increase in demand for U. S. exports and results in an upward movement along the export supply curve. Thus, as production is increased the price received by the exporter in the United States rises from P to $P_o$.[21] The price rise is a function of the price elasticities of export supply and demand as well as the height of the eliminated tariff.

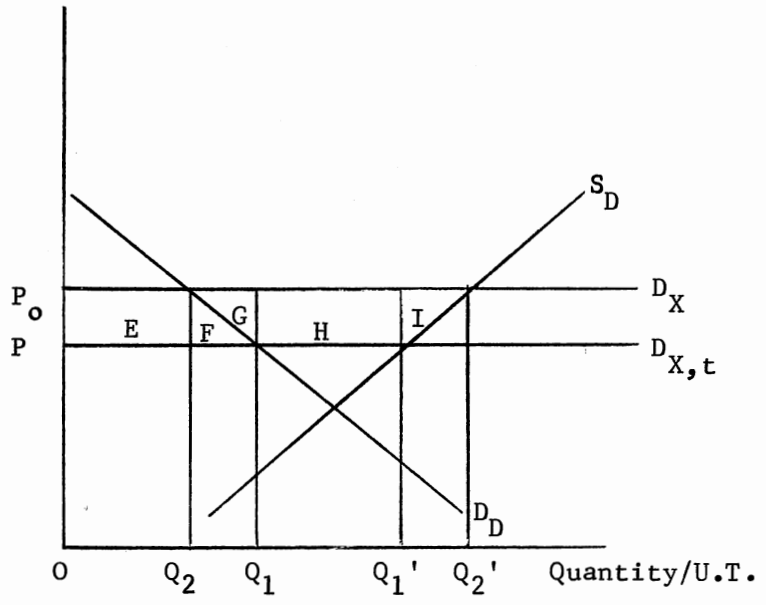
In the domestic market, the price rise causes an increase in domestic production and a decrease in the quantity demanded domestically. Assuming the amount by which the quantity supplied exceeds the quantity demanded is exported, exports from the U. S. increase. The increase in the quantity of exports (X) is illustrated in Figure 2(b) by the change in exports from $Q_1Q_1'$, at P to $Q_2Q_2'$ at $P_o$. The welfare effects for the United States are a loss of consumer surplus illustrated by the combination of areas E and F and an offsetting gain in producer surplus represented by the sum of areas E, F, G, H and I. The net result is a welfare gain for the United States composed of G, H, and I.

The percentage increase in the U. S. price of the exported good $\left(\frac{dP}{P}\right)$ is calculated as:

$$\frac{dP}{P} = \frac{t\eta_X}{\eta_X - \varepsilon_X - \varepsilon_X t}; \qquad (3.6)$$




(A)




(B)

Figure 2. Graphic Analysis for an Exported Commodity (A) U.S. Export Market; (B) U.S. Domestic Market

the magnitudes of the ensuing effects are estimated as:

$$\frac{dX}{X} = \frac{t\eta_X\varepsilon_X}{\eta_X - \varepsilon_X - \varepsilon_X t} \qquad (3.7)$$

for the percentage change in the quantity of exports $(\frac{dX}{X})$,

$$dV_X = V_X \left[ \frac{dP}{P} + \frac{dX}{X} + \frac{dP}{P}\cdot\frac{dX}{X} \right] \qquad (3.8)$$

for the change in the value of exports $(dV_X)$, and for the welfare gain $(dW_X)$ of the United States:

$$dW_X = \tfrac{1}{2}\cdot\left(\frac{dP}{P}\right)^2 \cdot \varepsilon_X \cdot V_X + V_X \cdot \frac{dP}{P}, \qquad (3.9)$$

where $\varepsilon_X$ and $\eta_X$ are, respectively, the price elasticities of U. S. export supply and U. S. export demand.[22]

Resource Adjustment

The elimination of tariffs causes a reduction in the output of the import-competing sectors and an increase in production by the exporting sectors. The changes in production precipitate changes in resource employment, given a fixed level of technology. This resource dislocation is a transitional phenomena which exists only until the economy returns to a position of long-run equilibrium; however, even the transitional unemployment of these factors is a cost to society which offsets to some extent any welfare gains from trade liberalization. Because of the difficulties involved in assessing the cost of relocating capital equipment, this study estimates the social cost of resource dislocation solely in terms of labor.

When the import-competing sectors reduce output, they either underutilize and/or release some of their labor resources. Until these

resources are once again fully-employed or reabsorbed by other parts of the economy, society loses potential output. The output expansion by the export sectors also involves a cost because people must change from jobs in other parts of the economy into employment in the expanding sectors; however, these transitional costs of expansion are much less because the time of transition is shorter. The sum of the dislocation costs in both markets approximates the cost to society.

The methodology for obtaining these estimates parallels that of Baldwin and Mutti as applied by them and also by Magee.[23] Changes in output are assumed to yield only changes in the quantity of employment, without changes in the intensity of labor utilization. The change in employment is estimated by multiplying the predicted long-run change in output by a direct labor-output coefficient.[24] Algebraically, for the import markets:[25]

$$\Delta L = \Delta Q\frac{L}{Q} = P'Q\varepsilon_D^*\left(\frac{dP'}{P + T}\right)\left(\frac{L}{P'Q}\right) \qquad (3.10)$$

where $\Delta L$ is the change in jobs, Q the quantity of domestic output, P'Q the initial value of output, $\varepsilon_D^*$ the long-run price elasticity of domestic supply, $\frac{dP'}{P+T}$ the percentage fall in the domestic price and $\frac{L}{P'Q}$ the number of employees per value of output. Because the value of output data include output for export, equation 3.10 is rewritten as:

$$\Delta L = \Delta Q\frac{L}{Q} = (V_S - V_X)\varepsilon_D^*\left[\frac{L}{(V_S - V_X)}\right] \qquad (3.11)$$

where $V_S$ is the value of domestic supply and $V_X$ is the value of U. S. exports. For the export markets, an analagous relationship exists:

$$\Delta L = V_S\varepsilon_D^*\left(\frac{dP}{P}\right)\left(\frac{L}{V_S}\right) \qquad (3.12)$$

The total change in jobs in each type of market is then converted to an annual figure assuming there is a two-year period of labor adjustment to the change in output.[26]

This annual change in labor is multiplied by the average duration of unemployment in years and by the annual average total cost of labor in the subgroups within the chemical industry.[27] This product is the cost of labor dislocation for each year of the two-year adjustment period.

The cost of dislocation is estimated using two alternative assumptions.[28] The first variant yields a minimum cost estimate for the dislocation given segregation of the import and export markets. It assumes that the average duration of unemployment for the import market is the average duration of unemployment for the economy as a whole, and therefore, by assumption, equals one-half the economy's average duration for the export market. The second variant assumes the average durations for the import and export markets are twice those of variant one. This recognizes the possible existence of small localized labor markets in which a plant closing substantially increases the average duration of unemployment. Variant two would yield a maximum cost estimate.

An important caveat is the possible overstatement of the transition costs resulting from the separate treatment of the import-competing and the export sectors. This would occur if the resources move easily from the import-competing sectors to the expanding export sectors. This would seem to be a likely occurrence within the sectors of the chemical industry. Hence, an alternative set of estimates of the transitional dislocation cost is made by netting out the production expansion due to increased exports from the output reduction in the import sector for

each chemical sector. If the net result is production expansion, it is treated as an export market as discussed above; otherwise it is treated as an import market. This integration of the import and export markets furnishes a set of lower-bound estimates of the cost under either variant.

## The Model Over Time

The model presented in the preceding section is a framework for static analysis. This section incorporates an intertemporal treatment into the analysis. The estimates of the welfare effects and the dislocation costs are the annual amounts of temporal flows which are of different durations. In order that the cost and welfare flows be commensurable, the flows must be discounted to derive their present values.

Two discount rates, 5 percent and 10 percent, are used to compute alternative estimates of the present values of the gains from and costs of free trade. Baldwin and Mutti used 5 percent, 10 percent, and 15 percent as a range of plausible rates; however, as they point out, this does not allow for growth of income and, hence, of demand and supply which causes their results to be biased downward.[29] Magee explicitly considers growth and shows that "the discount factor, incorporating both [the real] growth [rate, g,] and the rate of capitalization, r, . . . is approximately equal to r - g."[30] He believes a discount factor of 4 percent is most plausible but also computes estimates using discount rates of 7 and 10 percent.

The relevant long-run time horizon chosen for the analysis is rather arbitrary. Baldwin and Mutti use a ten-year horizon but also present estimates for a five-year horizon "which might be more realistic for politicians who face frequent elections."[31] They reject

an infinite time horizon as unrealistic because of changes in taste and technology that occur over time. They assume labor adjustment occurs within one year. Magee assumes the gains flow through perpetuity and labor adjustment occurs over five years.[32] He also reports, however, the present value of a five-year flow of benefits. This study uses a five-year time horizon for the long-run and assumes a two-year short-run.

The welfare gains from trade liberalization increase over time because long-run elasticities generally exceed those of the short-run.[33] Thus, the welfare gains discussed above (Equations 3.5 and 3.9) are calculated twice using the long-run and short-run elasticities. The short-run welfare effects are assumed to exist for the initial two years and the long-run effects are assumed for the remaining three years of the time horizon. This assumed stream of benefits is then discounted.

The annual dislocation costs are derived from the production change to a new long-run equilibrium position. The time horizon for the labor adjustment flow is assumed to be two years. It is the present-value of this two-year cost flow which is netted out of the discounted benefit stream.

## Summary

This chapter begins with a review of the literature. The study by Balassa estimates the static effects of trade liberalization using 1960 data. These effects on trade expansion and social welfare are presented for two types of commodities (industrial materials and manufactured goods). MacPhee quantifies the trade barriers in the steel industry and then estimates the restrictive effects of those barriers.

In his study, he presents several elasticity relationships from which he estimates the price and quantity effects of tariff removal. The Baldwin and Mutti paper estimates the net welfare effects of tariff removal for the U. S. import market in five industries. The net welfare effect is composed of the net consumer welfare gain and the loss from labor dislocation. Magee's paper follows Baldwin and Mutti's methodology but expands the analysis to include the effects in export markets. These previous works form the foundation for the analytical methodology used in this study.

The major portion of the chapter is devoted to the development of the theoretical methodology for this study. The model presented in the chapter consists of four components. The first two are static, partial equilibrium analyses of the U. S. import market and of the U. S. export market for a commodity (or commodity group). For the import market, elimination of a trade barrier will cause, in most cases, an increase in the duty-free world price and a decrease in the U. S. price of the import. The fall in the U. S. price of the import will be limited to only a fraction of the per-unit value of the barrier removed. The analysis for the export market is analagous to that for imports. The elimination of foreign trade barriers lowers the price paid by the rest-of-the-world for United States' exports. From the U. S. viewpoint, the lower price abroad increases the demand for the exported commodity and increases the U. S. price of the commodity. The analyses derive the changes in prices, the changes in the quantity and value of imports (exports), and the changes in social welfare (composed of the changes in producers' and consumers' surpluses and U. S. tariff revenue) which result from tariff elimination.

The third portion of the model focuses upon the social costs which occur because of resource adjustments to changes in domestic production which result from trade liberalization. The estimates of these costs are restricted to the labor resource and are subtracted from the estimates of the social welfare effects. The estimates of the annual social cost of labor dislocation are the product of the changes in employment, the average duration of unemployment and the average total cost of labor.

Lastly, the net welfare effects, i. e., the welfare gains less the resource dislocation costs, in the static model are treated as flows through time. Thus, it is necessary to select appropriate time horizons from which to derive the present values of the net social welfare effects.

ENDNOTES

[1]Bela Balassa, Trade Liberalization among Industrial Countries (New York, 1967). The four alternative trade arrangements discussed are: (a) a free trade area among industrial countries, (b) multilateral reductions among industrial countries extended to the nonindustrial nations under the m. f. n. clause, (c) a trade arrangement among the industrial nations excluding the EEC, and (d) integration of Western Europe.

[2]This section, written in collaboration with Kreinin, also appears as an article: Bela Balassa and Mordechai E. Kreinin, "Trade Liberalization under the 'Kennedy Round:' The Static Effects," Review of Economics and Statistics, XLIX (1967), pp. 125-137.

[3]See R. J. Ball and K. Marwah, "The U. S. Demand for Imports, 1948-1958," Review of Economics and Statistics, XLIV (1962), pp. 395-401. Their elasticities are for three broad categories: finished manufactures, semi-finished manufactures, and crude materials.

[4]Craig R. MacPhee, Restrictions on International Trade in Steel (Lexington, Mass., 1974).

[5]Mordechai E. Kreinin, "Effects of Tariff Changes on the Price and Volume of Imports," American Economic Review, LI (1961), p. 311.

[6]Robert E. Baldwin and John H. Mutti, "Policy Problems in the Adjustment Process (U. S.)," (unpublished paper).

[7]The industries are, as defined from the U. S. input-output tables: (16) Broad and Narrow Fabrics, Yarn and Thread mills; (27) Chemicals and Selected Chemical Products; (37) Primary Iron and Steel Manufacturing; (56) Radio, Television and Communications Equipment; and (59) Motor Vehicles and Equipment.

[8]Baldwin and Mutti, p. 6.

[9]Ibid., p. 10.

[10]Stephen P. Magee, "The Welfare Effects of Restrictions on U. S. Trade," Brookings Paper on Economic Activity, No. 3 (1972).

[11]James Jondrow, Eugene Devine, Louis Jacobons, Arnold Katz, and David O'Neill, Removing Restrictions on Imports of Steel, Review Copy, PRI 75-2 (Arlington, Va., May, 1975).

[12]The domestic production effect depends on the relevant elasticities. If the domestic supply is perfectly inelastic, the lower prices of imported chemicals will increase imports to fulfill the increased quantity demanded without altering domestic production.

[13]As viewed by the foreign suppliers, U. S. demand for their product has increased, causing them to expand and move upward along their supply curve.

[14]The remainder of the barrier is absorbed by foreign suppliers whose prices rise by (1-s)T.

[15]The equations 3.1 and 3.2 are from MacPhee, p. 45. Although MacPhee did not present derivations of these equations in his text, the author's own derivations are presented in Appendix B.

[16]Although this analysis is conventional in the literature, a good presentation is made by Magee, pp. 658-661.

[17]If the original tariff was fully protective, the government had no tariff revenue because of the exclusion of imports. The model assumes that some imports existed and, hence, some tariff revenue was collected prior to free trade; tariff elimination would by definition eliminate any tariff revenues.

[18]Equation 3.3 is from MacPhee, p. 45. Although MacPhee did not present derivations of these equations in his text, the author's own derivations are presented in Appendix B.

[19]Equation 3.4 is a rearrangement of MacPhee's equation (2.12), p. 45. As with the preceding equations, a derivation appears in Appendix B.

[20]Equation 3.5 is based on the discussion in Harry G. Johnson, "The Cost of Protection and the Scientific Tariff," Journal of Political Economy, 68 (1960), especially p. 332. Its derivation appears in Appendix B and it is used in the computation of the welfare effects reported in Chapter V.

In addition, for a selected set of assumptions, the components of the traditional welfare effect in the import market are calculated separately to illustrate the distribution of the effect among the producers (p), consumers (c), and government (g) sectors. The equations for these separate calculations follow; their derivations appear in Appendix B. The change (loss) in producers' surplus is:

$$dW_{M,p} = -\left(\frac{dP'}{P+T}\right)\ (V_S - V_X)\quad \left[\,1 + (\tfrac{1}{2})\left(\frac{dP'}{P+T}\right)\ \varepsilon_D\,\right]; \qquad (3.5.a)$$

the change (gain) in consumers' surplus is:

$$dW_{M,c} = -\left(\frac{dP'}{P+T}\right)\ V_D\ \left[\,1 + (\tfrac{1}{2})\left(\frac{dP'}{P+T}\right)\ \eta_D\,\right]; \qquad (3.5.b)$$

the change (loss) in tariff revenue is:

$$dW_{M,t} = V_M \left[ \frac{dP}{P} - \left(\frac{dP'}{P+T}\right)(1 + t) \right]. \qquad (3.5.c)$$

[21]The foreign price abroad for our exports falls, in final analysis, from P' to $P_o$.

[22]The derivations of the equations for the export market, i. e., Equations (3.6), (3.7), (3.8) and (3.9) appear in Appendix B. In addition, for a selected set of assumptions, the components of the traditional welfare effect on the export market are calculated separately to illustrate the distribution of the effect among the producers' (p) and consumers' (c) sectors. The equations for these separate calculations follow; their derivations appear in Appendix B.

The change (loss) in consumers' surplus is:

$$dW_{X,c} = \frac{dP}{P}(V_D - V_M)\left[1 + \tfrac{1}{2}\left(\frac{dP}{P}\right) \eta_D \right]; \qquad (3.9.a)$$

and the change (gain) in producers' surplus is:

$$dW_{X,p} = \frac{dP}{P} V_S \left[1 + \tfrac{1}{2} \left(\frac{dP}{P}\right) \varepsilon_D\right]. \qquad (3.9.b)$$

[23]Baldwin and Mutti, and Magee. This approach is criticized by Jondrow, et al.

[24]As Baldwin and Mutti, and Magee note, this coefficient is an average value, but is used as if it were also a marginal value. This assumes that the coefficient is a constant.

[25]Baldwin and Mutti, p. 12. As noted by Baldwin and Mutti, $\varepsilon_D^* \cdot \frac{dP'}{P+T}$ must be $\leq 1$; if not, $\Delta L > L$.

[26]The two-year period of adjustment is chosen because of evidence in the study by Jondrow, et al. for the steel industry. It found that the labor adjustment to an output change was nearly complete in one year and is complete within six quarters. Baldwin and Mutti assume a one-year period; Magee assumes a five-year period of adjustment.

[27]Both Baldwin and Mutti's and Magee's analysis makes use of the average wage of labor. If one were interested in the private cost of the dislocation, the lost wages of labor should be adjusted for unemployment benefits which are paid to the unemployed. However, the concern of this study is with the social cost of the transitional dislocation. As theory tells us, employees are paid according to their worth. It must be noted that most employees receive from their employers more than just their wage; fringe benefits are significant in amount. Thus, the worth of the employee is his total cost to the employer, i. e., his wage plus the value of his fringe benefits.

In the export market, the average duration is assumed to equal one-half that of the import market on the supposition that it is easier to move into an expanding industry than to make the transition to a new job from a contracting industry. This assumption is similar to one by Magee, pp. 682-683.

[28]Baldwin and Mutti, p. 14.

[29]Ibid., p. 11.

[30]Magee, p. 684.

[31]Baldwin and Mutti, p. 11.

[32]Magee, pp. 660, 680.

[33]In terms of Figures 1(b) and 2(b), the domestic supply and demand curves would become more elastic, rotating at the points of intersection with the original import supply (export demand) curves at the initial price levels. Thus the deadweight welfare triangles become larger over time (assuming the domestic price change is the same in the long-run and the short-run, which would be the case if the long-run elasticities of demand and supply both increase by the same proportion).

# CHAPTER IV

# THE DATA

## Introduction

The model described in the preceding chapter forms the basis for the empirical analysis of this study. Given the necessary data, the model is readily transformed into quantitative estimates.[1] One of the greatest challenges in doing research in international trade is presented by the collection of the data. The desired data do not always exist. The various sources of available data use several different methods of classification; hence, early in the research effort these classification schedules must be reconciled. Also, the available data are at different levels of aggregation. This difficulty is intensified because the integrity of data coverage diminishes as the level of disaggregation increases. As a result of these and other problems, extensive adjustments to the existing data are necessary. It is the purpose of this chapter to elaborate on the collection of the basic data and their modifications for this study.

## Classification Schedules

The classification system used in this study is the Standard International Trade Classification, Revised (SITC). It is presented in Table I disaggregated to the four-digit level. Unfortunately, the multiplicity of data sources for this study are not all arranged

TABLE I

STANDARD INTERNATIONAL TRADE CLASSIFICATION, REVISED*

SECTION 5. CHEMICALS

Division 51. Chemical Elements and Compounds

512 Organic chemicals
- 512.1 Hydrocarbons and their halogenated, sulfonated, nitrated or nitrosated derivatives
- 512.2 Alcohols, phenols, phenol-alcohols, glycerine
- 512.3 Ethers, epoxides, acetals
- 512.4 Aldehyde-, ketone- and quinone-function compounds
- 512.5 Acids and their halogenated, sulphonated, nitrated or nitrosated derivatives
- 512.6 Inorganic esters, their salts and derivatives
- 512.7 Nitrogen-function compounds
- 512.8 Organo-inorganic and heterocyclic compounds
- 512.9 Other organic chemicals

513 Inorganic chemicals: Elements, oxides and halogen salts
- 513.1 Oxygen, nitrogen, hydrogen, rare gases
- 513.2 Chemical elements n.e.s.
- 513.3 Inorganic acids and oxygen compounds of non-metals or metalloids
- 513.4 Halogen and sulphur compounds of non-metals or of metalloids
- 513.5 Metallic oxides, of kinds principally used in paints
- 513.6 Other inorganic bases and metallic oxides

514 Other inorganic chemicals
- 514.1 Metallic salts and peroxysalts of inorganic acids
- 514.2 Other metallic salts and peroxysalts of inorganic acids (I)
- 514.3 Other metallic salts and peroxysalts of inorganic acids (II)
- 514.9 Inorganic chemical products, n.e.s.

515 Radioactive and associated materials
- 515.1 Radioactive chemical elements and isotopes and their compounds and mixtures
- 515.2 Stable isotopes and their compounds
- 515.3 Compounds and mixtures, n.e.s. of thorium, of uranium, of rare earth metals, of yttrium or of scandium

Division 52. Mineral Tar and Crude Chemicals from Coal, Petroleum and Natural Gas

521 Mineral tar and crude chemicals from coal, petroleum, and natural gas

*SOURCE: "Standard International Trade Classification, Revised," United Nations, Department of Economic and Social Affairs, Statistical Papers, Series M, No. 34, New York, 1961.

TABLE I (Continued)

521.1 Mineral tar
521.3 Ammoniacal gas liquors and spent oxide produced in coal gas purification
521.4 Oil and other products of the distillation of coal and tar

Division 53. Dyeing, Tanning and Colouring Materials

531 Synthetic organic dyestuffs, natural indigo and colour lakes
531.0 Synthetic organic dyestuffs, natural indigo and colour lakes

532 Dyeing and tanning extracts, and synthetic tanning materials
532.1 Dyeing extracts (vegetable and animal)
532.3 Synthetic tanning materials
532.4 Tanning extracts of vegetable origin
532.5 Tannic acids (tannins) and derivatives

533 Pigments, paints, varnishes and related materials
533.1 Colouring materials, n.e.s.
533.2 Printing inks
533.3 Prepared paints, enamels, lacquers, varnishes, artists' colours, siccatives (paint driers) and mastics

Division 54. Medicinal and Pharmaceutical Products

541 Medicinal and pharmaceutical products
541.1 Vitamins and provitamins
541.3 Penicillin, streptomycin, tyrocidine and other antibiotics
541.4 Opium aklaloids, cocaine, caffein, quinine and other vegetable alkaloids, their salts and other derivatives
541.5 Hormones
541.6 Glycosides; glands and their extracts; sera, vaccines
541.7 Medicaments
541.9 Pharmaceutical goods

Division 55. Essential Oils and Perfume Materials; Toilet, Polishing and Cleansing Preparations

551 Essential oils, perfume and flavour materials
551.1 Essential oils and resinoids
551.2 Synthetic perfume and flavour materials and concentrates, and enfleurage greases and mixtures of alcohol and essential oils

553 Perfumery and cosmetics, dentifrices and other toilet preparations (except soaps)

TABLE I (Continued)

553.0 Perfumery and cosmetics, dentifrices and other toilet preparations (except soaps)

554 Soaps, cleansing and polishing preparations
- 554.1 Soaps
- 554.2 Surface-acting agents and washing preparations
- 554.3 Polishes, pastes, powder and similar preparations for polishing and preserving leather, wood, metal, glass and other materials

Division 56. Fertilizers, Manufactured

561 Fertilizers, manufactured
- 561.1 Nitrogenous fertilizers and nitrogenous fertilizer materials (other than natural), n.e.s.
- 561.2 Phosphatic fertilizers and phosphatic fertilizer materials (other than natural)(including superphosphates and basic dephosphorization slag)
- 561.3 Potassic fertilizers and potassic fertilizer materials (other than crude natural potassic salts)
- 561.9 Fertilizers, n.e.s.

Division 57. Explosives and Pyrotechnic Products

571 Explosives and pyrotechnic products
- 571.1 Propellent powders and other prepared explosives
- 571.2 Fuses, primers and detonators
- 571.3 Pyrotechnical articles
- 571.4 Hunting and sporting ammunition

Division 58. Plastic Materials, Regenerated Cellulose and Artificial Resins

581 Plastic materials, regenerated cellulose and artificial resins
- 581.1 Products of condensation, polycondensation and polyaddition (e.g., phenoplasts, amoniplasts, alkyds, polyallyl esters and other unsaturated polyesters, silicones)
- 581.2 Products of polymerization and copolymerization (e.g., polyethylene, polysterene, polyvinyl, etc. derivatives, coumaroneindene resins)
- 581.3 Regenerated cellulose, chemical derivatives of cellulose and vulcanized fibre
- 581.9 Other artificial resins and plastic materials

Division 59. Chemical Materials and Products, N.E.S.

TABLE I (Continued)

| | | |
|---|---|---|
| 599 | Chemical materials and products, n.e.s. | |
| | 599.2 | Insecticides, fungicides, disinfectants (including sheep and cattle dressing) and similar preparations |
| | 599.5 | Starches, inulin, gluten; albuminoidal substances; glues |
| | 599.6 | Wood and resin-based chemical products |
| | 599.7 | Organic chemical products, n.e.s. |
| | 599.9 | Chemical products and preparations, n.e.s. |

according to the SITC system. A partial list of the many existing classification systems includes the International Standard Industrial Classification (ISIC), the Brussels Tariff Nomenclature (BTN), the Standard Industrial Classification of the United States (SIC), the Tariff Schedule of the United States of America (TSUSA), and Schedule A, Statistical Classification of Commodities Imported into the United States. These classification systems are not completely amenable to cross-classification.

The BTN schedule is the basis for the tariff schedules of the world excluding the United States and Canada, each of which has its own classification schedule for tariffs. The BTN schedule corresponds exactly with the SITC schedule which was revised in 1961 to effect this correspondence at the five-digit SITC level. This correspondence is published by the United Nations.[2]

The United States arranges its tariff schedule according to its own unique classification system, the TSUSA. It does not correspond directly to the SITC; however, the best possible concordance has been established and published by the U. S. Bureau of Census.[3]

The U. S. import statistics are reported in terms of Schedule A.

> Schedule A rearranges and summarizes the approximately 10,000 commodity classifications of the Tariff Schedules of the United States Annotated (TSUSA) into approximately 2,400 7-digit Schedule A Classifications within the framework of the Standard International Trade Classification (SITC), Revised. . . . At the 1-, 2-, and 3-digit levels, the numbering system of Schedule A is identical with that of the SITC. The commodity coverage is not always identical, but it is believed that for most statistical purposes the coverage at the 1-, 2-, and 3-digit levels can be considered essentially comparable with that of the SITC.[4]

The cross-classification is from the U. S. Bureau of Census.[5]

Linking the two remaining classification systems discussed in this study to the SITC classification is tenuous because of the different orientations. Whereas the SITC, BTN, TSUSA, and Schedule A are arrangements according to commodity use, the ISIC and SIC are production-based systems focusing on industrial origin.

The United Nations has published a cross-classification of SITC items to ISIC groups;[6] however, it is not a complete concordance. Fortunately, the ISIC classified data source used in this study also indicates the SITC item corresponding to the ISIC category.

The concordance between the SIC and SITC systems which is used in this study is one compiled by the author. It is derived from a variety of sources at the level of aggregation necessary for use with the Census of Manufactures data.[7]

## Import and Export Data

The import and export data are from OECD statistics for the year 1972.[8] The data are reported and collected on the three- and four-digit SITC levels in terms of value of imports and exports. For the SITC subgroups which also report quantity of imports or exports, these data are collected likewise. It should be noted that the OECD data for the EEC include intra-EEC trade, but the intra-EEC trade statistics are also reported. For this study, the intra-EEC trade is subtracted from the OECD total. Hence, the EEC data of this study exclude intra-EEC trade.

The value of exports data are on an f. o. b. basis. The import figures are c. i. f. values for all countries except the United States and Canada. The latter two nations report f. o. b. statistics. In

order to maintain consistency in calculating the sundry price elasticities, the U. S. and Canadian f. o. b. import data must be converted to a c. i. f. equivalent.

The conversion of f. o. b. value of imports to c. i. f. values is made using information published by the U. S. Bureau of Census.[9] The series, which began in 1974, reports value of U. S. imports on three bases, i. e., customs value, f. a. s. value, and c. i. f. value, and is categorized according to the U. S. Schedule A commodity code. The 1974 U. S. import data are first regrouped from the Schedule A items into the SITC classification system. These data on both the f. a. s. and c. i. f. values of U. S. imports permit the calculation for each three-digit SITC group of a figure which is the percent of the f. a. s. value by which the c. i. f. value exceeds the f. a. s. value. These percentage figures are used to transform the reported 1972 f. o. b. import data of the United States into c. i. f. values. The same conversion factors, based on the U. S. data, are also applied to the Canadian value of imports data.

This conversion assumes the f. a. s. value is identical with the f. o. b. value which is not the case. Since no data on both the f. o. b. and c. i. f. values are available, the conversion and corresponding assumption appear to be the best possible and preferable to no adjustment at all. The conversion also assumes the f. a. s. - c. i. f. differential remained the same from 1972 to 1974. Again the 1974 commencement of the data series necessitates the assumption.

## Production Data

### For the United States

The production data for the United States is Value of Shipments data obtained from the 1972 Census of Manufactures. These data, published according to the SIC classification, are reclassified into the SITC classification used in this study according to a concordance established by the author.

Radioactive and associated materials (SITC 515) is an anomaly because the Census of Manufactures includes only radioactive isotopes shipped from non-AEC plants. Thus, it omits the AEC which is the major source of U. S. nuclear material production. To correct for this deficiency, reference was made to the AEC's Financial Summary for 1972 which reported production of nuclear materials; this figure is incorporated in the U. S. production data.[10]

### For the Rest-of-the-World

Production data for other countries in the study present a greater problem. No truly satisfactory source of disaggregated chemical production data could be found, as individual countries are reluctant to reveal information about their chemical production.[11] This data void necessitated an indirect approach to obtain the estimates of chemical production for the foreign countries of this study.

Values of gross output by country are reported in terms of the ISIC industrial classification system in the United Nation's Growth of World Industry, Volume I.[12] The data are quite aggregated; for each of the countries in this study, the volume reports the value of gross output for the chemical industry (ISIC's 351 and 352 combined).[13] These

data are in terms of the national currency. Therefore it is necessary to convert them into the equivalent U. S. dollar values using the 1972 conversion rates of the OECD.[14] As subsequently described, these values of gross chemical output for each nation are used to obtain the required disaggregated value of production data.

The initial disaggregated production data, with the exception of SITC 541 (Medicinal and pharmaceutical products), are obtained from the United Nation's Growth of World Industry, Volume II.[15] These data are quantity of output figures by country for selected individual ISIC numbers. The volume also reports the SITC number corresponding to each selected ISIC number. This permits the regrouping of these data into the SITC classification of this study.[16] For each country, including the United States, these re-grouped data are then aggregated to the three-digit SITC level and are also totalled for the nation's chemical industry. From these figures, a percent of total chemical production accounted for by each three-digit SITC is computed.

Several important things must be noted concerning the production data from GWI, II. First, for several countries omissions of the selected ISIC's are prevalent serving to vitiate the data. The United States, Japan and the EEC contain few omissions; their data are used as reported, subject to the adjustments described below. The United Kingdom, Canada, and the "other" countries have massive data omissions and are deemed unuseable.

Secondly, The Growth of World Industry, Volume II reports only selected ISIC items and, thus, provides incomplete coverage of the industry. Finally, the data are quantity figures rather than in terms of value of production.

In the case of Japan and the EEC, the three-digit SITC percentage of chemical production figures are adjusted to compensate for the incomplete coverage and to convert quantity data into value data. This procedure assumes that these countries have similar production proportions of selected to non-selected ISIC items within each SITC group and that the price level ratios of one three-digit SITC to another are comparable. An initial adjustment coefficient is created; it is the ratio of the U. S. Value of Shipments percent to the U. S. Growth of World Industry, Volume II percent for each three-digit SITC. Each adjustment coefficient is multiplied by the corresponding percentage production figure for each three-digit SITC group to obtain a partially-adjusted percentage figure. That is,

$$\frac{Vs_{xxx,i}}{Vs_{x,i}} = \left(\frac{Vs_{xxx,U.S.}}{Vs_{x,U.S.}} \Big/ \frac{S_{xxx,U.S.}}{S_{x,U.S.}}\right) \frac{S_{xxx,i}}{S_{x,i}}$$

where $Vs_{xxx,i}$ is the value of shipments (Vs) for the xxx SITC category for country i and $S_{xxx,i}$ is the quantity of output with the same subscripts.

In several cases, none of the selected ISIC items belong to a particular three-digit SITC group.[17] Hence, that SITC group has zero quantities produced by all countries. It is necessary in these cases to assume for the partially-adjusted figure the same percentage as the United States' Value of Shipments percentage figure.

A final adjustment is required because the resulting partially-adjusted percentages plus the adjusted percentage of SITC 541 (discussed in the succeeding paragraph) no longer sum to 100. The final adjusted percentage figures sum to 100 percent and are obtained by multiplying each partially adjusted percentage figure by the ratio of 100 percent

minus the SITC 541 percent to the total of the partially adjusted percents (excluding SITC 541).

The exceptional category in the production data is SITC 541, Medicinal and Pharmaceutical Products, which is nearly identical to ISIC 3522.[18] The United Nations' GWI,I, in addition to reporting the value of gross output of the chemical industry (ISIC 351 and 352) for each of the countries of this study, also reports value of output for various industry subparts for some of the countries of this study. The one subpart for which data are available for all the countries of this study is ISIC 3522. Thus, the percent of the total value of chemical output accounted for by SITC 541 is computed directly using ISIC 3522 as its proxy. This figure is then adjusted by the ratio of the U. S. Value of Shipments percent for SITC 541 to the U. S. gross output percent for ISIC 3522. The result is a final adjusted percent of total chemical output for SITC 541 for each of the foreign countries of this study.

As noted before, the data of the United Kingdom, Canada, and the "other" countries are replete with omissions. Thus, the best recourse for these countries seems to be the assumption of an average distribution of production. For each three-digit SITC excluding SITC 541 a percent-of-production figure is obtained by taking the average of the EEC's and Japan's adjusted percentages and the Value of Shipments' percentage for the U. S. As discussed above, for SITC 541 the percentage figure is obtained directly from the Growth of World Industry, Volume I. As in the case of Japan and the EEC, adjustment is necessary for the result to sum to 100 percent.

Finally, the adjusted percentages are multiplied by the respective national values of gross chemical output.[19] This yields the value of

production estimates for each three-digit SITC for each foreign country of the study.

To summarize, the production data of this study for each three-digit SITC group by country are: (1) for the United States, the Value of Shipments from the Census of Manufactures and the AEC's nuclear materials production, (2) for the EEC and for Japan, their respective adjusted percentage figures at the three-digit level times the national value of gross chemical output, and (3) for the United Kingdom, Canada, and the "other" countries, an adjusted average percentage figure times the country's gross chemical output.

## Domestic Consumption Estimates

Given the value of imports, exports, and domestic production for each country of this study for each three-digit SITC category, estimates of the value of domestic consumption are computed. These magnitudes equal the sum of production and imports less exports.

## Tariff Data

The computations of this study on the effects of tariff removal are performed twice using two sets of tariff data. One set is comprised of post-Kennedy Round ad valorem equivalent tariff rates which assume approval of the separate ASP package eliminating the ASP system. The second tariff set contains post-Kennedy Round rates without implementation of the ASP supplemental agreement.

### Tariffs Resulting from the Approval of Both Concession Packages

The former set of tariff rates are based on the GATT Tariff

Study.[20] The data of the GATT study include average ad valorem tariff (or ad valorem equivalent) m. f. n. rates of duty for each BTN heading for eleven countries. Two tariff averages are presented for each BTN. One is a simple arithmetic average of each national tariff line within the BTN. The other average is a weighted average of the tariff lines with the country's own imports at each tariff line as the weights.

Despite the many ways of calculating an average tariff, none is without bias.[21] The ideal would be a weighted average with the weights being the national imports that would occur under free trade. These weights are not known with certainty and cannot be estimated ex ante.

The simple unweighted average gives equal importance to all tariff lines "under the assumption that the 'law of large numbers' will lend meaning to the result."[22] But the importance of different items varies considerably; and an item of little trade significance, under either protected or free trade situations, may be given undue weight.

The weighted-by-own-imports tariff average is biased downward. A high duty which is highly restrictive would be given little importance in the average because of the "weight" of very few imports. At the extreme, a prohibitive tariff would have a zero weight.

A preferable and feasible tariff average is a tariff average weighted by world imports. Such an average does give recognition to the varying importance of different items in world trade but avoids the distortions created by the existing national tariff structures.

Unfortunately, the GATT study does not report weighted-by-world-imports tariff averages for each BTN.[23] Thus, for the present study the simple arithmetic averages are used rather than the more highly distorted alternative. These simple averages are regrouped according

to the SITC-BTN concordance. Since each four-digit SITC contains several BTN headings, a tariff average is computed for each SITC by weighting each BTN simple tariff average by the value of its world imports. The result is a simple-weighted tariff average for each four-digit SITC for each of the eleven countries of this paper.

In the U. S. import market, the effects of tariff removal are estimated by using these simple-weighted tariff averages for each four-digit SITC for the U. S. on the worksheets. For the three-digit categories, the U. S. four-digit tariffs are averaged using the four-digit world import data reported in the GATT study as weights.

In the export market, it is necessary to first compute "the tariff" faced by U. S. exports in each category. The simple-weighted tariff averages for each of the ten nations of the rest-of-the-world of this study are grouped by the four-digit SITC. By using the national value of consumption for the chemical industry (SITC 5) as a proportion of these ten countries' total consumption as the weights, the weighted average of the national tariffs (t) gives a "rest-of-the-world" tariff average for each four-digit SITC (t*).[24]

These foreign tariff averages represent the average tariff barriers faced by United States' exports in each four-digit SITC group. They are levied on the c. i. f. value of the recipient nation's imports (U. S. exports). Because the export data is reported in terms of the f. o. b. value, an adjustment to convert each c. i. f. foreign tariff average (t*) to a f. o. b. equivalent tariff (t**). The conversion is accomplished as follows:[25]

$$t^{**} = \left[ 1 + \frac{\text{c. i. f. value - f. o. b. value}}{\text{f. o. b. value}} \right] t^{*} \quad .$$

As in the import market, the three-digit tariff averages are computed as the weighted-by-world-imports average of the four-digit tariff averages.

Tariffs Resulting from Approval of the Kennedy Round Concessions Only

The Supplemental Agreement on Chemicals was negotiated among the U. S., EEC, U. K. and Switzerland; however, it was never ratified because of the failure of the U. S. Congress to approve the proposal. The American Selling Price system of valuation remains the practice for certain benzenoid chemical imports into the United States and the additional tariff reductions by the European parties on their imports have never transpired.

The second set of tariff data used in this study are post-Kennedy rates without implementation of the ASP supplemental agreement. Because of shortcomings in the available data, the rates should be regarded as approximate tariff averages.

The proposed additional duty concessions by Switzerland are on non-chemical goods, primarily jams and jellies, and are, thus, outside the scope of this sectoral study. The chemical tariff rates of the U. K. and the EEC that resulted from the primary Kennedy Round agreement, i. e., those in effect without the further concessions conditional upon U. S. removal of the ASP system, are garnered from GATT's Legal Instruments.[26] These tariff schedules report ad valorem rates by BTN subitems.[27] This study first computes a simple unweighted average of these subitem tariff rates for each BTN.[28] From these BTN tariff averages the same procedure is followed as described in the preceding section which assumed approval of the Supplemental Agreement.

The tariff averages for the United States are extrapolated from the corresponding tariff averages of the first scenario (ratification of the Supplemental Agreement) using data from a U. S. Tariff Commission study.[29] That study, "Major Industrial Product Sectors: Tariffs and Other Trade Barriers," contains post-Kennedy Round ad valorem tariff rates (or tariff equivalents) for the United States for several chemical sectors.[30] It also notes the tariff averages for these sectors which would exist using the rates in the "ASP package." Because these sectors contain, in most cases, several three-digit SITC categories, a ratio of the non-ratification to the ratification averages is computed for each sector.[31] This ratio is then multiplied times the corresponding three- and four-digit SITC tariff rates for the first scenario. Their products are the estimated U. S. tariff averages for the second scenario, which assumes that the Supplemental Agreement was never ratified.

## Price Elasticities

### U. S. Import Demand

The basic data on United States' short-run price elasticities of import demand are obtained from the research efforts of others. The other required price elasticities are derived from relationships between the various elasticities and import or export shares discussed below.

Because the purpose of this study is a disaggregated sectoral analysis, price elasticity estimates disaggregated to the four-digit SITC level are desirable; they are also nonexistent. Although many import demand elasticity estimates have been made for broad sectors of the economy, e. g., manufacturing as a whole, few studies have focused on individual commodities or industrial or commodity groups.[32] The price

elasticities of U. S. import demand used in this study are estimates for the three-digit SITC sectors within the chemical industry derived from papers by Kreinin and by Richardson.[33] Each three-digit level price elasticity also is applied to the four-digit subgroups.

Kreinin estimates, from time series data, import demand price elasticities disaggregated by commodity groups. The literature has discussed at length the downward bias inherent in elasticity estimates obtained by ordinary least-squares analysis of time series data.[34] The existence of this bias suggests that the elasticity estimates should be adjusted upwards.

In addition, studies indicate tariff elasticities exceed price elasticities.[35]

> [Their] results point to the conclusion that a reduction in tariffs is likely to have a larger effect on imports than an equivalent change in import prices -- a phenomenon which requires explanation. Aside from the downward bias in least-squares estimates of price elasticities, a possible explanation is that importers regard tariff changes as permanent and reallocate their purchases accordingly while changes in import prices are often considered transitory. Also, a ratchet effect may be operative in the second case. Once purchases are accommodated to a lower import price, habit formation or simply the acquired knowledge of foreign goods would limit the shift back to domestic commodities if import prices rose again. On the other hand, we have few instances when tariffs were raised in the postwar period.[36]

Balassa and Kreinin continue "[t]hese results suggest that, for purpose of estimating the possible effects of tariff reductions on United States' imports, the elasticities calculated . . . need to be adjusted upwards.[37] In this study such an adjustment is accomplished by the addition of three standard errors to the least-squares estimates by Kreinin.[38]

The remaining three-digit SITC sectors for which Kreinin presents

no estimates of the elasticity of import demand are assumed to have the elasticity of the chemical industry as an aggregate. This estimate results from the analysis by Richardson.

Richardson attempts to meet Orcutt's critique of the usual method to estimate elasticities; he uses a structural model, which incorporates both suppy and demand variables, to estimate the price responsiveness of import demand. No information is available which indicates the success of the different methodology employed by Richardson to avoid the inherent downward bias of the traditional approach.

This unevaluated new methodology and the additional problem of tariff elasticities exceeding price elasticities indicate that perhaps an upward adjustment, but of a smaller magnitude than three standard errors, would be appropriate. Thus, this study for SITC's 515, 521, 561, and 599 uses an adjusted import demand elasticity figure equal to Richardson's structural estimate plus one standard error.

U. S. Domestic Market and Export Supply

It can be shown that:[39]

$$\eta_M = \left(\frac{D}{M}\right) \eta_D - \left(\frac{S}{M}\right) \varepsilon_D \qquad (4.1)$$

where $\eta_M$ ($<0$) is the price elasticity of import demand, $\eta_D$ ($<0$) is the domestic demand price elasticity, $\varepsilon_D$ ($>0$) the domestic supply price elasticity, and D, S, and M are the (initial) quantities of demand, supply and imports, respectively. In an analagous way, one derives the relationship for the price elasticity of supply of exports ( $\varepsilon_x$) as a function of export shares and the domestic price elasticities of supply and demand, i. e.

$$\varepsilon_X = \left(\frac{S}{X}\right) \varepsilon_D - \left(\frac{D}{X}\right) \eta_D. \qquad (4.2)$$

The relationships formulated in Equations 4.1 and 4.2 cannot be used exactly as they were derived because the relationships assume that a commodity is either imported, in which case $M = D - S$, or exported ($X = S - D$), but not both. As a result of the coexistence of both imports and exports within each three-digit SITC group, an adjustment to each equation must be made.

In the import market, the proper supply figure is not the nation's gross output. It is rather the output that is consumed within that country. That is, the "S" in Equation 4.1 should be "S-X."[40] Analagously, in the export market, the coexistence of imports requires that "D" be replaced with "D-M."[41] Thus, the equations used in the computations of this study are:

$$\eta_M = \left(\frac{D}{M}\right) \eta_D - \left(\frac{S-X}{M}\right) \varepsilon_D \qquad (4.3)$$

and

$$\varepsilon_X = \left(\frac{S}{X}\right) \varepsilon_D - \left(\frac{D-M}{X}\right) \eta_D. \qquad (4.4)$$

It is assumed that the relationship between the domestic demand and supply price elasticities is:[42]

$$\eta_D = -\tfrac{1}{2} \varepsilon_D \qquad (4.5)$$

Substituting this assumption into Equation 4.3 produces the following relationship for the calculation of the price elasticity of domestic supply:

$$\varepsilon_D = \eta_M \left[\frac{1}{-\frac{1}{2}\left(\frac{D}{M}\right) - \left(\frac{S-X}{M}\right)}\right]. \qquad (4.6)$$

The estimates of the domestic supply elasticities for the U. S. and the assumption of Equation 4.5 yields the domestic demand price elasticities for each three-digit SITC.[43]

The data on export shares and the estimates of the U. S. domestic demand and supply price elasticities are used in Equation 4.4. The results are estimates of the elasticity of the supply of U. S. exports to the rest-of-the-world.

Foreign Elasticities

For the individual countries of the rest-of-the-world, the same relationships apply; however, even less data are available than for the United States. Because of the lack of disaggregated price elasticity estimates, it is assumed that the domestic elasticities of supply and of demand are identical for all countries.[44]

The countries considered in this study are the most developed and highly industrialized countries in the world. Furthermore, these countries have technologically and structurally similar chemical industries. The technological gap between the U. S. and its European and Japanese competitors which existed after World War II has been eliminated and these countries are now technologically competitive.[45] The meager empirical evidence available for international comparisons of national industrial structures suggests that the U. S. and U. K. have the least concentrated structures.[46] These similarities in combination with the internationality of many chemical companies give foundation to the assumption of identical domestic price elasticities.

For each three-digit SITC the domestic price elasticities of the United States are used in Equations 4.3 and 4.4. These elasticities in

combination, as indicated by Equation 4.3, with each country's import shares yield estimates for each country's import demand elasticity on a three-digit SITC level of disaggregation. Similarly, using export shares and Equation 4.4, disaggregated estimates are derived for the foreign countries' price elasticities of export supply.[47]

World Elasticities

For the world as a whole, the price elasticities of import demand and export supply are weighted averages of the individual country elasticities. Specifically, the elasticity of export supply from the rest-of-the-world equals:[48]

$$\varepsilon_{X,\ W\text{-}U.S.} = \sum_{i=1}^{n\text{-}U.S.} \varepsilon_{X,i} \left(\frac{X_i}{X_{W\text{-}U.S.}}\right), \qquad (4.7)$$

And the elasticity of world import demand equals:[49]

$$\eta_{M,W} = \sum_{i=1}^{n} \eta_{M,i} \left(\frac{M_i}{M_W}\right). \qquad (4.8)$$

U. S. Import Supply and Export Demand

The effect of trade barrier elimination in the import market depends on the price elasticities of U. S. import demand ($\varepsilon_M$) and of the rest-of-the-world's supply of imports to the United States ($\varepsilon_{X,W\text{-}U.S.}$). MacPhee has demonstrated that the latter elasticity depends on the rest-of-the-world's elasticity of export supply and the share of world exports that the United States imports:[50]

$$\varepsilon_M = \varepsilon_{X,W\text{-}U.S.} \left(\frac{M_{W\text{-}U.S.}}{M_{U.S.}}\right). \qquad (4.9)$$

Lastly, to complete the U. S. export market, one must have the price elasticity of demand for United States' exports. It is, as MacPhee shows, a function of export shares, the elasticity of the supply of exports from the rest-of-the-world and of the elasticity of world import demand. That is, $\eta_X$ is calculated as:[51]

$$\eta_X = \eta_{M,W}\left(\frac{X_W}{X_{U.S.}}\right) - \varepsilon_{X,\ W-U.S.}\left(\frac{X_{W-U.S.}}{X_{U.S.}}\right). \quad (4.10)$$

Long-Run Price Elasticities

The lack of long-run price elasticity estimates necessitates the use of an assumed relationship to their short-run counterparts. Following Magee, it is assumed here that the long-run domestic elasticities equal three times those of the short-run.[52] Substitution of these long-run domestic price elasticities into Equations 4.3 and 4.4 yields the long-run import demand and export supply elasticities needed for the calculation of the long-run welfare effects.

## Effects in U. S. Import and Export Markets

The computations to estimate the effect of trade barrier removal in the import and export markets of the United States are those indicated by the model of the preceding chapter. In the import market, the United States' f. o. b. value of imports is used because it is upon that value the U. S. levies the tariff.[53]

For the effect of the removal of foreign tariffs on the U. S. export market, the foreign tariffs cannot be used directly with the given f. o. b. value of U. S. exports. As previously discussed, the average foreign tariff must be converted to an f. o. b. equivalent tariff.

## Labor Data

The data are constructed at the three-digit SITC level of aggregation to estimate the effects of trade liberalization on the labor market. The figure used in this study for the economy's average duration of unemployment is the 1972 annual average duration for the nondurable goods manufacturing sector (which includes chemicals) reported in Employment and Earnings.[54]

The remaining labor data are reported on the basis of SIC codes and must be rearranged into the SITC system of classification; this is accomplished using an updated version of the concordance presented by Hufbauer.[55] The total number of employees for each SIC group are reported in the 1972 Census of Manufactures -- General Summary.[56] These are regrouped and totalled for each SITC sector.

The latest available data on the total cost of labor is for 1971 as reported in the Annual Survey of Manufactures.[57] These data are adjusted to 1972 estimates. The adjustment factor used for each SIC code is the corresponding ratio of the average annual earnings for production workers for 1972 to a comparable 1971 figure. The 1972 data are obtained by conversion of average weekly earnings reported in Employment and Earnings into annual figures. The 1971 statistics are the annual payroll per production employee data of the Annual Survey of Manufactures. The 1972 estimates thus obtained are then regrouped according to the SITC classification system. The 1972 average total labor cost per employee for each three-digit SITC classification is the average of its corresponding SIC data weighted by the number of employees in each SIC group. In the case of Radioactive and associated materials (SITC 515) the total labor cost per employee for the chemical industry as a

whole is used.

## Summary

This chapter discusses in detail the data used in the study, including their sources, rearrangements, and many adjustments. The various sources of available data use several different methods of classification. The data are all transformed to the SITC, Revised classification system, using the published cross-classifications or a concordance compiled by the author between the SITC system and the BTN, TSUSA, Schedule A, ISIC or SIC systems.

The types of data are import-export data, production and consumption data, two sets of tariff data, estimates of price elasticities (both U. S. and foreign), and labor data. The import and export data are OECD statistics for the year 1972 which is the first year the Kennedy Round concessions became fully effective. The value of exports data are on an f. o. b. basis. The import figures are c. i. f. values for all countries except the United States and Canada which report f. o. b. imports. In order to maintain consistency in calculating the sundry price elasticities, the U. S. and Canadian f. o. b. import data must be converted to a c. i. f. equivalent.

The production data for the United States are Value of Shipments data obtained from the 1972 Census of Manufactures. Production of Radioactive and associated materials is partially from the AEC's Financial Summary for 1972. The paucity of production data for the rest-of-the-world serves as an obstacle for this study. The basic data are from the United Nations' Growth of the World Industry which is classified according to the ISIC system and is incomplete in coverage. To

# APPENDIXES

short-run price elasticity of import demand for the U. S. existing in the literature. In the analysis it is necessary to make certain assumptions. Hence, it is assumed that the domestic price elasticity of demand is equal to one-half the domestic supply elasticity, that the domestic elasticities are identical for all the countries in the study, and that the long-run domestic elasticities are equal to three times their short-run counterparts.

These data permit the estimation of the trade effects in the U. S. import and export markets and the social welfare effects. The estimation methods are discussed in the preceding chapter.

The labor data include the number of employees, as reported in the 1972 Census of Manufacturers -- General Summary, and the average duration of unemployment for nondurable manufactured goods, reported in Employment and Earnings. The basic data for the total cost of labor derive from the Annual Survey of Manufactures. These data, for 1971, are adjusted to 1972 estimates. These data are used to compute the social costs of labor dislocation. As discussed in the preceding chapter, these costs are deducted from the social welfare gains to estimate the net social welfare effects.

ENDNOTES

[1]In Appendix C, sample worksheets for the computations described in this chapter are illustrated.

[2]United Nations, Department of Economic and Social Affairs, "Standard International Trade Classification, Revised," Statistical Papers, Series M, No. 34 (New York, 1961).

[3]United States Bureau of the Census, U. S. Foreign Trade Statistics Classifications and Cross-Classifications, 1970 (Washington, D. C., February, 1971).

[4]Ibid., pp. 3-6.

[5]Ibid.

[6]United Nations, Department of Economic and Social Affairs, "Classification of Commodities By Industrial Origin," Statistical Papers, Series M, No. 43, Rev. 1 (New York, 1971).

[7]The SITC - SIC (1972) concordance is established, to the extent possible at the four-digit level, from the following sources: G. C. Hufbauer, "Hypotheses and the Tests of Trade Patterns," The Technology Factor in International Trade, ed. Raymond Vernon (New York, 1970); United Nations, "Standard International Trade Classification, Revised;" United States, Bureau of the Census, 1967 Census of Manufactures -- Alphabetic Index of Manufactured Products (Washington, D. C., 1970); United States, Bureau of the Census, 1972 Census of Manufactures -- Numerical List of Manufactured Products, New (1972) SIC Basis (Washington, D. C., 1975).

[8]Organization for Economic Cooperation and Development, Statistics of Foreign Trade, Series C Trade by Commodities -- Market Summaries, 1 (Paris, 1972).

[9]United States, Bureau of the Census, U. S. General Imports, Schedule A Commodity by Country, Report FT 135, December, 1974 (Washington, D. C., 1975).

[10]United States, Atomic Energy Commission, 1972 Financial Report (Washington, D. C., 1972).

[11]The non-existence of a satisfactory data source was confirmed by two sources: (1) A telephone conversation on March 8, 1976, with Mr. Samuel Berger, who is currently with the Bureau of Domestic Commerce.

Previously Mr. Berger was author of the Special Comprehensive Reports in United States, Department of Commerce, Chemicals: Quarterly Industry Reports (Washington, D. C., 1974), which reported on the chemical industry in individual foreign countries. (2) A letter of January 27, 1976, from H. G. Humphry of the Directorate For Science, Technology and Industry, OECD, Paris, France.

[12]United Nations, Department of Economic and Social Affairs, The Growth of World Industry, Volume I, 1973 Edition, Commodity Production Data, 1964-1973 (New York, 1975). Hereafter abbreviated GWI,I.

[13]Switzerland is the exception. The most recent chemical production data available for Switzerland is for 1967, i. e., Sales of Chemicals & Allied Products, 1967, in Organization for Economic Cooperation and Development, The Chemical Industry, 1967-1968; however, annual industrial production indices are published for Switzerland and in the U. N.'s GWI,I. The relevant index is for an aggregated industrial sector composed of ISIC's 351, 352, 353, and 354. The 1967 indices are used to extrapolate from the 1967 data the value of production (sales) for 1972.

[14]OECD, Series C.

[15]United Nations, Department of Economic and Social Affairs, The Growth of World Industry, Volume II, 1973 Edition (New York, 1975). Hereafter abbreviated GWI,II).

[16]The correspondences of the reported selected ISIC categories to specific SITC categories are exact; however, in general, the ISIC and the SITC systems are not fully comparable and the cross-classification between them is approximate.

[17]SITC's 515, 521, 532, 541, 553, 571, 599.

[18]It includes ISIC 3522 plus "Bandages, etc. Impregnated or Coated with Pharmaceutical Products or Put up for Retail Sale," "Dental Amalgams, Sterile Sutures, (Metal, Yarn, Gut, etc.), Dental Cements, First Aid Boxes Containing Limited Supplies, not professional Medical Kits," and a portion of "Other Pharmaceutical Goods."

[19]Values of gross chemical output are derived as discussed at the beginning of this section.

[20]The Contracting Parties to the General Agreement on Tariffs and Trade, Basic Documentation For Tariff Study: Summary Table No. 1 -- Tariff and Trade Summaries by BTN Headings (Geneva, July, 1970). Hereafter GATT Tariff Study).

[21]Bela Balassa, "Tariff Protection in Industrial Countries: An Evaluation," Readings in International Economics (Homewood, Ill.: 1968).

[22]Ibid., p. 581.

[23]The volume of the GATT Tariff Study which is in terms of industrial product categories does report tariff averages weight-by-world imports; unfortunately, the industrial product classification system is not comparable to the SITC system at the four-digit SITC level.

[24]It should be noted that the Canadian tariff are f. o. b. tariffs. They are first converted to c. i. f. tariffs so as to be comparable with the c. i. f. tariffs levied by the other countries. The conversion is described in the succeeding paragraph of the text.

[25]Actually the data available for the c.i.f.-f.o.b. conversion is available only in terms of c. i. f. and f. a. s. terms; thus, f. a. s. should be substituted for f. o. b. in the equation. Since it is assumed the two are equivalent, whereas in fact f. o. b. exceeds f. a. s. by the amount of the loading costs, the t*'s used overstate the correct converted f. o. b. tariff equivalents.

To illustrate the conversion, suppose the domestic price of the product were $5 and the quantity exported were ten units. The f. o. b. value is $50; whereas, assuming freight and insurance amount to 20 percent the c. i. f. value would be $60. Additionally, assume the foreign ad valorem tariff rate is 10 percent levied on the c. i. f. value. The duty collected would be $6 which is 12 percent of the f. o. b. value. Thus, the foreign tariffs must be adjusted upward to compensate for the f. o. b. export data. Algebraically,

$$t^{**} = \left(1 + \frac{\text{c.i.f.} - \text{f.o.b.}}{\text{f.o.b.}}\right) t^{*}$$

$$t^{**} = \left(\frac{\text{f.o.b.} + \text{c.i.f.} - \text{f.o.b.}}{\text{f.o.b.}}\right) t^{*}$$

$$t^{**} = \frac{\text{c.i.f.}}{\text{f.o.b.}}\, t^{*}$$

$$t^{**}\ (\text{f.o.b.}) = t^{*}\ (\text{c.i.f.})$$

[26]The Contracting Parties to the General Agreement on Tariffs and Trade, Legal Instruments Embodying The Results of the 1964-67 Trade Conference (Geneva, 1967).

[27]The EEC schedule lists concession rates of duty assuming approval of the supplemental treaty abolishing the ASP system. These rates are then footnoted with one of four signs. Three of the signs $C_1$, $C_2$, and $C_3$ indicate that if the ASP system is not abolished by the United States, "the concession rate will be equivalent to the base rate less" four-tenths, six-tenths, and seven-tenths, respectively, "of the difference between the base rate and the final rate." GATT, Legal Instruments, pp. 2826-2827. The remaining sign $C_4$ indicates the concession's duty-free rate will not apply if ASP remains in existence. Thus, the non-ratification tariff rates for each BTN subitem first had to be individually computed as indicated by its symbol. These results then are averaged to derive the simple tariff average for each BTN.

[28]The U. K. schedule lists the concession duty rates assuming approval of the ASP package and also lists in parentheses the tariff

rates which apply in the event the supplemental chemical agreement is not ratified. These bracketed rates are recorded directly. However, whereas the EEC list is virtually complete, the U. K. concession list contains many exclusions. The BTN items with only partial coverage are so noted in the schedule. The probable effect is that the computed BTN tariff averages misrepresent the "true" tariff average. Thus, in these cases, the simple average for the BTN of the ASP-abolished subitem rates is calculated in addition to the average of the ASP-in-existence rates. For each BTN, the ratio of the simple average of the ASP-abolished rates from the GATT Tariff Study to the average from the incomplete list from the GATT Legal Instruments is used as an adjustment coefficient. This coefficient is multiplied times the simple average of ASP-in-existence rates calculated from Legal Instruments to compensate for the partial listing and to more closely approximately the "true" BTN tariff average.

[29]A direct tariff data source would be preferable to this extrapolation. Initially such a direct source was utilized, but then was rejected. U. S. Bureau of the Census, U. S. Imports for Consumption and General Imports, Report 246, 1971 Annual (Washington, D. C., 1972). Since it resulted in tariff averages (with ASP still in effect) substantially lower in most cases than the averages with ratification of the Supplemental Agreement, its data is highly suspect in its comparability to the GATT Tariff Study.

[30]U. S. Tariff Commission, "Major Industrial Product Sectors: Tariffs and Other Trade Barriers," Part III of Trade Barriers, TC Publication 665 (Washington, D. C., 1974).

[31]Three, three-digit SITC groups are not included in the chemical category and their product sectors make no reference to the ASP package; therefore, the ratio is assumed to be one.

[32]Studies presenting disaggregated estimates, which are not used in this study, are made by Barend A. DeVries, "Price Elasticities of Demand for Individual Commodities Imported into the United States," International Monetary Fund Staff Papers, I (April, 1951), pp. 397-419; Mordechai E. Kreinin, "Price Elasticities in International Trade," Review of Economics and Statistics, 49 (1967), pp. 510-516; James E. Price and James B. Thornblade, "U. S. Import Demand Functions Disaggregated by Country and Commodity," Southern Economic Journal, 39 (1974), pp. 46-57, for individual commodities, for SITC's 5 and 7 and SITC's 6 and 8, and for SITC commodity groups by country of origin, respectively; Robert M. Stern, "Price Elasticities in International Trade: A Compilation and Annotated Bibliography of Recent Research" (Unpublished paper, University of Michigan, 1975).

[33]Mordechai E. Kreinin, "Disaggregated Import Demand Functions -- Further Results," Southern Economic Journal, 40 (July, 1973), pp. 19-25; and J. David Richardson, The Response of Imports and Domestic Demand to Price, Tariff, and Exchange Rate Changes: A Structural Estimation Study for Selected U. S. Manufactures (Unpublished paper, 1972).

Kreinin's estimates are for SITC's 512, 513, and 514; SITC's 531, 532, 533, and 535; SITC 541; SITC 581; SITC's 551, 553, 554, and 571. Richardson's estimate is for SIC 28.

[34]For example, see the classic article by G. H. Orcutt, "Measurement of Price Elasticities in International Trade," Review of Economics and Statistics, XXXII (1950), pp. 117-132; or an excellent and concise discussion of this special problem in Edward E. Leamer and Robert W. Stern, Quantitative International Economics (Boston, 1970).

[35]See DeVries; Lawrence B. Krause, "U. S. Imports 1947-1958," Econometrica, 30 (1962), pp. 221-238; and Mordechai E. Kreinin, "Effect of Tariff Changes on the Price and Volume of Imports," American Economic Review, LI (1961), pp. 310-324.

[36]Bela Balassa and Mordechai E. Kreinin, "Trade Liberalization under the 'Kennedy Round': The Static Effects," Review of Economics and Statistics, XLIX (1967), p. 127.

[37]Ibid.

[38]This procedure is not unique to this study. As Balassa and Kreinin note in "Trade Liberalization Under the 'Kennedy Round'," "available information does not provide a precise indication for selecting appropriate values within the range indicated" (p. 127). They add one standard error in their computations. Kreinin, "Price Elasticities in International Trade," suggests adding two standard errors to the estimates used. Ball and Marwah in their study (R. J. Ball and K. Marwah, "The U. S. Demand for Imports, 1948-1958," Review of Economics and Statistics, XLIV (1962), pp. 395-401), add three standard errors to attain an upper bound for the estimates. Whatever final adjustment is chosen, it is admittedly quite arbitrary. The addition of three standard errors is chosen in this study to overcome both the downward bias of least-squares time series estimates and the understatement of tariff elasticities by price elasticities of import demand.

[39]This section of the study extracts from a discussion of the elasticity relationships in Craig R. MacPhee, Restrictions on International Trade in Steel (Lexington, Mass., 1974), pp. 58-67; in particular, Equation 4.1 appears on pp. 58-59 without derivation. This author's derivation of that equation is:

$$\eta_M = \frac{\frac{dM}{M}}{\frac{dP}{P}} = \frac{dM}{M} \cdot \frac{P}{dP} = \frac{P}{dP} \cdot \frac{d(D-S)}{D-S}$$

$$\eta_M = \frac{P}{dP} \cdot \frac{dD-dS}{D-S}$$

$$= \frac{P}{dP} \cdot \frac{dD}{D-S} - \frac{P}{dP} \cdot \frac{dS}{D-S}$$

$$\eta_M = \frac{P}{dP} \cdot \frac{D}{D} \cdot \frac{dD}{D-S} - \frac{P}{dP} \cdot \frac{S}{S} \cdot \frac{dS}{D-S}$$

$$\eta_M = \eta_D \cdot \frac{D}{M} - \varepsilon_D \cdot \frac{S}{M}$$

[40]This can be shown as follows. Since the domestic demand is computed as $D = S + M - X$ and Equation 4.1 assumes that $M = D - S^*$, where $S^*$ is the relevant production figure, substitution yields $M = S + M - X - S^*$. This reduces to $S^* = S - X$.

An alternative approach to the problem of the simultaneous existence of imports and exports is suggested by Joe Stone, currently a graduate student at Michigan State University. He assumes that each good within a category can be classified as either an importable or an exportable and that the domestic demand and supply price elasticities are identical for both types of goods. The equation he suggests as appropriate is:

$$\eta_M = \frac{D}{M} \eta_D - \frac{S}{M} \varepsilon_D + \frac{X}{M} \varepsilon_X.$$

If $\varepsilon_D = \varepsilon_X$, this relationship is identical to the alternative used in the present study. If they are not equal, his relationship differs but is not problem-free. First, even a highly disaggregated commodity group contains items that are both imported and exported and the data does not permit classification of a good as either an importable or exportable as Stone assumes is possible. Hence, there is no way statistically to compare the alternative approaches. Furthermore, there is no reason to believe that the domestic supply and demand price elasticities are necessarily identical for both types of goods. And as a practical problem, $\eta_D$, $\varepsilon_D$ and $\varepsilon_X$ are all unknowns to be estimated from $\eta_M$. Assumptions additional to that made in the present study, i. e., $\eta_D = -\frac{1}{2} \varepsilon_D$ are necessary to obtain values for the three unknowns. Joe Stone, "The Static Effects of Trade Liberalization: An Estimate for Large Traders" (Unpublished paper, Michigan State University, 1976).

[41]Since $X = S - D^*$, substitution for S in $D = S + M - X$ yields $D^* = D - M$.

[42]This assumption was made by Stephen P. Magee, "The Welfare Effects of Restrictions on U. S. Trade," Brookings Paper on Economic Activity, No. 3 (1972), p. 665.

[43]Several alternative assumptions concerning the elasticities were tried and judged to be unacceptable. First, Richardson's estimates of the domestic demand elasticity for the aggregated commodity "chemicals" were used in combination with the disaggregated import demand elasticities. The immediate disadvantage for this study is the level of aggregation; however, disaggregated estimates do not exist. Magnitudes of the domestic supply elasticities were derived from Equation 4.1. These estimates all carried a negative sign, whether using Richardson's preferred structural estimates (both the coefficient itself and the

lower bound of the confidence interval) or the lower bound of his less preferred simple least-squares estimate. A consistently negatively-signed domestic supply elasticity seemed implausible.

Secondly, a set of domestic demand elasticities were estimated from the relationship 4.1 using Baldwin and Mutti's assumption that the domestic supply elasticity ranged somewhere between zero and one. In order to obtain a negative domestic demand elasticity for SITC 512, the domestic supply elasticity had to be equal to or less than 0.09. Choosing a domestic supply elasticity less than 0.09 a priori seemed even more arbitrary than the assumed relationship. Robert E. Baldwin and John H. Mutti, "Policy Problems in the Adjustment Process (U. S.), (Unpublished paper).

[44]Such an assumption has been made in other studies: MacPhee, p. 60 and Bela Balassa, Trade Liberalization among Industrial Countries (New York, 1967), p. 49.

[45]Jules Backman, The Economics of the Chemical Industry (Washington, D. C., 1970), p. 243.

[46]Joe S. Bain, International Differences in Industrial Structure (New Haven, Conn., 1966), pp. 67-122. For specific chemical sub-industries, the data are particularly limited and inconclusive; however, unlike the U. S., European and Japanese governments tend to participate in private markets and to permit cartels which together cause true market concentration to be understated.

[47]The preceding computations are shown, for the United States, in Worksheet I and, for the foreign countries, in Worksheet II.

[48]MacPhee, p. 64. MacPhee includes the derivation which follows in his text:

$$\varepsilon_M = (dX_x/X_x)(P/dP)$$

$$= \sum_{i=1}^{N} (dX_i/X_i)(P/dP)(X_i/X_w) \quad \text{since} \quad \sum_{i=1}^{N} X_i = X_w$$

$$= \sum_{x=1}^{N} \varepsilon_{Xi} (X_i/X_w)$$

[49]MacPhee, p. 62, derives Equation 4.6 in his text as follows:

$$\eta_W = (dM_w/M_w)(P/dP)$$

$$= \sum_{i=1}^{N} (dM/M)(P/dP) \quad \text{since} \quad M_w = \sum_{i=1}^{N} M_i \quad [\text{sic}]$$

$$= \sum_{i=1}^{N} (dM_i/M_i)(P/dP)(M_i/M_w)$$

$$= \sum_{i=1}^{N} \eta_i (M_i/M_w).$$

These world estimates are computed on Worksheet II.

[50]The equation and its derivation appear in MacPhee, p. 64. MacPhee calls $\varepsilon_M$ the price elasticity of the supply of exports to the U. S. ( $\varepsilon_i$). His derivation is:

$$\varepsilon_i = (dX_{w-i}/M_i)(P/dP)$$

$$= (dX_{w-i}/X_{w-i})(P/dP)(X_{w-i}/M_i)$$

$$= \varepsilon_{w-i} (X_{w-i}/M_i).$$

[51]MacPhee, p. 67. His derivation of the Equation 4.8, which uses absolute values of the elasticities:

$$\eta_{xi} = (dX_i/X_i)(P/dP)$$

$$= (P/dP)d(X_w-X_{w-i})/(X_w-X_{w-i}) \text{ since } X_w = X_i + X_{w-i}$$

$$= (dX_w/dP)[P/(X_w-X_{w-i})] + (dX_{w-i}/dP)[P/(X_w-X_{w-i})]$$

$$= (dX_w/X_w)(P/dP)\, X_w/(X_w-X_{w-i}) + (dX_{w-i}/X_{w-i}/X_{w-i})$$

$$(P/dP)X_{w-i}/(X_w-X_{w-i})$$

$$= \eta_x (X_w/X_i) + \varepsilon_{w-i}(X_{w-i}/X_i).$$

See Worksheet III.

[52]Magee, pp. 665, 675.

[53]This is generally the case, assuming the ASP package had been removed as in the first set of worksheets. In the second set of computations, ASP remains in existence. Thus, the actual ad valorem tariff equivalent rate in the case of benezoid chemicals is levied on the value determined by the selling price of an equivalent American product rather than the f. o. b. import value. However, the ad valorem tariff rates used in the computations are rates already adjusted to compensate for ASP and are tariff equivalents if the tariffs were levied on f. o. b. values (not ad valorem percents computed from duty collected as a percent of dutiable value).

[54]United States, Bureau of Labor Statistics, Employment and Earnings, Vol. 19, No. 7, January, 1973.

[55]Hufbauer, "Hypotheses and Tests of Trade Patterns." His concordance is between the three-digit SITC and the four-digit SIC codes based on the 1967 SIC. The concordance must be updated to correspond to the revised 1972 SIC classifications.

[56]United States, Bureau of the Census, 1972 Census of Manufactures -- Subject Series General Summary (Washington, D. C., 1975).

[57]United States, Bureau of the Census, Annual Survey of Manufactures: 1970-1971 (Washington, D. C., 1973).

# CHAPTER V

# EMPIRICAL RESULTS

## Introduction

This chapter presents the empirical results obtained from applying the data described in the preceding chapter to the theoretical model presented in Chapter III. The first section discusses the elasticity estimates which are derived. The second section recounts the price effects as well as the long- and short-run effects on trade quantities and values. The third section presents the impact of trade liberalization on the labor market. The fourth section relates the estimated impact on the social welfare of the United States citizenry. The fifth section compares the results from disaggregated data to those obtained from data at an aggregate level. The final section summarizes the findings presented in the chapter.

## Elasticity Estimates

The elasticity data are restricted to the three-digit SITC level of disaggregation. The estimates of the elasticities of U. S. import demand used in this study are taken from the research efforts of others. They range from -0.97 for Essential oils, perfume and flavor materials; Perfumery and cosmetics, dentifrices and other toilet preparations (except soaps); Soaps, cleansing and polishing preparations; and Explosive and pyrotechnic products, i. e., SITC's 551, 553, 554 and 571

respectively, to -3.03 for SITC's 531, 532, and 533 which combined form SITC Divisions 53, Dyeing, tanning and coloring materials. The SITC sectors for which it is necessary to assume the import demand elasticity of the chemical industry in aggregate have an assumed elasticity of -2.15; these sectors are Radioactive and associated materials; Mineral tar and crude chemicals from coal, petroleum, and natural gas; Manufactured fertilizers; and Chemical materials and products not elsewhere classified; i. e., SITC's 515, 521, 561 and 599.

The other elasticities for the United States are derived, as discussed previously, from these data on the U. S. elasticity of import demand. The set of elasticities at the three-digit SITC level for the United States are presented in Table II. Overall the results appear to be reasonable. Two SITC groups contain estimates which are suspect because they are extreme; the estimates are the import supply and export demand elasticities for the Synthetic organic dyestuffs, natural indigo, and color lakes group (SITC 531), which equal 56.763 and -333.345 respectively, and for the Dyeing and tanning extracts and synthetic tanning group (SITC 532), which respectively equal 16.955 and -91.498.[1]

Disregarding these two sectors at this point, the range of estimates of the elasticity of the supply of imports into the U. S. is from 1.114 for SITC 512, Organic chemicals, to 4.172 for SITC 561, Manufactured fertilizers. In the export market, the estimated elasticities for the U. S. supply of exports range from 0.165 (SITC 554: Soaps, cleansing and polishing preparations) to 1.687 (SITC 513: Inorganic chemicals -- elements, oxides, and halogen salts). For the elasticity of demand for U. S. exports the variation extends from -1.250 (SITC 554: Soaps, cleansing and polishing preparations) to -11.475 (SITC 561: Manufactured fertilizers).

TABLE II

ESTIMATED ELASTICITIES FOR THE U.S.

| SITC | Import Market | | Domestic Market | | Export Market | |
|---|---|---|---|---|---|---|
| | $\eta_M$ | $\varepsilon_M$ | $\eta_D$ | $\varepsilon_D$ | $\eta_X$ | $\varepsilon_X$ |
| 512 | -1.14 | 1.114 | -0.032 | 0.064 | -2.083 | 0.618 |
| 513 | -1.14 | 1.468 | -0.071 | 0.142 | -5.433 | 1.687 |
| 514 | -1.14 | 2.736 | -0.016 | 0.033 | -4.814 | 0.665 |
| 515 | -2.15 | 3.632 | -0.178 | 0.355 | -5.471 | 1.573 |
| 521 | -2.15 | 3.061 | -0.004 | 0.008 | -2.349 | 0.626 |
| 531 | -3.03 | 56.763 | -0.160 | 0.320 | -333.345 | 6.137 |
| 532 | -3.03 | 16.955 | -2.068 | 4.137 | -91.498 | 7.202 |
| 533 | -3.03 | 1.871 | -0.004 | 0.007 | -1.909 | 0.521 |
| 541 | -1.09 | 2.107 | -0.008 | 0.016 | -2.458 | 0.376 |
| 551 | -0.97 | 1.311 | -0.015 | 0.030 | -4.491 | 1.233 |
| 553 | -0.97 | 1.183 | -0.002 | 0.004 | -3.386 | 0.606 |
| 554 | -0.97 | 2.014 | -0.001 | 0.002 | -1.250 | 0.165 |
| 561 | -2.15 | 4.172 | -0.072 | 0.144 | -11.475 | 1.840 |
| 571 | -0.07 | 1.309 | -0.029 | 0.057 | -3.688 | 0.808 |
| 581 | -1.57 | 3.013 | -0.026 | 0.052 | -2.702 | 0.477 |
| 599 | -2.15 | 1.906 | -0.033 | 0.065 | -2.006 | 0.636 |

The import demand and export supply elasticities for each of the foreign countries considered in this study are calculated in order to enable completion of the set of necessary U. S. elasticities. These calculations, as previously noted, assume that the other countries' domestic elasticities are identical with the U. S. domestic elasticities; the resultant foreign elasticity estimates are presented in Table III.

As a point of interest, the average chemical import demand elasticity for Japan is compared with estimates from two other studies. The average chemical import demand elasticity is the average of this study's elasticities for each three-digit SITC group weighted by the value of Japan's imports for each group. The resultant weighted average import demand elasticity for SITC 5 for Japan equals 2.138. Kreinin estimates the import demand elasticity for the combined categories of SITC 5 and 7 as 2.0 for Japan.[2] His technique is to estimate elasticities for the U. S. using regression analysis and to derive the foreign estimates from the relationship based on import shares and assuming identical domestic elasticities. In another study, using regression analysis of OECD index data for Japan, Kreinin obtained an estimated relative price elasticity of import demand for SITC 5 of 1.17 with a standard error of 0.52.[3] The estimate plus three standard errors, as used in this paper, thus would equal 2.73.

The comparison of this study's weighted average to Kreinin's estimates is reassuring by its revelation that the estimates are within the same ballpark; however, the comparison is of limited usefulness due to the fact that this study's basic elasticity data are Kreinin's disaggregated estimates for the U. S. and carry the same flaws as his independent estimates for Japanese chemical imports.

TABLE III

ESTIMATED FOREIGN ELASTICITIES

| | | Japan | Canada | U.K. | EEC | Other | World[a] |
|---|---|---|---|---|---|---|---|
| 512 | $\eta_{M,i}$ | -0.895 | -0.212 | -0.270 | -0.150 | -0.040 | -0.403 |
| | $\varepsilon_{X,i}$ | 0.339 | 0.686 | 0.301 | 0.137 | 0.072 | 0.200 |
| 513 | $\eta_{M,i}$ | -0.956 | -0.135 | -0.614 | -1.649 | -0.147 | -0.846 |
| | $\varepsilon_{X,i}$ | 0.772 | 0.166 | 1.279 | 0.863 | 0.379 | 0.727 |
| 514 | $\eta_{M,i}$ | -3.147 | -0.161 | -0.601 | -1.253 | -0.086 | -0.706 |
| | $\varepsilon_{X,i}$ | 0.713 | 0.232 | 0.352 | 0.459 | 0.191 | 0.430 |
| 515 | $\eta_{M,i}$ | -2.222 | -0.178 | -0.807 | -1.742 | -1.149 | -1.680 |
| | $\varepsilon_{X,i}$ | 70.299 | 0.355 | 0.931 | 3.716 | 2.604 | 2.436 |
| 521 | $\eta_{M,i}$ | -5.764 | -0.102 | -0.314 | -0.710 | -0.247 | -0.737 |
| | $\varepsilon_{X,i}$ | 4.224 | 0.858 | 0.570 | 0.700 | 0.564 | 0.825 |
| 531 | $\eta_{M,i}$ | -19.915 | -4.554 | -10.347 | -27.589 | -1.239 | -11.645 |
| | $\varepsilon_{X,i}$ | 27.551 | 2038.880 | 5.406 | 8.701 | 0.730 | 6.482 |
| 532 | $\eta_{M,i}$ | -3.315 | -4.252 | -2.068 | -5.760 | -2.068 | -3.749 |
| | $\varepsilon_{X,i}$ | 23.292 | 72.392 | 4.137 | 6.023 | 4.137 | 6.051 |
| 533 | $\eta_{M,i}$ | -0.463 | -0.053 | -0.165 | -0.083 | -0.020 | -0.238 |
| | $\varepsilon_{X,i}$ | 0.221 | 0.299 | 0.056 | 0.031 | 0.026 | 0.056 |
| 541 | $\eta_{M,i}$ | -0.360 | -0.135 | -0.277 | -0.335 | -0.031 | -0.315 |
| | $\varepsilon_{X,i}$ | 1.103 | 0.345 | 0.081 | 0.156 | 0.032 | 0.148 |
| 551 | $\eta_{M,i}$ | -0.531 | -0.399 | -0.361 | -0.474 | -0.129 | -0.543 |
| | $\varepsilon_{X,i}$ | 4.292 | 4.485 | 0.345 | 0.329 | 0.104 | 0.384 |
| 553 | $\eta_{M,i}$ | -0.573 | -0.108 | -0.231 | -0.708 | -0.031 | -0.350 |
| | $\varepsilon_{X,i}$ | 0.684 | 0.646 | 0.078 | 0.117 | 0.061 | 0.129 |
| 554 | $\eta_{M,i}$ | -0.314 | -0.039 | -0.230 | -0.472 | -0.018 | -0.213 |
| | $\varepsilon_{X,i}$ | 0.237 | 0.939 | 0.055 | 0.135 | 0.025 | 0.100 |
| 561 | $\eta_{M,i}$ | -2.444 | -0.072 | -1.817 | -4.189 | -0.426 | -2.186 |
| | $\varepsilon_{X,i}$ | 2.549 | 0.144 | 8.354 | 1.606 | 0.665 | 1.267 |

[a]The world elasticities are $\eta_{M,W}$ and $\varepsilon_{X,W-U.S.}$.

TABLE III (Continued)

| | | Japan | Canada | U.K. | EEC | Other | World |
|---|---|---|---|---|---|---|---|
| 571 | $\eta_{M,i}$ | -2.749 | -0.180 | -0.794 | -0.663 | -0.042 | -0.581 |
| | $\varepsilon_{X,i}$ | 1.654 | 0.326 | 0.166 | 0.333 | 0.073 | 0.293 |
| 581 | $\eta_{M,i}$ | -2.186 | -0.117 | -0.218 | -0.352 | -0.042 | -0.363 |
| | $\varepsilon_{X,i}$ | 0.407 | 0.687 | 0.208 | 0.141 | 0.085 | 0.201 |
| 599 | $\eta_{M,i}$ | -0.191 | -0.102 | -0.151 | -0.332 | -0.033 | -0.382 |
| | $\varepsilon_{X,i}$ | 0.373 | 0.389 | 0.132 | 0.196 | 0.065 | 0.176 |

# Price and Trade Effects of Tariff Elimination

## Introduction

The price and trade effects of the removal of the post-Kennedy Round tariff rates are estimated under two alternative scenarios. The first assumes that the Supplemental Agreement on Chemicals was approved by the U. S. Congress and ratified by the participating nations. The tariff data are from a single source which lends to them a semblance of comparability, uniformity and reliability. The second scenario derives from the reality that the U. S. Congress never approved the supplemental ASP chemical package.

It should be noted that the estimated price and trade effects of tariff elimination presented in this section exceed the effects which may result from U. S. participation in the current round of GATT. The President's negotiating authority in the GATT session now beginning is granted by the Trade Act of 1974 and is limited in most cases to maximum reductions of 60 percent from the existing tariff duties.

For each of the two scenarios the import and export markets are analyzed separately. The effects in the import markets occur as a result of the removal of U. S. tariff barriers to imports. The effects estimated in this study are the percentage decrease in the U. S. price of the imported commodity, the percentage increase in the duty-free price received by the foreign supplier, the percentage change in the quantity of imports, and the change in the value of imports. The latter two trade effects are estimated for both the short-run and the long-run (which is denoted by *). The price effects are the same in either case given the assumed relationship between the short- and long-run elasticities.

The analysis of the U. S. export markets considers the removal of tariffs by the foreign countries of the study. As discussed previously, the foreign tariffs are averaged to yield a single measure of their restrictive height. The estimated effects which occur are the percentage change in the U. S. price of the commodity exported by the U. S. and the short-run and long-run trade effects, i. e., the percentage change in quantity and the change in the value of exports.

Initially the presentation of the empirical results is restricted to the relatively aggregated three-digit SITC level. It is hoped that this limitation, by reducing the volume of estimates, facilitates the discussion of the results. The restriction is later removed and the disaggregated results are presented in their entirety.

## An Overview

### The First Scenario: Implementation of Both Kennedy Round Concession Packages

The Import Markets. The first scenario assumes the approval and final ratification of the Supplemental Agreement on Chemicals; thus, the tariff rates are those resulting from implementation of both Kennedy Round concession packages. The estimated price and trade effects of tariff elimination in the U. S. import markets are shown in Table IV at the three-digit SITC level for the first scenario. The post-Kennedy Round weighted average U. S. tariffs for the three-digit SITC groups range from 0.7 percent for Manufactured fertilizers (SITC 561) to 23.7 percent for Synthetic organic dyestuffs, natural indigo and color lakes (SITC 531).

The estimated percentage decline in the U. S. price of the imported

TABLE IV

SURVEY OF PRICE AND TRADE EFFECTS OF U.S. TARIFF REMOVAL ON THE U.S. IMPORT MARKET: FIRST SCENARIO

| SITC | t (%) | $\frac{dP'}{P+T}$ (%) | $\frac{dP}{P}$ (%) | $\frac{dM}{M}$ (%) | $dV_M$ (million $) | $dV_M^*$ (million $) |
|---|---|---|---|---|---|---|
| 512 | 10.6 | -5.0 | 5.1 | 5.7 | 56.447 | 117.428 |
| 513 | 4.3 | -2.4 | 1.8 | 2.7 | 15.833 | 34.967 |
| 514 | 5.8 | -3.9 | 1.6 | 4.5 | 4.833 | 11.994 |
| 515 | 2.9 | -1.8 | 1.1 | 3.9 | 5.552 | 14.235 |
| 521 | 2.8 | -1.6 | 1.1 | 3.5 | 0.369 | 0.932 |
| 531 | 23.7 | -18.4 | 1.0 | 55.7 | 59.484 | 176.375 |
| 532 | 4.1 | -3.4 | 0.6 | 10.2 | 1.064 | 3.074 |
| 533 | 9.8 | -3.6 | 5.8 | 10.9 | 2.754 | 6.418 |
| 541 | 9.3 | -5.8 | 3.0 | 6.3 | 14.137 | 33.472 |
| 551 | 5.0 | -2.8 | 2.1 | 2.7 | 3.529 | 7.534 |
| 553 | 8.2 | -4.3 | 3.5 | 4.2 | 2.117 | 4.462 |
| 554 | 7.8 | -5.0 | 2.4 | 4.9 | 1.043 | 2.453 |
| 561 | 0.7 | -0.5 | 0.2 | 1.0 | 2.785 | 7.427 |
| 571 | 9.0 | -4.9 | 3.6 | 4.8 | 1.805 | 3.900 |
| 581 | 10.9 | -6.7 | 3.5 | 10.5 | 25.374 | 63.761 |
| 599 | 7.3 | -3.3 | 3.7 | 7.1 | 15.444 | 36.001 |
| Total for SITC 5 | | | | | 212.570 | 524.433 |

goods is lowest for Manufactured fertilizers (SITC 561), having an estimated decrease of 0.5 percent. The greatest percentage decline is 18.4 percent for Synthetic organic dyestuffs, natural indigo and color lakes (SITC 531). As might be expected, these price declines correspond in magnitude to the height of the tariff removed. The percentage increases in the duty-free prices range from 0.2 percent to 5.8 percent for SITC 561, Manufactured fertilizers, and SITC 533, Pigments, paints, varnishes and related materials, respectively.

These duty-free price increases relative to the corresponding tariffs which are eliminated show substantial variation. For Pigments, paints, varnishes and related materials (SITC 533) the duty-free price increases by more than half the extinquished tariff, i. e., $(dP/P) / t = 0.59$, whereas for Synthetic organic dyestuffs, natural indigo, and color lakes (SITC 531) the duty-free price increases by only .04 of the tariff. The unweighted average of the ratios of the percent increase in the duty-free price to the percent decrease in tariff is 0.36. That indicates that, on the average, just over one-third of the tariff reduction goes to the foreign supplier in the form of increased prices.[4]

The percentage increase in the quantity of imports is largest for Synthetic organic dyestuffs, natural indigo, and color lakes (SITC 531) being estimated to equal 55.7 percent. The next largest increase in the quantity of imports is 10.9 percent; three groups, SITC's 532, 533, and 581 (Dyeing and tanning extracts, and synthetic tanning materials, Pigments, paints, varnishes and related materials; and Plastic materials, regenerated cellulose and artificial resins, respectively) all have percentage quantity increases between 10 and 11 percent. Manufactured fertilizers (SITC 561) displays the smallest percentage

increase in the quantity of imports, equal to 1.0 percent, which reflects, in part, the fact that its post-Kennedy Round average tariff rate is the least of all the groups within the chemical industry.

The effects on the quantity of imports, shown in Table IV, are estimated percentage changes for the short-run. Because of the algebra of the calculations, the assumption that the long-run elasticities are three times those of the short-run yields long-run percentage increases in the quantity of imports which equal three times those of the short-run. The long-run increases are not displayed in the Table.

Finally, for the import markets, the estimated increases in the value of imports ranges from $0.369 million for Mineral tar and crude chemicals from coal, petroleum and natural gas (SITC 521) to $59.484 million for Synthetic organic dyestuffs, natural indigo, and color lakes (SITC 531). Organic chemicals (SITC 512) also indicate a substantial increase in the value of imports; the estimated short-run increase is $56.447 million for this group. The long-term increases in the value of imports are somewhat less than three times their short-run counterparts.[5] These long-run estimates, indicated by an *, are shown in the far right-hand column of Table IV.

The Export Markets. This study also estimates the effects in the United States' export markets of the elimination of tariffs by the 10 foreign countries of the study. The following portion of the discussion continues the first scenario which assumes approval of the Supplemental Agreement. The empirical results are displayed in Table V. The averages of the foreign tariffs faced by the U. S. exports range from a high of 10.9 percent for Perfumery and cosmetics, dentifrices and other

TABLE V

SURVEY OF PRICE AND TRADE EFFECTS OF FOREIGN TARIFF REMOVAL ON THE U.S. EXPORT MARKET: FIRST SCENARIO

| SITC | t** (%) | $\frac{dP}{P}$ (%) | $\frac{dX}{X}$ (%) | $dV_X$ (million $) | $dV_X^*$ (million $) |
|---|---|---|---|---|---|
| 512 | 8.9 | 6.7 | 4.2 | 123.267 | 222.132 |
| 513 | 6.4 | 4.8 | 8.1 | 34.830 | 79.325 |
| 514 | 7.0 | 6.1 | 4.1 | 15.890 | 29.119 |
| 515 | 2.1 | 1.6 | 2.6 | 7.690 | 17.272 |
| 521 | 3.3 | 2.6 | 1.6 | 1.296 | 2.322 |
| 531 | 9.9 | 9.7 | 59.6 | 39.962 | 109.568 |
| 532 | 4.4 | 4.1 | 29.3 | 1.251 | 3.456 |
| 533 | 7.9 | 6.1 | 3.2 | 9.489 | 16.277 |
| 541 | 8.8 | 7.5 | 2.8 | 49.780 | 78.272 |
| 551 | 6.9 | 5.3 | 6.6 | 7.334 | 15.657 |
| 553 | 10.9 | 9.1 | 5.5 | 6.326 | 11.352 |
| 554 | 10.1 | 8.8 | 1.5 | 9.744 | 12.798 |
| 561 | 1.5 | 1.2 | 2.4 | 10.830 | 25.326 |
| 571 | 10.1 | 8.1 | 6.6 | 4.265 | 8.261 |
| 581 | 10.7 | 9.0 | 4.3 | 93.887 | 160.576 |
| 599 | 6.7 | 5.0 | 3.2 | 46.506 | 83.898 |
| Total for SITC 5 | | | | 462.347 | 875.611 |

toilet preparations (except soaps), SITC 553, to a low of 1.5 percent for Manufactured fertilizers, SITC 561. This latter group, SITC 561, also has the lowest U. S. tariff as discussed in the earlier section on the import markets.

The elimination of these foreign tariffs increases the demand experienced by U. S. exporters resulting in price increases. The percentage increases in U. S. export prices for all the three-digit groups average 6.0 percent. The sector displaying the smallest estimated price increase, equal to a 1.2 percent increase, is Manufactured fertilizers (SITC 561). Four groups have price increases exceeding 8.5 percent. They are Synthetic organic dyestuffs, natural indigo and color lakes (SITC 531) with a 9.7 estimated price increase; Perfumery and cosmetics, dentifrices and other toilet preparations (except soaps) (SITC 553) with 9.1 percent; Soaps, cleansing and polishing preparations (SITC 554) with 8.8 percent; and Plastic materials, regenerated cellulose and artificial resins (SITC 581) with 9.0 percent. These price increases average more than twice the average increase in the duty-free price for U. S. imports.

Two sectors show extremely large percentage increases in the quantity of exports. The 59.6 percent increase for Synthetic organic dyestuffs, natural indigo and color lakes (SITC 531) and the 29.3 percent increase for Dyeing and tanning extracts, and synthetic tanning materials (SITC 532) reflect the extreme estimates of the elasticity of export demand derived for these two sectors. Excluding these two sectors, the percentage increases in the quantity of exports range from 1.5 percent for Soaps, cleansing and polishing preparations (SITC 554) to 8.1 percent for Inorganic chemicals--elements, oxides and halogen

salts (SITC 513).

The estimated impact in dollar magnitudes of foreign tariff elimination reveals considerable variation. The smallest increases in exports for the short-run are for the groups Mineral tar and crude chemicals from coal, petroleum and natural gas (SITC 521) and Dyeing and tanning extracts and synthetic tanning materials (SITC 532), which have increases of $1.296 million and $1.251 million respectively. By far the largest short-run increase is estimated to be in the exports of U. S. Organic chemicals (SITC 512) where the increase is calculated to be $123.267 million.

The long-run effects allow for complete adjustment assuming no other changes. The long-run increases in exports are estimated to extend from $2.322 million for Mineral tar and crude chemicals from coal, petroleum and natural gas (SITC 521) to $222.132 million for Organic chemicals (SITC 512).

### The Second Scenario: Implementation of Only the First Kennedy Round Package

The second Scenario uses the tariff rates resultant from the Kennedy Round concessions alone, without the approval and final ratification of the additional concessions contained in the Supplemental Agreement on Chemicals. As under the first scenario, the effects of tariff elimination in both the import and export markets are considered separately.

The Import Markets. For the import markets, the estimated effects of tariff elimination for the second scenario are shown in Table VI for the three-digit SITC groups. The U. S. tariff data are extrapolated

TABLE VI

SURVEY OF PRICE AND TRADE EFFECTS OF U.S. TARIFF REMOVAL ON THE U.S. IMPORT MARKET: SECOND SCENARIO

| SITC | t (%) | $\frac{dP}{P+T}$ (%) | $\frac{dP}{P}$ (%) | $\frac{dM}{M}$ (%) | $dV_M$ (million $) | $dV_M^*$ (million $) |
|---|---|---|---|---|---|---|
| 512 | 11.0 | -5.2 | 5.3 | 5.9 | 58.595 | 121.835 |
| 513 | 4.5 | -2.5 | 1.9 | 2.8 | 16.545 | 36.408 |
| 514 | 6.0 | -4.1 | 1.7 | 4.6 | 4.995 | 12.322 |
| 515 | 3.0 | -1.8 | 1.1 | 4.0 | 5.664 | 14.569 |
| 521 | 2.8 | -1.6 | 1.1 | 3.5 | 0.369 | 0.932 |
| 531 | 26.5 | -20.1 | 1.1 | 60.9 | 65.108 | 193.038 |
| 532 | 4.6 | -3.8 | 0.7 | 11.4 | 1.193 | 3.442 |
| 533 | 11.0 | -4.0 | 6.5 | 12.2 | 3.097 | 7.226 |
| 541 | 9.3 | -5.8 | 3.0 | 6.3 | 14.137 | 33.472 |
| 551 | 5.4 | -3.0 | 2.2 | 2.9 | 3.752 | 8.058 |
| 553 | 8.8 | -4.6 | 3.8 | 4.5 | 2.285 | 4.805 |
| 554 | 8.4 | -5.4 | 2.6 | 5.2 | 1.115 | 2.615 |
| 561 | 0.7 | -0.5 | 0.2 | 1.0 | 2.785 | 7.427 |
| 571 | 9.3 | -5.1 | 3.8 | 4.9 | 1.871 | 4.013 |
| 581 | 10.9 | -6.7 | 3.5 | 10.5 | 25.374 | 63.761 |
| 599 | 7.5 | -3.4 | 3.8 | 7.3 | 15.883 | 37.040 |
| Total for SITC 5 | | | | | 222.768 | 550.963 |

estimates as discussed in Chapter IV. The range of the tariffs is wider than under the first scenario extending from a low of 0.7 percent (as in the first scenario) for Manufactured fertilizers (SITC 561) to a high of 26.5 percent for Synthetic organic dyestuffs, natural indigo and color lakes (SITC 531). These same categories also are the extreme points of the range of estimated percentage changes in the U. S. price of imports; they are decreases of 0.5 percent and 20.1 percent respectively.

The percentage increases in the duty-free prices range from 0.2 percent for Manufactured fertilizers (SITC 561) to 6.5 percent for Pigments, paints, varnishes and related materials (SITC 533). These figures compare to 0.2 percent and 5.8 percent under the first scenario.

The combination of an extremely large estimate of the import supply elasticity for Synthetic organic dyestuffs, natural indigo, and color lakes (SITC 531) and its high tariff causes the estimated percentage increase in the quantity of imports for SITC 531 to be extremely large, equaling 60.9 percent. The second largest estimate is the 12.2 percent increase in imported quantities of Pigments, paints, varnishes and related materials (SITC 533). The smallest increase, 1.0 percent, is estimated for Manufactured fertilizers (SITC 561).[6]

The percentage quantity increases in imports are transformed into dollar magnitudes for both the short-run and long-run. The smallest estimated increase in the value of imports is $0.369 million in the short-run and $0.932 million in the long-run for Mineral tar and crude chemicals from coal, petroleum and natural gas (SITC 521). Synthetic organic dyestuffs, natural indigo, and color lakes (SITC 531) displays the largest estimated increases; they equal $65.108 million and $193.038

million for the short-run and long-run, respectively.

The Export Markets. The results for the U. S. export market under the second scenario are displayed in Table VII. The foreign tariffs, i. e., the averages of the foreign tariffs faced by U. S. exports within each group, range from 13.9 percent for Plastic materials, regenerated cellulose and artificial resins (SITC 581) to 2.8 percent for Radioactive and associated materials (SITC 515). For comparison, the same two SITC groups have, respectively, tariff rates of 10.7 percent and 2.1 percent under the first scenario which assumes approval of the separate agreement on chemicals. The non-ratification of the separate agreement results in higher tariff rates for all the chemical groups as can be seen by comparing the rates of Table VII to those of Table V which assumes ratification. The category with the highest tariff rate (10.9 percent) under the first scenario, Perfumery and cosmetics, dentifrices and other toilet preparations (except soaps) (SITC 553) has a tariff average of 13.4 percent, which is the second highest, under the second scenario. Manufactured fertilizers (SITC 561) has an average foreign tariff equal to 3.7 percent.

Because of the higher initial tariff rates, ceteris paribus, the estimated impact of tariff removal is greater for the second scenario, considered here, than for the first. The predicted increases in the U. S. prices of U. S. exports extend from the smallest increase, 2.2 percent, for Radioactive and associated materials (SITC 515) to 11.6 percent for Plastic materials, regenerated cellulose and artificial resins (SITC 581) which is the largest predicted price increase. The mean of the SITC three-digit group price increases is 7.6 percent for

TABLE VII

SURVEY OF PRICE AND TRADE EFFECTS OF FOREIGN TARIFF REMOVAL ON THE U.S. EXPORT MARKET: SECOND SCENARIO

| SITC | t** (%) | $\frac{dP}{P}$ (%) | $\frac{dX}{X}$ (%) | $dV_X$ (million $) | $dV_X$* (million $) |
|---|---|---|---|---|---|
| 512 | 12.5 | 9.4 | 5.8 | 173.212 | 313.209 |
| 513 | 8.2 | 6.1 | 10.3 | 44.892 | 102.600 |
| 514 | 8.9 | 7.7 | 5.1 | 20.192 | 36.992 |
| 515 | 2.8 | 2.2 | 3.4 | 10.217 | 22.815 |
| 521 | 4.2 | 3.3 | 2.1 | 1.670 | 2.990 |
| 531 | 11.1 | 10.9 | 66.7 | 45.188 | 124.005 |
| 532 | 5.8 | 5.3 | 38.6 | 1.662 | 4.600 |
| 533 | 10.8 | 8.3 | 4.3 | 12.966 | 22.360 |
| 541 | 11.3 | 9.7 | 3.6 | 64.645 | 102.031 |
| 551 | 8.7 | 6.7 | 8.3 | 9.313 | 19.919 |
| 553 | 13.4 | 11.1 | 6.8 | 7.812 | 14.143 |
| 554 | 12.6 | 11.0 | 1.8 | 12.147 | 15.880 |
| 561 | 3.7 | 3.2 | 5.8 | 27.413 | 63.139 |
| 571 | 11.3 | 9.1 | 7.3 | 4.779 | 9.238 |
| 581 | 13.9 | 11.6 | 5.5 | 123.528 | 208.990 |
| 599 | 8.0 | 6.0 | 3.8 | 55.788 | 100.610 |
| Total for SITC 5 | | | | 615.424 | 1163.521 |

the present alternative, as opposed to 6.0 percent for the first scenario.

The extremely high (in absolute quantities) elasticities of U. S. export demand for sectors SITC 531 and 532 (Synthetic organic dyestuffs, natural indigo, and color lakes and Dyeing and tanning extracts, and synthetic tanning materials, respectively) cause the trade effects also to be extremely high. The short-run percentage increase in the quantity of U. S. exports for Synthetic organic dyestuffs, natural indigo and color lakes is estimated to be 66.7 percent. The corresponding increase in the value of exports is $45.188 million. For the long-run, the increase in the value of exports is predicted to be $124.005 million.

In the case of Dyeing and tanning extracts, and synthetic tanning materials (SITC 532) the elimination of an average foreign tariff equal to 5.8 percent causes a 38.6 percent increase in the quantity of U. S. exports. In dollar terms, the estimated increase in the value of exports is $1.662 million in the short-run and $4.600 million in the long-run.

Disregarding these two sectors, the greatest percentage increase in the quantity of exports is 10.3 percent for Inorganic chemicals -- elements, oxides and halogen salts (SITC 513). Soaps, cleansing and polishing preparations (SITC 554) has the smallest increase in the quantity of exports, equal to 1.8 percent. These are the estimates for the short-run. The results for the long-run adjustment equal three times the short-run percentages.

The short-run increases in exports vary from $1.670 million for Mineral tar and crude chemicals from coal, petroleum, and natural gas, (SITC 521) to $173.212 million for Organic chemicals (SITC 512).

## Effects Aggregated for the Chemical Industry

The preceding section of the chapter has presented an overview of the price and trade effects of tariff elimination. For the purposes of such a survey, the results were aggregated into the 16 SITC groups contained in the chemical industry. The trade effects can be further aggregated for the chemical industry as a whole. The industry totals are shown in Table VII for both scenarios. Because the first scenario assumes both Kennedy Round packages became effective whereas the second scenario is based only on the tariff concessions of the Kennedy Round package without approval of the ASP package, the differences between the results under both scenarios indicate the impact of Congressional approval of the Supplemental Agreement; these results are also shown in Table VIII.

In all three cases, i. e., elimination of either set of tariffs or approval of the ASP package, the increase in U. S. chemical exports exceeds the increase in U. S. chemical imports. The excess of exports over imports is especially pronounced in the case of the impact of the Supplemental Agreement because of the large concessions by the rest-of-the-world relative to the U. S. concessions.

## The Effects in Their Entirety

### Introduction

This section presents the entire set of price and trade effects. These estimates are summarized in the preceding section at the three-digit level of aggregation.

The results of tariff elimination for the first scenario are

TABLE VIII

VALUE OF TRADE EFFECTS FROM TARIFF ELIMINATION FOR THE U.S. CHEMICAL INDUSTRY
(SITC 5)
(Million $)

| | $V_{M,f.o.b.}$ (1972) | $V_X$ (1972) | $dV_M$ (%) | $dV_X$ (%) | $dV_{M^*}$ (%) | $dV_X^*$ (%) |
|---|---|---|---|---|---|---|
| SITC 5 (U.S.) | 2014.588 | 4133.649 | ... | ... | ... | ... |
| First Scenario | ... | ... | 212.570 (10.6%) | 462.347 (11.2%) | 524.433 (26.0%) | 875.611 (21.2%) |
| Second Scenario | ... | ... | 222.768 (11.0%) | 615.424 (14.9%) | 550.963 (27.3%) | 1163.521 (28.1%) |
| Impact of Supplemental Agreement | ... | ... | 10.198 (0.5%) | 153.077 (3.7%) | 26.530 (1.3%) | 287.910 (7.0%) |

... Not Applicable.

estimated from tariffs effective following the ratification of both concession packages negotiated for chemicals in the Kennedy Round. These tariffs, for each four-digit SITC group, are displayed in Figure 3 for easy visual comparison of the U. S. and foreign tariff averages. The U. S. tariffs are listed in Table IX and the foreign tariffs are listed in Table X.

The tariffs used in the second scenario are those resulting solely from the Kennedy Round concessions package without implementation of the ASP package. The tariffs are graphically illustrated in Figure 4, which shows that, in general, the foreign tariffs exceed U. S. tariffs for this scenario. In contrast, in the first scenario U. S. and foreign tariffs are relatively more comparable.

### The First Scenario

The entire set of estimated results are computed at the four-digit SITC level. The results of the first scenario, which are discussed here, derive from tariff rates which assume that the Supplemental Agreement on Chemicals was ratified. The effects estimated for the U. S. import market are shown in Table IX. Table X displays the estimated price and trade effects of foreign tariff removal in the export market. The estimates at the four-digit level are described in terms of a range within each three-digit sector. The effects in the export market are compared to those in the U. S. import market for each three-digit group because it seems reasonable that tariff elimination by the U. S. would only occur within the context of multilateral agreement to free trade.

The import market for Organic chemicals (SITC 512) exhibits U. S. tariff averages which range from 5.2 percent to 14.4 percent for Other

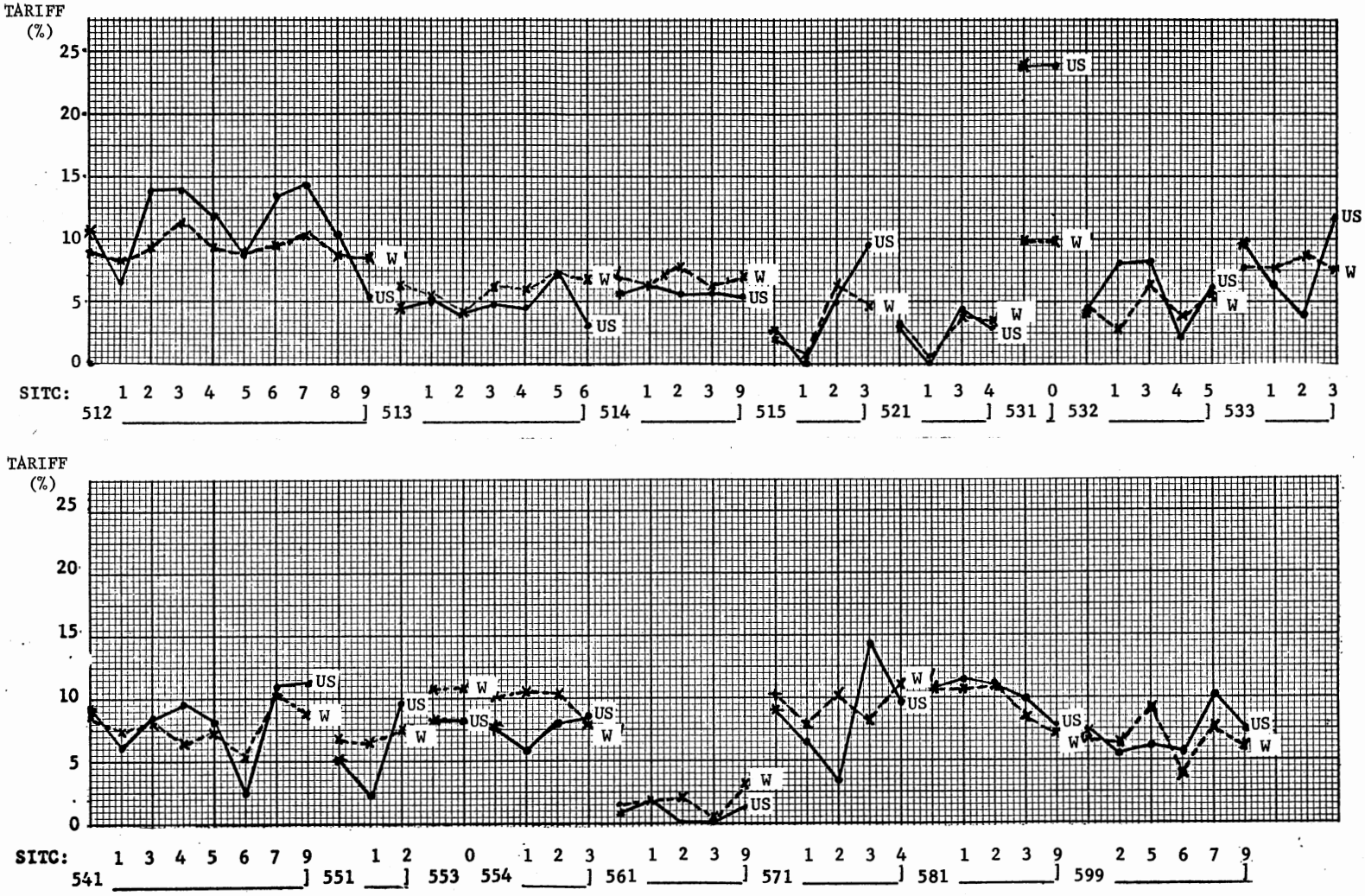



Figure 3. Tariff Comparison: First Scenario

U.S.- United States tariff averages
W- Foreign tariff averages

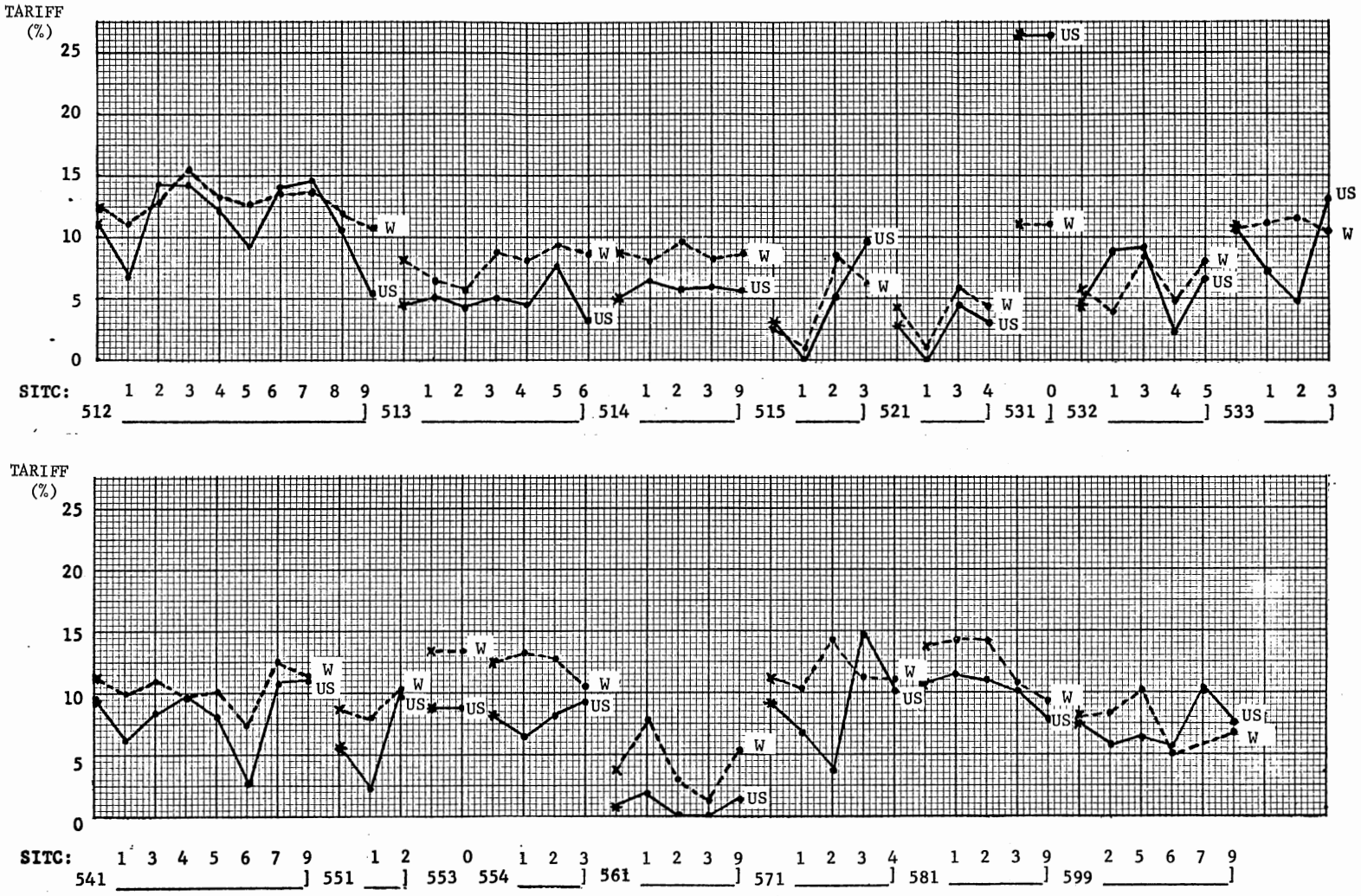



Figure 4. Tariff Comparison: Second Scenario

U.S.-United States tariff averages
W-Foreign tariff averages

TABLE IX

ESTIMATED PRICE AND TRADE EFFECTS OF U.S. TARIFF REMOVAL ON THE U.S. IMPORT MARKET: FIRST SCENARIO

| SITC | t (%) | $\frac{dP'}{P+T}$ (%) | $\frac{dP}{P}$ (%) | $\frac{dM}{M}$ (%) | $dV_M$ (million $) | $dV_M^*$ (million $) |
|---|---|---|---|---|---|---|
| 512 | 10.6 | -5.0 | 5.1 | 5.7 | 56.447 | 117.428 |
| 5121 | 6.5 | -3.1 | 3.2 | 3.5 | --- | --- |
| 5122 | 13.9 | -6.4 | 6.6 | 7.3 | --- | --- |
| 5123 | 13.8 | -6.4 | 6.5 | 7.3 | --- | --- |
| 5124 | 11.9 | -5.5 | 5.7 | 6.3 | --- | --- |
| 5125 | 8.9 | -4.2 | 4.3 | 4.8 | --- | --- |
| 5126 | 13.6 | -6.3 | 6.4 | 7.2 | --- | --- |
| 5127 | 14.4 | -6.6 | 6.8 | 7.5 | --- | --- |
| 5128 | 10.2 | -4.8 | 4.9 | 5.5 | --- | --- |
| 5129 | 5.2 | -2.5 | 2.6 | 2.9 | --- | --- |
| 513 | 4.3 | -2.4 | 1.8 | 2.7 | 15.833 | 34.967 |
| 5131 | 5.0 | -2.7 | 2.1 | 3.1 | --- | --- |
| 5132 | 4.2 | -2.3 | 1.8 | 2.6 | 1.495 | 3.274 |
| 5133 | 4.8 | -2.6 | 2.0 | 3.0 | 0.857 | 1.893 |
| 5134 | 4.4 | -2.4 | 1.9 | 2.7 | --- | --- |
| 5135 | 7.4 | -4.0 | 3.1 | 4.6 | 4.208 | 9.298 |
| 5136 | 3.2 | -1.8 | 1.4 | 2.0 | 8.360 | 18.251 |
| 514 | 5.8 | -3.9 | 1.6 | 4.5 | 4.833 | 11.994 |
| 5141 | 6.3 | -4.2 | 1.8 | 4.8 | --- | --- |
| 5142 | 5.7 | -3.9 | 1.6 | 4.4 | --- | --- |
| 5143 | 5.8 | -3.9 | 1.6 | 4.4 | --- | --- |
| 5149 | 5.5 | -3.7 | 1.5 | 4.3 | --- | --- |
| 515 | 2.9 | -1.8 | 1.1 | 3.9 | 5.552 | 14.235 |
| 5151 | 0.0 | -0.0 | 0.0 | 0.0 | --- | --- |
| 5152 | 5.0 | -3.0 | 1.8 | 6.5 | --- | --- |
| 5153 | 9.6 | -5.7 | 3.4 | 12.2 | --- | --- |
| 521 | 2.8 | -1.6 | 1.1 | 3.5 | 0.369 | 0.932 |
| 5211 | 0.0 | -0.0 | 0.0 | 0.0 | 0.000 | 0.000 |
| 5213 | 4.5 | -2.6 | 1.8 | 5.5 | --- | --- |
| 5214 | 3.0 | -1.7 | 1.2 | 3.7 | 0.343 | 0.863 |
| 531 | 23.7 | -18.4 | 1.0 | 55.7 | 59.484 | 176.375 |
| 5310 | | | | | | |
| 532 | 4.1 | -3.4 | 0.6 | 10.2 | 1.064 | 3.074 |
| 5321 | 8.0 | -6.4 | 1.1 | 19.3 | --- | --- |

---Necessary data not available.

TABLE IX (Continued)

| SITC | t (%) | $\frac{dP'}{P+T}$ (%) | $\frac{dP}{P}$ (%) | $\frac{dM}{M}$ (%) | $dV_M$ (million $) | $dV_M^*$ (million $) |
|---|---|---|---|---|---|---|
| 5323 | 8.2 | -6.5 | 1.2 | 19.7 | --- | --- |
| 5324 | 2.1 | -1.8 | 0.3 | 5.3 | 0.489 | 1.415 |
| 5325 | 6.2 | -5.0 | 0.9 | 15.1 | --- | --- |
| 533 | 9.8 | -3.6 | 5.8 | 10.9 | 2.754 | 6.418 |
| 5331 | 6.6 | -2.5 | 4.0 | 7.4 | 0.711 | 1.647 |
| 5332 | 4.3 | -1.6 | 2.6 | 4.9 | 0.227 | 0.527 |
| 5333 | 11.7 | -4.3 | 6.9 | 13.0 | 1.420 | 3.317 |
| 541 | 9.3 | -5.8 | 3.0 | 6.3 | 14.137 | 33.472 |
| 5411 | 6.2 | -3.9 | 2.0 | 4.3 | 1.819 | 4.317 |
| 5413 | 8.5 | -5.3 | 2.7 | 5.8 | 2.609 | 6.200 |
| 5414 | 9.8 | -6.1 | 3.1 | 6.6 | 2.032 | 4.823 |
| 5415 | 8.2 | -5.1 | 2.6 | 5.6 | 2.739 | 6.511 |
| 5416 | 2.6 | -1.7 | 0.9 | 1.8 | 0.306 | 0.715 |
| 5417 | 11.0 | -6.8 | 3.5 | 7.4 | 1.625 | 3.855 |
| 5419 | 11.2 | -6.9 | 3.6 | 7.5 | 0.189 | 0.448 |
| 551 | 5.0 | -2.8 | 2.1 | 2.7 | 3.529 | 7.534 |
| 5511 | 2.2 | -1.2 | 0.9 | 1.2 | 1.034 | 2.219 |
| 5512 | 9.5 | -5.2 | 3.8 | 5.0 | 2.129 | 4.588 |
| 553 | 8.2 | -4.3 | 3.5 | 4.2 | 2.117 | 4.462 |
| 5530 | | | | | | |
| 554 | 7.8 | -5.0 | 2.4 | 4.9 | 1.043 | 2.453 |
| 5541 | 5.8 | -3.8 | 1.8 | 3.6 | 0.178 | 0.417 |
| 5542 | 8.0 | -5.1 | 2.5 | 5.0 | 0.709 | 1.663 |
| 5543 | 8.5 | -5.4 | 2.6 | 5.3 | 0.120 | 0.282 |
| 561 | 0.7 | -0.5 | 0.2 | 1.0 | 2.785 | 7.427 |
| 5611 | 1.8 | -1.2 | 0.6 | 2.5 | 1.798 | 4.702 |
| 5612 | 0.0 | -0.0 | 0.0 | 0.0 | 0.000 | 0.000 |
| 5613 | 0.0 | -0.0 | 0.0 | 0.0 | 0.000 | 0.000 |
| 5619 | 1.3 | -0.9 | 0.4 | 1.8 | 1.027 | 2.709 |
| 571 | 9.0 | -4.9 | 3.6 | 4.8 | 1.805 | 3.900 |
| 5711 | 6.5 | -3.6 | 2.7 | 3.5 | 0.262 | 0.562 |
| 5712 | 3.5 | -2.0 | 1.5 | 1.9 | 0.050 | 0.107 |
| 5713 | 14.4 | -7.6 | 5.7 | 7.4 | 1.208 | 2.605 |
| 5714 | 9.8 | -5.3 | 3.9 | 5.2 | 0.603 | 1.304 |

TABLE IX (Continued)

| SITC | t (%) | $\frac{dP^T}{P+T}$ (%) | $\frac{dP}{P}$ (%) | $\frac{dM}{M}$ (%) | $dV_M$ (million $) | $dV_M^*$ (million $) |
|---|---|---|---|---|---|---|
| 581 | 10.9 | -6.7 | 3.5 | 10.5 | 25.374 | 63.761 |
| 5811 | 11.4 | -7.0 | 3.6 | 10.9 | --- | --- |
| 5812 | 11.0 | -6.7 | 3.5 | 10.6 | --- | --- |
| 5813 | 10.1 | -6.2 | 3.2 | 9.8 | 1.615 | 4.067 |
| 5819 | 7.9 | -4.9 | 2.6 | 7.7 | 0.166 | 0.416 |
| 599 | 7.3 | -3.3 | 3.7 | 7.1 | 15.444 | 36.001 |
| 5992 | 5.6 | -2.6 | 2.9 | 5.5 | 2.182 | 5.067 |
| 5995 | 6.2 | -2.8 | 3.2 | 6.0 | 7.490 | 17.367 |
| 5996 | 5.6 | -2.6 | 2.9 | 5.5 | 0.259 | 0.603 |
| 5997 | 10.3 | -4.6 | 5.2 | 9.9 | 1.016 | 2.371 |
| 5999 | 7.4 | -3.4 | 3.8 | 7.2 | 2.798 | 6.508 |

TABLE X

ESTIMATED PRICE AND TRADE EFFECTS OF FOREIGN TARIFF REMOVAL ON THE U.S. EXPORT MARKET: FIRST SCENARIO

| SITC | t** (%) | $\frac{dP}{P}$ (%) | $\frac{dX}{X}$ (%) | $dV_X$ (million $) | $dV_X^*$ (million $) |
|---|---|---|---|---|---|
| 512 | 8.9 | 6.7 | 4.2 | 123.267 | 222.132 |
| 5121 | 7.3 | 5.5 | 3.4 | --- | --- |
| 5122 | 9.3 | 7.0 | 4.3 | --- | --- |
| 5123 | 11.2 | 8.4 | 5.2 | --- | --- |
| 5124 | 9.4 | 7.1 | 4.4 | --- | --- |
| 5125 | 8.9 | 6.7 | 4.2 | --- | --- |
| 5126 | 9.5 | 7.2 | 4.4 | --- | --- |
| 5127 | 10.1 | 7.6 | 4.7 | --- | --- |
| 5128 | 8.7 | 6.6 | 4.1 | --- | --- |
| 5129 | 8.5 | 6.4 | 4.0 | --- | --- |
| 513 | 6.4 | 4.8 | 8.1 | 34.830 | 79.325 |
| 5131 | 5.4 | 4.1 | 6.9 | 0.642 | 1.459 |
| 5132 | 4.1 | 3.1 | 5.2 | 3.630 | 8.230 |
| 5133 | 6.3 | 4.7 | 8.0 | 2.586 | 5.900 |
| 5134 | 6.0 | 4.5 | 7.6 | 0.304 | 0.693 |
| 5135 | 7.3 | 5.5 | 9.2 | 2.324 | 5.291 |
| 5136 | 7.1 | 5.3 | 9.0 | 25.167 | 59.363 |
| 514 | 7.0 | 6.1 | 4.1 | 15.890 | 29.119 |
| 5141 | 6.1 | 5.3 | 3.5 | --- | --- |
| 5142 | 7.8 | 6.8 | 4.5 | --- | --- |
| 5143 | 6.2 | 4.7 | 3.1 | --- | --- |
| 5149 | 7.0 | 6.1 | 4.1 | --- | --- |
| 515 | 2.1 | 1.6 | 2.6 | 7.690 | 17.272 |
| 5151 | 0.6 | 0.5 | 0.7 | 1.354 | 2.937 |
| 5152 | 6.4 | 4.9 | 7.7 | 2.473 | 5.551 |
| 5153 | 4.8 | 3.7 | 5.8 | 4.834 | 10.819 |
| 521 | 3.3 | 2.6 | 1.6 | 1.296 | 2.322 |
| 5211 | 0.4 | 0.3 | 0.2 | 0.001 | 0.002 |
| 5213 | 4.1 | 3.2 | 2.0 | 0.001 | 0.002 |
| 5214 | 3.5 | 2.7 | 1.7 | 1.362 | 2.432 |
| 531 | 9.9 | 9.7 | 59.6 | 39.962 | 109.568 |
| 5310 | | | | | |

---Necessary data not available.

TABLE X (Continued)

| SITC | t** (%) | $\frac{dP}{P}$ (%) | $\frac{dX}{X}$ (%) | $dV_X$ (million $) | $dV_X^*$ (million $) |
|---|---|---|---|---|---|
| 532 | 4.4 | 4.1 | 29.3 | 1.251 | 3.456 |
| 5321 | 2.8 | 2.6 | 18.7 | 0.244 | 0.673 |
| 5323 | 6.4 | 5.9 | 42.5 | 0.906 | 2.507 |
| 5324 | 3.9 | 3.6 | 26.0 | --- | --- |
| 5325 | 5.9 | 5.4 | 39.2 | --- | --- |
| 533 | 7.9 | 6.1 | 3.2 | 9.489 | 16.277 |
| 5331 | 7.7 | 6.0 | 3.1 | 1.485 | 2.536 |
| 5332 | 8.7 | 6.7 | 3.5 | 1.075 | 1.844 |
| 5333 | 7.9 | 6.1 | 3.2 | 6.993 | 11.995 |
| 541 | 8.8 | 7.5 | 2.8 | 49.780 | 78.272 |
| 5411 | 7.3 | 6.3 | 2.4 | 0.879 | 1.386 |
| 5413 | 8.3 | 7.1 | 2.7 | 13.633 | 21.528 |
| 5414 | 6.6 | 5.7 | 2.1 | 0.277 | 0.354 |
| 5415 | 7.4 | 6.4 | 2.4 | 2.872 | 4.510 |
| 5416 | 5.1 | 4.4 | 1.7 | 3.538 | 5.574 |
| 5417 | 10.4 | 8.9 | 3.3 | 22.680 | 35.715 |
| 5419 | 8.9 | 7.6 | 2.9 | 4.300 | 6.942 |
| 551 | 6.9 | 5.3 | 6.6 | 7.334 | 15.657 |
| 5511 | 6.6 | 5.1 | 6.3 | 4.295 | 9.148 |
| 5512 | 7.5 | 5.8 | 7.1 | 3.093 | 6.583 |
| 553 | 10.9 | 9.1 | 5.5 | 6.326 | 11.352 |
| 5530 | | | | | |
| 554 | 10.1 | 8.8 | 1.5 | 9.744 | 12.798 |
| 5541 | 10.6 | 9.3 | 1.5 | 0.809 | 1.051 |
| 5542 | 10.4 | 9.1 | 1.5 | 8.248 | 10.763 |
| 5543 | 8.1 | 7.1 | 1.2 | 0.774 | 1.011 |
| 561 | 1.5 | 1.2 | 2.4 | 10.830 | 25.326 |
| 5611 | 1.7 | 1.5 | 2.7 | 1.978 | 4.536 |
| 5612 | 2.2 | 1.9 | 3.5 | 2.868 | 6.610 |
| 5613 | 0.4 | 0.3 | 0.6 | 0.409 | 0.954 |
| 5619 | 3.3 | 2.8 | 5.2 | 12.543 | 29.005 |
| 571 | 10.1 | 8.1 | 6.6 | 4.265 | 8.261 |
| 5711 | 7.9 | 6.4 | 5.2 | 0.750 | 1.446 |
| 5712 | 10.2 | 8.2 | 6.6 | 0.736 | 1.421 |
| 5713 | 8.3 | 6.7 | 5.4 | 0.760 | 1.462 |
| 5714 | 11.1 | 8.9 | 7.2 | 1.811 | 3.508 |

TABLE X (Continued)

| SITC | t** (%) | $\frac{dP}{P}$ (%) | $\frac{dX}{X}$ (%) | $dV_X$ (million $) | $dV_X^*$ (million $) |
|---|---|---|---|---|---|
| 581 | 10.7 | 9.0 | 4.3 | 93.887 | 160.576 |
| 5811 | 10.6 | 8.9 | 4.2 | 28.538 | 47.904 |
| 5812 | 11.2 | 9.4 | 4.5 | 49.901 | 84.223 |
| 5813 | 8.6 | 7.2 | 3.4 | 10.641 | 17.788 |
| 5819 | 7.3 | 6.1 | 2.9 | 3.486 | 5.822 |
| 599 | 6.7 | 5.0 | 3.2 | 46.506 | 83.898 |
| 5992 | 6.4 | 4.8 | 3.0 | 7.679 | 13.753 |
| 5995 | 9.3 | 6.9 | 4.4 | 3.962 | 7.174 |
| 5996 | 3.9 | 2.9 | 1.9 | 3.094 | 5.586 |
| 5997 | 7.6 | 5.7 | 3.6 | 16.974 | 30.563 |
| 5999 | 6.1 | 4.6 | 2.9 | 13.990 | 25.109 |

organic chemicals (5129) and Nitrogen-function compounds (5127), respectively. Elimination of these tariffs by the U. S. would cause the U. S. price of the imported goods to fall by 2.5 percent for Other organic chemicals (5129) and 6.6 percent for Nitrogen-function compounds (5127); furthermore, it would result in increases of the duty-free price received by the foreign suppliers which equal 2.6 percent and 6.8 percent, respectively.

U. S. exports of Organic chemicals (SITC 512) face average foreign tariffs which range from 7.3 percent for Hydrocarbons and their halogenated, sulfonated, nitrated or nitrosated derivatives (5121) to 11.2 percent for Ethers, epoxides, acetals (5123). This is less variation than for the import side of this sector.

For comparison with the immediately preceding discussion of the import market, exports of Other organic chemicals (5129), the imports of which have the lowest U. S. tariff within the group, face an average foreign tariff of 8.5 percent. The foreign tariffs average 10.1 percent on U. S. exports of Nitrogen-function compounds (5127). The elimination of these foreign tariffs would increase the U. S. price of the export commodity by 6.4 percent in the case of Other organic chemicals (5129) and by 7.6 percent for Nitrogen-function compounds (5127).

The quantity of imports into the U. S. for these same two subgroups would increase by 2.9 percent for Other organic chemicals (5129) and by 7.5 percent for Nitrogen-function compounds (5127) as a result of tariff elimination. The exports of the U. S. would experience a quantity increase equal to 4.0 percent and 4.7 percent, respectively.

The tariff average of 4.3 percent of imports of Inorganic chemicals: Elements, oxides and halogen salts, SITC 513, conceals U. S.

tariffs which vary from 3.2 percent for Other inorganic bases and metallic oxides (5136) to 7.4 percent for Metallic oxides, of kinds principally used in paints (5135). The highest tariff (5135's) is extreme, however; the second highest tariff is 4.8 percent for Inorganic acids and oxygen compounds of non-metals or metalloids (5133). The corresponding effects resulting from tariff elimination are, for Metallic oxides, of kinds principally used in paints (5135), an import price decrease of 4.0 percent, a duty-free price rise of 3.1 percent, and a 4.6 percent increase in the quantity of imports. For Other inorganic bases and metallic oxides (5136) these effects are estimated to be, respectively, a 1.8 percent decrease, a 1.4 percent duty-free price increase, and a 2.0 percent increase in imports.

The foreign tariffs levied on U. S. exports of Inorganic chemicals: Elements, oxides, and halogen salts (SITC 513) range from 4.1 percent on Chemical elements n. e. s. (5132) to 7.3 percent on Metallic oxides of kinds principally used in paints (5135). The elimination of foreign tariffs on U. S. exports of Other inorganic bases and metallic oxides (5136), which average 7.1 percent, would increase the U. S. price by 5.3 percent and increase exports, in terms of quantity, by 9.0 percent. The elimination of tariffs on exports of Metallic oxides, of kinds principally used in paints (5135) results in an 5.5 percent increase in the U. S. price and a 9.2 percent quantity increase in exports. The estimated changes in the value of trade in Metallic oxides, of kinds principally used in paints (5135) are, for the short-run, increased imports of $4.208 million and increased exports of $2.324 million. It is estimated that trade liberalization would increase, for Other inorganic bases and metallic oxides (5136), imports by $8.360 million and exports

by $25.167 million.

The variation of tariffs levied on U. S. imports within the sector Other inorganic chemicals (SITC 514) extends from 5.5 percent for Inorganic chemical products, n. e. s. (5149) to 6.3 percent for Metallic salts and peroxysalts of inorganic acids (5141). The corresponding declines in the U. S. prices of the imports as a result of tariff elimination are 3.7 percent and 4.2 percent. In comparison, U. S. exports of Inorganic chemical products, n. e. s. (5149) incur foreign tariffs which average 7.0 percent. The elimination of such tariffs would drive up the U. S. price an estimated 6.1 percent as a result of increased foreign demand. These data are, coincidently, the averages of Other inorganic chemicals (SITC 514) as a whole and represent neither the upper or lower extreme.

A wide range of U. S. tariffs exists for Radioactive and associated materials (SITC 515). For Radioactive chemical elements and isotopes and their compounds and mixtures (5151) the tariff is nil; whereas the tariff average is 9.6 percent for Compounds and mixtures, n. e. s. of thorium, of uranium, of rare earth metals, of yttrium or of scandium (5153). The removal of this 9.6 percent tariff is estimated to result in a 5.7 percent decline in the price of imported Compounds and mixtures, n. e. s. of thorium, of uranium, of rare earth metals, of yttrium, or of sandium (5153), and a 12.2 percent increase in the quantity of imports. Foreign suppliers would experience a 3.4 percent increase in the price they receive.

In the export sector, foreign tariffs range from 0.6 percent for Radioactive chemical elements and isotopes and their compounds and mixtures (5151) to 6.4 percent for Stable isotopes and their compounds

(5152). The remaining subgroup within the Radioactive and associated materials (SITC 515) group, Compounds and mixtures, n. e. s. of thorium, of uranium, of rare earth metals, of yttrium, or of scandium (5153), faces an average 4.8 percent tariff abroad. Its elimination would increase the U. S. price 3.7 percent and increase exports, in terms of quantity, 5.8 percent.

The tariff on Mineral tar (5211) is nil. The highest tariff average within Mineral tar and crude chemicals from coal, petroleum, and natural gas (SITC 521) is 4.5 percent on Ammoniacal gas liquors and spent oxide produced in coal gas purification (5213), the elimination of which results in a 2.6 percent decline in the U. S. price of the import and a 5.5 percent increase in the quantity of imports. The increased value of imports approximates $26 thousand.

The foreign tariffs on the subgroups within Mineral tar and crude chamicals from coal, petroleum, and natural gas (SITC 521) are 0.4 percent on Mineral tar (5211), 4.1 percent on Ammoniacal gas liquors and spent oxide produced in coal gas purification (5213), and 3.5 percent on Oil and other products of the distillation of coal and tar (5214). Free trade would increase the U. S. price of Ammoniacal gas liquors and spent oxide produced in coal gas purification (5213) 3.2 percent and increase exports 2.0 percent. The short-term increase in exports is valued at $1 thousand.

The division of Dyeing, Tanning and Coloring Materials (SITC 53) consists of three three-digit groups. One three-digit group, Synthetic organic dyestuffs, natural indigo and color lakes (SITC 531) is not subdivided at the four-digit level and is described in the previous section only. Dyeing and tanning extracts, and synthetic tanning materials

(SITC 532) consists of four four-digit subgroups with tariffs ranging from 2.1 percent to 8.2 percent. The subgroup Tanning extracts of vegetable origin (5324), which has the lowest U. S. tariff within its group, displays a price decline of 1.8 percent for the import price paid by the U. S. consumer, whereas the duty-free price increase is 0.3 percent. These price changes would result in an increase in the quantity of imports of 5.3 percent in the short-run. The value increases in imports of Tanning extracts of vegetable origin (5324) are estimated as $0.489 million in the short-run and $1.415 million in the long-run which are increases of 5.6 percent and 16.2 percent, respectively. The most highly tariffed subgroup, Synthetic tanning materials (5323), indicates a 6.5 percent decrease in the U. S. import price and a 1.2 percent increase in the duty-free price. The quantity of imports would increase by 19.7 percent following the elimination of U. S. tariffs.

The foreign tariffs within Dyeing and tanning extracts, and synthetic tanning materials (SITC 532) range from 2.8 percent to 6.4 percent for Dyeing extracts (vegetable and animal)(5321) and Synthetic tanning materials (5323), respectively. The greatest tariff being on Sythetic tanning materials (5323) coincides with the situation for the U. S. The removal of the foreign tariff on Synthetic tanning materials (5323) would result in a 5.9 percent increase in the U. S. price and a 42.5 percent increase in the quantity of exports by the U. S.

The tariff range for the four-digit subgroups of Pigments, paints, varnishes and related materials (SITC 533) extended from 4.3 percent for Printing inks (5332) to 11.7 percent for Prepared paints, enamels, lacquers, varnishes, artists' colors, siccatives (paint driers) and mastics (5333). Their elimination results in respective import price

declines of 1.6 percent and 4.3 percent. The quantity of imports would increase 4.9 percent and 13.0 percent, respectively. For Prepared paints, enamels, lacquers, varnishes, artists' colors, siccatives and mastics (5333) the increase in the value of imports is $1.420 million, in the short-run and $3.317 million in the long-run.

The foreign tariffs for this group are 7.7 percent for Coloring materials, n. e. s. (5331), 8.7 percent for Printing inks (5332) and 7.9 percent for Prepared paints, enamels, lacquers, varnishes, artists' colors, siccatives and mastics (5333). For comparison with the U. S. import market results, tariff elimination abroad for Printing inks (5332) would increase the U. S. price of the exported commodities 6.7 percent. Multilateral tariff elimination would create short-run estimated increases in the value of U. S. imports of $0.227 million and in the value of exports of $1.075 million.

Medicinal and pharmaceutical products (SITC 541) consists of seven four-digit subgroups. Glycosides, glands and their extracts, sera, and vaccines (5416) has the lowest tariff, 2.6 percent, the elimination of which would result in a price decline for the U. S. consumer of 1.7 percent. The foreign suppliers would reap a duty-free increase of 0.9 percent and the quantity of imports would increase 1.8 percent. These effects combine to increase the duty-free value of imports by $0.306 million in the short-run and $0.715 million in the long-run. In comparison, the most heavily tariffed subgroup, Pharmaceutical goods (5419), whose tariff given ratification of the Supplemental Agreement is 11.2 percent, shows an estimated increase in the value of imports of $0.189 million in the short-run and $0.448 million in the long run. This is the result of a 3.6 percent increase in the duty-free price and a 7.5 percent

increase in the quantity of imports. The U. S. consumer would experience a price decrease of 6.9 percent.

The tariffs faced by U. S. exports of Medicinal and pharmaceutical products (SITC 541) to the rest-of-the-world extend from 5.1 percent for Glycosides, glands and their extracts, sera, and vaccines (5416) to 10.4 percent for Medicaments (5417). Removal of this latter tariff would cause an increase in the U. S. price of Medicaments (5417) estimated to equal 8.9 percent. Furthermore, exports would increase by 3.3 percent in terms of quantity and in terms of value by $22.680 million.

The least heavily tariffed subgroup, exports of Glycosides, glands and their extracts, sera, and vaccines (5416), is also the least tariffed by the U. S. on the import market side, and the two markets are readily compared. Elimination of foreign tariffs would create an upward force on U. S. prices of Glycosides, glands and their extracts, sera, and vaccines (5416) of 4.4 percent. The short-run effects on trade would be to increase exports by 1.7 percent of their initial quantity and to increase the value of exports by $3.538 million.

U. S. imports of Essential oils and resinoids (5511) have a 2.2 percent tariff and Synthetic perfume and flavor materials and concentrates, and enfleurage greases and mixtures of alcohol and essential oils (5512) have a 9.5 percent tariff, which average, when weighted by world imports, the 5.0 percent U. S. tariff for the composite three-digit group. The corresponding U. S. prices decrease, as a result of free entry into the U. S., by 1.2 percent and 5.2 percent. The duty-free value of imports increases respectively, in the short-run, by $1.034 million and $2.129 million.

The export markets incur foreign tariffs on Essential oils and

resinoids (5511) and on Synthetic perfume and flavor materials and concentrates, and enfleurage greases and mixtures of alcohol and essential oils (5512) which equal 6.6 percent and 7.5 percent, respectively. The respective U. S. prices in the case of foreign tariff removal increase by 5.1 percent and 5.8 percent. The value of exports increase in the short-run by $4.295 million and $3.093 million. In the long-run, the increased export values are $9.148 million for Essential oils and resinoids (5511) and $6.583 million for Synthetic perfume and flavor materials and concentrates, and enfleurage greases and mixtures of alcohol and essential oils (5512), whereas the comparable import increases are, respectively, $2.219 million and $4.588 million.

The tariff range for Soaps, cleansing and polishing preparations (SITC 554) extends from 5.8 percent for Soaps (5541) to 8.5 percent for Polishes, pastes, powder and similar preparations for polishing and preserving leather, wood, metal, glass and other materials (5543).[7] Surface-acting agents and washing preparations (5542) has a tariff average of 8.0 percent. The elimination of these tariffs would yield estimated declines of the U. S. prices equal to 3.8 percent for Soaps (5541) and 5.4 percent for Polishes, pastes, powder and similar preparations for polishing, and preserving leather, wood, metal, glass and other materials (5543). Correspondingly, the duty-free prices would tend to increase by 1.8 percent and 2.6 percent and imports would increase by 3.6 percent and 5.3 percent. The dollar magnitudes of imports would increase in the short-run by $0.178 million and by $0.120 million, respectively.

The foreign tariffs levied on U. S. exports average 10.6 percent for Soaps (5541), 10.4 percent for Surface-acting agents and washing preparations (5542), and 8.1 percent for Polishes, pastes, powder and similar preparations for polishing and preserving leather, wood, glass

and other materials (5543). Their elimination would tend to drive up the U. S. prices by 9.3 percent in the case of Soaps (5541) and 7.1 percent in Polishes, pastes, powder, and similar preparations for polishing and preserving leather, wood, metal, glass and other materials (5543). The corresponding export quantities would increase by percentages equal to 1.5 and 1.2 and short-run export values would rise by $0.809 million and $0.774 million, respectively.

Both Phosphatic fertilizers and phosphatic fertilizer materials (other than natural) (5612) and Potassic fertilizers and potassic fertilizer materials (5613) carry no tariffs when imported into the United States. The U. S. does levy tariffs which average 1.3 percent on Fertilizers, n. e. s. (5619) and 1.8 percent on Nitrogenous fertilizers and nitrogeneous fertilizer materials (other than natural), n. e. s. (5611). This study estimates that the elimination of the tariff on Nitrogenous fertilizers and nitrogenous fertilizer materials (other than natural), n. e. s. (5611) would result in a 1.2 percent decrease in the price paid by the U. S. consumer, while foreign suppliers would gain a 0.6 percent increase in the price they receive. As a result of the price effect, the quantity of imports is estimated to increase by 2.5 percent. The predicted value magnitudes are a $1.798 million increase in the short-run and a $4.702 million long-run increase in the duty-free value of imports of Nitrogenous fertilizers and nitrogenous fertilizer materials (other than natural), n. e. s. (5611).

The foreign tariffs range from 0.4 percent on Potassic fertilizers and potassic fertilizer materials (other than crude natural potassic salts) (5613) to 3.3 percent on Fertilizers, n. e. s. (5619). Compared to the U. S. import market for the Nitrogenous fertilizers and

nitrogenous fertilizer materials (other than natural), n. e. s. subgroup (5611), elimination of its 1.7 percent tariff would tend to increase U. S. prices by 1.5 percent and U. S. exports by 2.7 percent of the initial quantity. The value of the increment in exports is estimated to be $1.978 million in the short-run.

Elimination of tariffs on Explosives and pyrotechnic products (SITC 571) causes price declines for U. S. imports of such commodities which range from 2.0 percent for Fuses, primers and detonators (5712), upon which the average tariff is 3.5 percent, to 7.6 percent for Pyrotechnical articles (5713), upon which the average tariff is 14.4 percent. The value of imports in the short-run for these subgroups would increase by $0.050 million, or 3.4 percent, and $1.208 million (13.5 percent), respectively.

The categories which are the extremes for the U. S. import market are not the extremes for the export market, which displays foreign tariffs from a low of 7.9 percent for Propellent powders and other prepared explosives (5711) to a high of 11.1 percent for Hunting and sporting ammunition (5714). For comparison with the discussion of U. S. imports, the effects of eliminating the 8.3 percent foreign tariff on Pyrotechnical articles (5713) are discussed here. The estimated price effect is an increase of 6.7 percent in the price of commodities in the U. S. The value of exports would increase by $0.760 million in the short-run which is less than the predicted increase in value of imports for Pyrotechnical articles (5713).

The tariff variation for imports of Plastic materials, regenerated cellulose and artificial resins (SITC 581) extends from a low for Other artificial resins and plastic materials (5819) of 7.9 percent to a high

for Products of condensation, polycondensation and polyaddition (5811) of 11.4 percent. The corresponding effects on the U. S. price of the imports are predicted to be decreases of 4.9 percent and 7.0 percent. In both subcategories, the foreign suppliers would receive slightly less than one-third of the tariff eliminated as price increases. The quantity of imports of Products of condensation, polycondensation and polyaddition (5811) would increase about 10.9 percent. The increase in imports of Other artificial resins and plastic materials (5819) is estimated as 7.7 percent in terms of quantity and as $0.166 million for the short-run change in value.

The tariff for U. S. exports of Plastic materials, regenerated cellulose and artificial resins (SITC 581) vary from 7.3 percent to 11.2 percent. The lowest tariff is on Other artificial resins and plastic materials (5819), whereas the highest tariff is on Products of polymerization and copolymerization (5812). Products of condensation, polycondensation and polyaddition (5811) have the second highest average foreign tariff, equal to 10.6 percent. Foreign tariff elimination would increase the U. S. prices of this subgroup (5811) by 8.9 percent and the quantity of exports would increase by 4.2 percent. The short-run effect for this category on the value of trade would be an increase in exports equal to $28.538 million.[8]

The Chemical materials and products not elsewhere classified group (SITC 599) exhibits tariffs on U. S. imports which range from 5.6 percent for Insecticides, fungicides, disinfectants (including sheep and cattle dressing) and similar preparations (5992) and for Wood and resin-based chemical products (5996) to 10.3 percent for Organic chemical products, n. e. s. (5997). For imports of Insecticides, fungicides,

disinfectants and similar preparations (5992) and of Wood and resin-based chemical products (5996), the estimated price declines are 2.6 percent and the estimated increases in the quantity of imports equal 5.5 percent. In terms of the value of imports, the short-run increases equal $2.182 million for Insecticides, fugicides, disinfectants and similar preparations (5992) and $0.259 million for Wood and resin-based chemical products (5996).

The largest U. S. import price decline within SITC 599, 4.6 percent, is predicted for Organic chemical products, n. e. s. (5997). Furthermore, tariff elimination within this subgroup results in the duty-free price increasing 5.2 percent and the quantity of imports increasing 9.9 percent. These increases combine and produce a short-run increase of $1.016 million in the duty-free value of imports of Organic chemical products, n. e. s. (5997).

Exports within this catch-all category (SITC 599) incur average tariffs abroad which vary from 3.9 percent for Wood and resin-based chemical products (5996) to 9.3 percent for Starches, inulin, gluten; albuminoidal substances; glues (5995). The exports of the subgroup Organic chemical products, n. e. s. (5997) face foreign tariffs which average 7.6 percent which is above the average for its three-digit group. Free trade for these exports would drive up the U. S. price an estimated 5.7 percent, while the quantity of exports increases by 3.6 percent. The value of exports would increase $16.974 million in the short-run.

## The Second Scenario and a Comparison of the Two Scenarios

The analysis of the second scenario estimates the impact of the

elimination of the tariffs existing after the Kennedy Round reductions but without implementation of the Supplemental Agreement on chemicals. The results of the analysis under the assumption of non-ratification are presented in their entirety in Table XI for the import market and in Table XII for the export market.

The tariffs of the second scenario either equal or exceed those of the first scenario, and, therefore, the estimated effects accordingly either equal or exceed those discussed in the preceding section. Rather than extracting for this text the highlights of these estimated effects which are displayed in the tables, it seems of greater interest to follow a discussion of the tariffs of the second scenario with a comparison of the estimated effects under the two scenarios. This would give some measure of the impact on the U. S. of the failure of Congress to approve the Supplemental Agreement on chemicals. The estimates of the value of trade effects resulting from ratification of the Supplemental Agreement are shown in Table XIII. These estimates are the differences between the estimates of the second scenario and those of the first scenario.[9]

Organic chemicals, SITC group 512, displays U. S. tariffs which range from 5.4 percent for Other organic chemicals (5129) to 14.9 percent for Nitrogen-function compounds (5127), assuming non-ratification of the ASP package. On average, these tariffs are 0.4 of a percentage point above those of the first scenario. The price effects in the import market as well as the increment in the quantity of imports differ, on average, by 0.2 of a percentage point between the two scenarios. Comparison of the results for the value of increased imports from tariff elimination under both scenarios reveals that ratification of the Supplemental Agreement would have increased U. S. imports of Organic

TABLE XI

ESTIMATED PRICE AND TRADE EFFECTS OF U.S. TARIFF REMOVAL ON THE U.S. IMPORT MARKET: SECOND SCENARIO

| SITC | t (%) | $\frac{dP'}{P+T}$ (%) | $\frac{dP}{P}$ (%) | $\frac{dM}{M}$ (%) | $dV_M$ (million $) | $dV_M^*$ (million $) |
|---|---|---|---|---|---|---|
| 512 | 11.0 | -5.2 | 5.3 | 5.9 | 58.595 | 121.835 |
| 5121 | 6.7 | -3.2 | 3.3 | 3.7 | --- | --- |
| 5122 | 14.4 | -6.6 | 6.8 | 7.6 | --- | --- |
| 5123 | 14.3 | -6.6 | 6.8 | 7.5 | --- | --- |
| 5124 | 12.3 | -5.7 | 5.9 | 6.5 | --- | --- |
| 5125 | 9.2 | -4.4 | 4.4 | 5.0 | --- | --- |
| 5126 | 14.1 | -6.5 | 6.7 | 7.4 | --- | --- |
| 5127 | 14.9 | -6.9 | 7.0 | 7.8 | --- | --- |
| 5128 | 10.6 | -5.0 | 5.1 | 5.7 | --- | --- |
| 5129 | 5.4 | -2.6 | 2.7 | 3.0 | --- | --- |
| 513 | 4.5 | -2.5 | 1.9 | 2.8 | 16.545 | 36.408 |
| 5131 | 5.2 | -2.8 | 2.2 | 3.2 | --- | --- |
| 5132 | 4.4 | -2.4 | 1.9 | 2.8 | 1.598 | 3.516 |
| 5133 | 5.0 | -2.7 | 2.1 | 3.1 | 0.891 | 1.963 |
| 5134 | 4.5 | -2.5 | 1.9 | 2.8 | --- | --- |
| 5135 | 7.7 | -4.2 | 3.2 | 4.7 | 4.320 | 9.525 |
| 5136 | 3.3 | -1.8 | 1.4 | 2.1 | 8.607 | 18.993 |
| 514 | 6.0 | -4.1 | 1.7 | 4.6 | 4.995 | 12.322 |
| 5141 | 6.5 | -4.4 | 1.8 | 5.0 | --- | --- |
| 5142 | 5.9 | -4.0 | 1.7 | 4.6 | --- | --- |
| 5143 | 6.0 | -4.1 | 1.7 | 4.6 | --- | --- |
| 5149 | 5.7 | -3.9 | 1.6 | 4.4 | --- | --- |
| 515 | 3.0 | -1.8 | 1.1 | 4.0 | 5.664 | 14.569 |
| 5151 | 0.0 | -0.0 | 0.0 | 0.0 | --- | --- |
| 5152 | 5.2 | -3.2 | 1.9 | 6.8 | --- | --- |
| 5153 | 9.9 | -5.9 | 3.5 | 12.6 | --- | --- |
| 521 | 2.8 | -1.6 | 1.1 | 3.5 | 0.369 | 0.932 |
| 5211 | 0.0 | -0.0 | 0.0 | 0.0 | 0.000 | 0.000 |
| 5213 | 4.5 | -2.6 | 1.8 | 5.5 | --- | --- |
| 5214 | 3.0 | -1.7 | 1.2 | 3.7 | 0.343 | 0.863 |
| 531 | 26.5 | -20.1 | 1.1 | 60.9 | 65.108 | 193.038 |
| 5310 | | | | | | |

---Necessary data not available.

TABLE XI (Continued)

| SITC | t (%) | $\frac{dP'}{P+T}$ (%) | $\frac{dP}{P}$ (%) | $\frac{dM}{M}$ (%) | $dV_M$ (million $) | $dV_M^*$ (million $) |
|---|---|---|---|---|---|---|
| 532 | 4.6 | -3.8 | 0.7 | 11.4 | 1.193 | 3.442 |
| 5321 | 9.0 | -7.1 | 1.3 | 21.5 | --- | --- |
| 5323 | 9.2 | -7.2 | 1.3 | 21.9 | --- | --- |
| 5324 | 2.3 | -1.9 | 0.3 | 5.8 | 0.533 | 1.546 |
| 5325 | 6.9 | -5.5 | 1.0 | 16.8 | --- | --- |
| 533 | 11.0 | -4.0 | 6.5 | 12.2 | 3.097 | 7.226 |
| 5331 | 7.4 | -2.7 | 4.4 | 8.3 | 0.794 | 1.848 |
| 5332 | 4.8 | -1.8 | 2.9 | 5.4 | 0.252 | 0.583 |
| 5333 | 13.1 | -4.8 | 7.7 | 14.4 | 1.584 | 3.702 |
| 541 | 9.3 | -5.8 | 3.0 | 6.3 | 14.137 | 33.472 |
| 5411 | 6.2 | -3.9 | 2.0 | 4.3 | 1.819 | 4.317 |
| 5413 | 8.5 | -5.3 | 2.7 | 5.8 | 2.609 | 6.200 |
| 5414 | 9.8 | -6.1 | 3.1 | 6.6 | 2.032 | 4.823 |
| 5415 | 8.2 | -5.1 | 2.6 | 5.6 | 2.739 | 6.511 |
| 5416 | 2.6 | -1.7 | 0.9 | 1.8 | 0.306 | 0.715 |
| 5417 | 11.0 | -6.8 | 3.5 | 7.4 | 1.625 | 3.855 |
| 5419 | 11.2 | -6.9 | 3.6 | 7.5 | 0.189 | 0.448 |
| 551 | 5.4 | -3.0 | 2.2 | 2.9 | 3.752 | 8.058 |
| 5511 | 2.4 | -1.4 | 1.0 | 1.3 | 1.133 | 2.419 |
| 5512 | 10.3 | -5.6 | 4.1 | 5.4 | 2.303 | 4.966 |
| 553 | 8.8 | -4.6 | 3.8 | 4.5 | 2.285 | 4.805 |
| 5530 | | | | | | |
| 554 | 8.4 | -5.4 | 2.6 | 5.2 | 1.115 | 2.615 |
| 5541 | 6.3 | -4.1 | 2.0 | 4.0 | 0.198 | 0.464 |
| 5542 | 8.6 | -5.5 | 2.6 | 5.3 | 0.748 | 1.760 |
| 5543 | 9.2 | -5.8 | 2.8 | 5.7 | 0.129 | 0.304 |
| 561 | 0.7 | -0.5 | 0.2 | 1.0 | 2.785 | 7.427 |
| 5611 | 1.8 | -1.2 | 0.6 | 2.5 | 1.798 | 4.702 |
| 5612 | 0.0 | -0.0 | 0.0 | 0.0 | 0.000 | 0.000 |
| 5613 | 0.0 | -0.0 | 0.0 | 0.0 | 0.000 | 0.000 |
| 5619 | 1.3 | -0.9 | 0.4 | 1.8 | 1.027 | 2.709 |

TABLE XI (Continued)

| SITC | t (%) | $\frac{dP'}{P+T}$ (%) | $\frac{dP}{P}$ (%) | $\frac{dM}{M}$ (%) | $dV_M$ (million $) | $dV_M^*$ (million $) |
|---|---|---|---|---|---|---|
| 571 | 9.3 | -5.1 | 3.8 | 4.9 | 1.871 | 4.013 |
| 5711 | 6.7 | -3.7 | 2.7 | 3.6 | 0.267 | 0.575 |
| 5712 | 3.6 | -2.0 | 1.5 | 2.0 | 0.052 | 0.112 |
| 5713 | 14.8 | -7.8 | 5.8 | 7.6 | 1.236 | 2.673 |
| 5714 | 10.1 | -5.5 | 4.1 | 5.3 | 0.624 | 1.339 |
| 581 | 10.9 | -6.7 | 3.5 | 10.5 | 25.374 | 63.761 |
| 5811 | 11.4 | -7.0 | 3.6 | 10.9 | --- | --- |
| 5812 | 11.0 | -6.7 | 3.5 | 10.6 | --- | --- |
| 5813 | 10.1 | -6.2 | 3.2 | 9.8 | 1.615 | 4.067 |
| 5819 | 7.9 | -4.9 | 2.6 | 7.7 | 0.166 | 0.416 |
| 599 | 7.5 | -3.4 | 3.8 | 7.3 | 15.883 | 37.040 |
| 5992 | 5.8 | -2.7 | 3.0 | 5.7 | 2.261 | 5.254 |
| 5995 | 6.4 | -2.9 | 3.3 | 6.3 | 7.822 | 18.203 |
| 5996 | 5.7 | -2.6 | 2.9 | 5.6 | 0.263 | 0.612 |
| 5997 | 10.6 | -4.7 | 5.4 | 10.2 | 1.051 | 2.450 |
| 5999 | 7.6 | -3.4 | 3.9 | 7.4 | 2.876 | 6.693 |

TABLE XII

ESTIMATED PRICE AND TRADE EFFECTS OF FOREIGN TARIFF REMOVAL ON THE U.S. EXPORT MARKET: SECOND SCENARIO

| SITC | t** (%) | $\frac{dP}{P}$ (%) | $\frac{dX}{X}$ (%) | $dV_X$ (million $) | $dV_X^*$ (million $) |
|---|---|---|---|---|---|
| 512 | 12.5 | 9.4 | 5.8 | 173.212 | 313.209 |
| 5121 | 11.1 | 8.3 | 5.1 | --- | --- |
| 5122 | 12.8 | 9.6 | 5.9 | --- | --- |
| 5123 | 15.4 | 11.5 | 7.1 | --- | --- |
| 5124 | 13.3 | 9.9 | 6.2 | --- | --- |
| 5125 | 12.7 | 9.5 | 5.9 | --- | --- |
| 5126 | 13.7 | 10.2 | 6.3 | --- | --- |
| 5127 | 13.6 | 10.2 | 6.3 | --- | --- |
| 5128 | 11.9 | 8.9 | 5.5 | --- | --- |
| 5129 | 10.9 | 8.2 | 5.1 | --- | --- |
| 513 | 8.2 | 6.1 | 10.3 | 44.892 | 102.600 |
| 5131 | 6.6 | 4.9 | 8.4 | 0.782 | 1.781 |
| 5132 | 5.8 | 4.4 | 7.4 | 5.170 | 11.767 |
| 5133 | 8.9 | 6.7 | 11.2 | 3.683 | 8.425 |
| 5134 | 8.1 | 6.1 | 10.2 | 0.414 | 0.945 |
| 5135 | 9.4 | 7.0 | 11.8 | 3.008 | 6.878 |
| 5136 | 8.8 | 6.6 | 11.1 | 32.392 | 74.037 |
| 514 | 8.9 | 7.7 | 5.1 | 20.192 | 36.992 |
| 5141 | 8.2 | 7.1 | 4.7 | --- | --- |
| 5142 | 9.7 | 8.4 | 5.6 | --- | --- |
| 5143 | 8.3 | 7.2 | 4.8 | --- | --- |
| 5149 | 8.8 | 7.6 | 5.1 | --- | --- |
| 515 | 2.8 | 2.2 | 3.4 | 10.217 | 22.815 |
| 5151 | 0.9 | 0.7 | 1.1 | 2.028 | 4.524 |
| 5152 | 8.7 | 6.6 | 10.4 | 3.381 | 7.622 |
| 5153 | 6.3 | 4.8 | 7.6 | 6.360 | 14.293 |
| 521 | 4.2 | 3.3 | 2.1 | 1.670 | 2.990 |
| 5211 | 0.9 | 0.7 | 0.4 | 0.002 | 0.004 |
| 5213 | 5.7 | 4.4 | 2.8 | 0.001 | 0.003 |
| 5214 | 4.5 | 3.5 | 2.2 | 1.777 | 3.171 |
| 531 | 11.1 | 10.9 | 66.7 | 45.188 | 124.005 |
| 5310 | | | | | |

---Necessary data not available

TABLE XII (Continued)

| SITC | t** (%) | $\frac{dP}{P}$ (%) | $\frac{dX}{X}$ (%) | $dV_X$ (million $) | $dV_X$* (million $) |
|---|---|---|---|---|---|
| 532 | 5.8 | 5.3 | 38.6 | 1.662 | 4.600 |
| 5321 | 3.9 | 3.6 | 26.0 | 0.341 | 0.943 |
| 5323 | 8.6 | 7.9 | 57.1 | 1.236 | 3.428 |
| 5324 | 4.9 | 4.5 | 32.6 | --- | --- |
| 5325 | 8.1 | 7.5 | 53.8 | --- | --- |
| 533 | 10.8 | 8.3 | 4.3 | 12.966 | 22.360 |
| 5331 | 11.1 | 8.5 | 4.4 | 2.132 | 3.670 |
| 5332 | 11.5 | 8.8 | 4.6 | 1.423 | 2.455 |
| 5333 | 10.6 | 8.1 | 4.2 | 9.377 | 16.114 |
| 541 | 11.3 | 9.7 | 3.6 | 64.645 | 102.031 |
| 5411 | 10.0 | 8.6 | 3.2 | 1.199 | 1.889 |
| 5413 | 11.0 | 9.4 | 3.5 | 18.053 | 28.504 |
| 5414 | 9.5 | 8.1 | 3.1 | 0.328 | 0.521 |
| 5415 | 10.1 | 8.6 | 3.3 | 3.906 | 6.207 |
| 5416 | 7.4 | 6.4 | 2.4 | 5.132 | 8.059 |
| 5417 | 12.6 | 10.7 | 4.0 | 27.461 | 43.524 |
| 5419 | 11.5 | 9.8 | 3.7 | 5.674 | 9.000 |
| 551 | 8.7 | 6.7 | 8.3 | 9.313 | 19.919 |
| 5511 | 8.0 | 6.2 | 7.6 | 5.230 | 11.144 |
| 5512 | 9.7 | 7.5 | 9.2 | 4.040 | 8.635 |
| 553 | 13.4 | 11.1 | 6.8 | 7.812 | 14.143 |
| 5530 | | | | | |
| 554 | 12.6 | 11.0 | 1.8 | 12.147 | 15.880 |
| 5541 | 13.4 | 11.7 | 1.9 | 1.022 | 1.335 |
| 5542 | 12.8 | 11.1 | 1.8 | 10.067 | 13.136 |
| 5543 | 10.6 | 9.3 | 1.5 | 1.010 | 1.312 |
| 561 | 3.7 | 3.2 | 5.8 | 27.413 | 63.139 |
| 5611 | 7.7 | 6.6 | 12.1 | 9.097 | 21.134 |
| 5612 | 3.0 | 2.6 | 4.7 | 3.894 | 8.954 |
| 5613 | 1.2 | 1.0 | 1.9 | 1.323 | 3.063 |
| 5619 | 5.3 | 4.5 | 8.3 | 20.285 | 46.996 |
| 571 | 11.3 | 9.1 | 7.3 | 4.779 | 9.238 |
| 5711 | 10.4 | 8.4 | 6.8 | 0.992 | 1.919 |
| 5712 | 14.4 | 11.5 | 9.3 | 1.049 | 2.044 |
| 5713 | 11.2 | 9.0 | 7.3 | 1.034 | 2.004 |
| 5714 | 11.1 | 8.9 | 7.2 | 1.811 | 3.508 |

TABLE XII (Continued)

| SITC | t** (%) | $\frac{dP}{P}$ (%) | $\frac{dX}{X}$ (%) | $dV_X$ (million $) | $dV_X$* (million $) |
|---|---|---|---|---|---|
| 581 | 13.9 | 11.6 | 5.5 | 123.528 | 208.990 |
| 5811 | 14.3 | 11.9 | 5.7 | 38.700 | 65.720 |
| 5812 | 14.4 | 12.0 | 5.7 | 64.070 | 108.557 |
| 5813 | 10.9 | 9.1 | 4.3 | 13.532 | 22.732 |
| 5819 | 9.3 | 7.8 | 3.7 | 4.478 | 7.507 |
| 599 | 8.0 | 6.0 | 3.8 | 55.788 | 100.610 |
| 5992 | 8.3 | 6.2 | 3.9 | 9.995 | 17.998 |
| 5995 | 10.1 | 7.5 | 4.8 | 4.322 | 7.847 |
| 5996 | 5.1 | 3.8 | 2.4 | 4.010 | 7.185 |
| 5997 | 10.2 | 7.6 | 4.8 | 22.795 | 41.239 |
| 5999 | 6.9 | 5.2 | 3.3 | 15.890 | 28.618 |

TABLE XIII

ESTIMATED VALUE OF TRADE EFFECTS OF
THE SUPPLEMENTAL AGREEMENT

| SITC | $dV_M$ (million $) | $dV_M$* (million $) | $dV_X$ (million $) | $dV_X$* (million $) |
|---|---|---|---|---|
| 512 | 2.148 | 4.407 | 49.945 | 91.077 |
| 5121 | --- | --- | --- | --- |
| 5122 | --- | --- | --- | --- |
| 5123 | --- | --- | --- | --- |
| 5124 | --- | --- | --- | --- |
| 5125 | --- | --- | --- | --- |
| 5126 | --- | --- | --- | --- |
| 5127 | --- | --- | --- | --- |
| 5128 | --- | --- | --- | --- |
| 5129 | --- | --- | --- | --- |
| 513 | 0.712 | 1.441 | 10.062 | 23.275 |
| 5131 | --- | --- | 0.140 | 0.322 |
| 5132 | 0.103 | 0.242 | 1.540 | 3.537 |
| 5133 | 0.034 | 0.070 | 1.097 | 2.525 |
| 5134 | --- | --- | 0.110 | 0.252 |
| 5135 | 0.112 | 0.227 | 0.684 | 1.587 |
| 5136 | 0.247 | 0.742 | 7.225 | 14.674 |
| 514 | 0.162 | 0.328 | 4.302 | 7.873 |
| 5141 | --- | --- | --- | --- |
| 5142 | --- | --- | --- | --- |
| 5143 | --- | --- | --- | --- |
| 5149 | --- | --- | --- | --- |
| 515 | 0.112 | 0.334 | 2.527 | 5.543 |
| 5151 | --- | --- | 0.674 | 1.587 |
| 5152 | --- | --- | 0.908 | 2.071 |
| 5153 | --- | --- | 1.526 | 3.474 |
| 521 | 0.000 | 0.000 | 0.374 | 0.668 |
| 5211 | 0.000 | 0.000 | 0.001 | 0.002 |
| 5213 | --- | --- | 0.000 | 0.001 |
| 5214 | 0.000 | 0.000 | 0.415 | 0.739 |
| 531 | 5.624 | 16.663 | 5.226 | 14.437 |
| 5310 | --- | --- | --- | --- |
| 532 | 0.129 | 0.368 | 0.411 | 1.144 |
| 5321 | --- | --- | 0.097 | 0.270 |
| 5323 | --- | --- | 0.330 | 0.921 |
| 5324 | 0.044 | 0.131 | --- | --- |
| 5325 | --- | --- | --- | --- |

--- Necessary data not available.

TABLE XIII (Continued)

| SITC | $dV_M$ (million $) | $dV_M^*$ (million $) | $dV_X$ (million $) | $dV_X^*$ (million $) |
|---|---|---|---|---|
| 533 | 0.343 | 0.808 | 3.477 | 6.083 |
| 5331 | 0.083 | 0.201 | 0.647 | 1.134 |
| 5332 | 0.025 | 0.056 | 0.348 | 0.611 |
| 5333 | 0.164 | 0.385 | 2.384 | 4.119 |
| 541 | 0.000 | 0.000 | 14.865 | 23.759 |
| 5411 | 0.000 | 0.000 | 0.320 | 0.503 |
| 5413 | 0.000 | 0.000 | 4.420 | 6.976 |
| 5414 | 0.000 | 0.000 | 0.051 | 0.167 |
| 5415 | 0.000 | 0.000 | 1.034 | 1.697 |
| 5416 | 0.000 | 0.000 | 1.594 | 2.485 |
| 5417 | 0.000 | 0.000 | 4.781 | 7.809 |
| 5419 | 0.000 | 0.000 | 1.374 | 2.058 |
| 551 | 0.223 | 0.524 | 1.979 | 4.262 |
| 5511 | 0.099 | 0.200 | 0.935 | 1.996 |
| 5512 | 0.174 | 0.378 | 0.947 | 2.052 |
| 553 | 0.168 | 0.343 | 1.486 | 2.791 |
| 5530 | | | | |
| 554 | 0.072 | 0.162 | 2.403 | 3.082 |
| 5541 | 0.020 | 0.047 | 0.213 | 0.284 |
| 5542 | 0.039 | 0.097 | 1.819 | 2.373 |
| 5543 | 0.009 | 0.022 | 0.236 | 0.301 |
| 561 | 0.000 | 0.000 | 16.583 | 37.813 |
| 5611 | 0.000 | 0.000 | 7.119 | 16.598 |
| 5612 | 0.000 | 0.000 | 1.026 | 2.344 |
| 5613 | 0.000 | 0.000 | 0.914 | 2.109 |
| 5619 | 0.000 | 0.000 | 7.742 | 17.991 |
| 571 | 0.066 | 0.113 | 0.514 | 0.977 |
| 5711 | 0.005 | 0.013 | 0.242 | 0.473 |
| 5712 | 0.002 | 0.005 | 0.313 | 0.623 |
| 5713 | 0.028 | 0.068 | 0.274 | 0.542 |
| 5714 | 0.021 | 0.035 | 0.000 | 0.000 |

TABLE XIII (Continued)

| SITC | $dV_M$ (million $) | $dV_M^*$ (million $) | $dV_X$ (million $) | $dV_X^*$ (million $) |
|---|---|---|---|---|
| 581 | 0.000 | 0.000 | 29.641 | 48.414 |
| 5811 | --- | --- | 10.262 | 17.816 |
| 5812 | --- | --- | 14.169 | 24.334 |
| 5813 | 0.000 | 0.000 | 2.891 | 4.944 |
| 5819 | 0.000 | 0.000 | 0.992 | 1.685 |
| 599 | 0.439 | 1.039 | 9.282 | 16.712 |
| 5992 | 0.079 | 0.187 | 2.316 | 4.245 |
| 5995 | 0.332 | 0.836 | 0.360 | 0.673 |
| 5996 | 0.004 | 0.009 | 0.916 | 1.599 |
| 5997 | 0.035 | 0.079 | 5.821 | 10.676 |
| 5999 | 0.078 | 0.185 | 1.900 | 3.509 |

chemicals (SITC 512) by $2.148 million in the short-run and $4.407 million in the long-run.[10]

For the export market, tariffs range from 10.9 percent for Other organic chemicals (5129) to 15.4 percent for Ethers, epoxides, acetals (5123). These subgroups had in the first scenario average foreign tariffs equal to 8.5 percent and 11.2 percent, respectively. The increase in the U. S. prices of the exported commodities as a result of tariff elimination is 8.2 percent for Other organic chemicals (5129) and is 11.5 percent for Ethers, epoxides, acetals (5123). This latter price increase compares to an 8.4 percent increase under the first scenario. For the group Organic chemicals in aggregate (SITC 512), the results of this study indicate that ratification of the Supplemental Agreement would have increased, in the short-run, U. S. exports by $49.945 million.[11]

The U. S. import market for Inorganic chemicals: elements, oxides and halogen salts (SITC 513) without the Supplemental Agreement having been implemented contains tariffs which range from 3.3 percent to 7.7 percent for Other inorganic bases and metallic oxides (5136) and metallic oxides, of kinds principally used in paints (5135), respectively. The group's average tariff exceeds that of the first scenario by 0.2 percentage points. The price and import trade effects are greater by 0.1 of a percentage point on average.

Using Metallic oxides, of kinds principally used in paints (5135) as an example, the elimination of tariffs on U. S. imports which result from the Kennedy Round without implementation of the separate ASP package would increase U. S. imports in the short-run by $4.320 million. Elimination of tariffs in effect with implementation of the ASP package would

increase U. S. imports by $4.208 million. Thus, ratification of the ASP package would have increased U. S. imports by $0.112 million. In the export market for Metallic oxides, of kinds principally used in paints (5135), the results indicate that ratification would increase exports by $0.684 million.

The foreign tariffs of the second scenario range from 5.8 percent for Chemical elements, n. e. s. to 9.4 percent for Metallic oxides, of kinds principally used in paints (5135). The comparable tariffs for the first scenario are 4.1 percent to 7.3 percent. On average for the group Inorganic chemicals: elements, oxides and halogen salts (SITC 513), the tariffs of the second scenario exceed those assuming ratification by 1.8 percentage points.

The range of U. S. tariffs on imports of Other inorganic chemicals (SITC 514) extends from 5.7 percent on Inorganic chemical products, n. e. s. (5149) to 6.5 percent on Metallic salts and peroxysalts of inorganic acids (5141), each of which are 0.2 of a percentage point above the extremities of the alternative assumption. The price decreases in the U. S. price of the imports are estimated to be 3.9 percent for Inorganic chemical products, n. e. s. (5149) and 4.4 percent for Metallic salts and peroxysalts of inorganic acids (5141), whereas the duty-free prices are predicted to increase by 1.6 percent and 1.8 percent, respectively. Under the alternative assumption these duty-free price increases are 1.5 percent and 1.8 percent, respectively. The percentage change in the quantity of imports averages for Other inorganic chemicals (SITC 514) 0.1 of a percentage point greater in the second scenario. Comparison of the predicted changes for the short-run in the value of imports from tariff elimination indicates that ratification of the ASP package would increase imports into the U. S. by $0.162 million for

Other inorganic chemicals (SITC 514). This same comparison applied to the export market shows that ratification of the ASP package would increase exports of Other inorganic chemicals (SITC 514) from the U. S. by $4.302 million.

Exports of Other inorganic chemicals (SITC 514) under the second scenario face foreign tariffs which range from an average of 8.2 percent for Metallic salts and peroxysalts of inorganic acids (5141) to 9.7 percent for Other metallic salts and peroxysalts of inorganic acids (I) (5142). Had the Supplemental Agreement become effective, these respective foreign tariff averages would be 6.1 percent and 7.8 percent. Removal of the 8.2 percent tariff on Metallic salts and peroxysalts of inorganic acids (5141) would increase both the U. S. price of that subgroup's products by 7.1 percent and the quantity of exports by 4.7 percent. These effects correspond, respectively, to 5.3 percent and 3.5 percent in the first scenario.

U. S. imports of Radioactive and associated materials (SITC 515) face an average tariff of 3.0 percent which reflects a tariff variation from nil for Radioactive chemical elements and isotopes and their compounds and mixtures (5151) to 9.9 percent for Compounds and mixtures, n. e. s. of thorium, of uranium, of rare earth metals, of yttrium or of scandium (5153) at the four-digit level. The average tariff in the preceding section for Radioactive and associated materials (SITC 515) is 2.9 percent. Elimination of the high tariff on Compounds and mixtures, n. e. s. of thorium, of uranium, of rare earth metals, of yttrium, or of scandium (5153), 9.9 percent, would decrease the U. S. price of such products by 5.9 percent and increase imports by 12.6 percent of their initial quantity. The lack of approval of the separate

agreement on chemicals caused foreign tariffs on U. S. exports of this group to be 0.7 of a percentage point greater on average. The foreign tariff range of the second scenario is from 0.9 percent for the subgroup Radioactive chemical elements and isotopes and their compounds and mixtures (5151) to 8.7 percent for the subgroup Stable isotopes and their compounds (5152), which compares to 0.6 percent and 6.4 percent in the alternative assumption previously discussed.

In the case of Mineral tar and crude chemicals from coal, petroleum, and natural gas (SITC 521), the data indicate that the approval of the Supplemental Agreement on chemicals does not alter the average U. S. tariff on imports. Hence, the effects are the same in both scenarios. In the export market, however, the Supplemental Agreement would result in tariff reductions abroad from 4.2 percent to the 3.3 percent of the first scenario. The highest tariff for the group under the second scenario is on Ammoniacal gas liquors and spent oxide produced in coal gas purification (5213) which incurs a 5.7 percent rate. That tariff's removal would increase its U. S. price by 4.4 percent and increase U. S. exports 2.8 percent in terms of quantity.

Comparison of the results at the aggregated three-digit level reveals that approval of the Supplemental Agreement by Congress would not change, in the case of Mineral tar and crude chemicals from coal, petroleum, and natural gas (SITC 521), U. S. imports and would increase U. S. exports by $0.374 million. In the case of Synthetic organic dyestuffs, natural indigo and color lakes (SITC 531), U. S. imports would increase by $5.624 million and exports by $5.226 million.

The tariffs on U. S. imports of Dyeing and tanning extracts, and synthetic tanning materials (SITC 532) range from 2.3 percent on Tanning

extracts of vegetable origin (5324) to 9.2 percent on Synthetic tanning materials (5323). In the previous discussion which assumed approval of the ASP package this range extends from 2.1 percent to 8.2 percent. It is estimated that free trade would decrease U. S. prices by 1.9 percent for Tanning extracts of vegetable origin (5324) and by 7.2 percent for Synthetic tanning materials (5323). The corresponding increases in the quantity of imports are 5.8 percent and 21.9 percent.

The average tariffs incurred by U. S. exports of Dyeing and tanning extracts, and synthetic tanning materials (SITC 532) vary from 3.9 percent on Dyeing extracts (vegetable and animal) (5321) to 8.6 percent on Synthetic tanning materials (5323) under the current assumptions, compared to 2.8 percent and 6.4 percent under the previous alternative. Their elimination would increase U. S. prices of these products 3.6 percent and 7.9 percent on Dyeing extracts (vegetable and animal) (5321) and Synthetic tanning materials (5323), respectively, and increase their respective quantities of U. S. exports by 26.0 percent and 57.1 percent.

Comparison of the estimates of the short-run changes in the value of trade for Dyeing and tanning extracts, and synthetic tanning materials (SITC 532) indicates that ratification of the Supplemental Agreement would increase for the United States imports by $0.129 million and exports by $0.411 million. For SITC 533 the comparison reveals that ratification would increase U. S. imports by $0.343 million and U. S. exports by $3.477 million.

The tariffs existing without ratification are, in the U. S. import market for Pigments, paints, varnishes and related materials (SITC 533), 7.4 percent on Coloring materials n.e.s. (5331), 4.8 percent on Printing inks (5332), and 13.1 percent on Prepared paints, enamels, lacquers, varnishes, artists' colors, siccatives (paint driers) and mastics (5333),

and, correspondingly in the export market, 11.1 percent, 11.5 percent and 10.6 percent. The average tariffs for the group exceed those of the first scenario by 1.2 percentage points in the import market and by 2.9 percentage points in the export market.

The Supplemental Agreement does not alter the U. S. tariff averages on Medicinal and pharmaceutical products (SITC 541) and the effects of their elimination remains as discussed in the previous section. The foreign tariffs on U. S. exports of Medicinal and Pharmaceutical products (SITC 541) are greater on average by 2.5 percentage points as a result of the non-ratification of the separate agreement. The higher range of the second scenario extends from 7.4 percent on Glycosides; glands and their extracts; sera; vaccines (5416) to 12.6 percent on Medicaments (5417). The estimated price increases from the tariff elimination and consequent increased foreign demand are 6.4 percent for Glycosides; glands and their extracts; sera; vaccines (5416) to 12.6 percent on Medicaments (5417). The corresponding increases in the quantity of exports are 2.4 percent and 4.0 percent, respectively. Ratification of the Supplemental Agreement would increase U. S. exports by $1.594 million for Glycosides; glands and their extracts; sera; vaccines (5416) and $4.781 million for Medicaments (5417), respectively. For Medicinal and pharmaceutical products (SITC 541) as a whole, the value of U. S. exports from ratification totals $14.865 million.

Under the second scenario, U. S. tariffs are 2.4 percent for Essential oils and resinoids (5511) and 10.3 percent for Synthetic perfume and flavor materials and concentrates and enfleurage greases and mixtures of alcohol and Essential oils (5512) which can be compared to 2.2 percent and 9.5 percent, respectively, following ratification. In

the export market, the tariff averages are 8.0 percent and 9.7 percent, respectively, which correspond to post-ratification averages of 6.6 percent and 7.5 percent.

Ratification of the Supplemental Agreement would increase in the short-run U. S. imports of Essential oils and resinoids (5511) by $0.099 million and U. S. exports by $0.935 million. U. S. trade of Synthetic perfume and flavor materials and concentrates, and enfleurage greases and mixtures of alcohol and Essential oils (5512) would experience a short-run increase of $0.174 million of imports and $0.947 million of exports.

Perfumery and cosmetics, dentifrices and other toilet preparations (except Soaps) (SITC 553) contains no disaggregated subgroups at the four-digit level. Ratification of the Supplemental Agreement would result in $0.168 million worth and $1.486 million worth of increased imports and exports, respectively.

In the case of Soaps, cleansing and polishing preparations (SITC 554), non-ratification results in tariffs on U. S. imports which average 0.6 of a percentage point greater than those effected by ratification and which range from 6.3 percent for Soaps (5541) to 9.2 percent for Polishes, pastes, powder and similar preparations for polishing and preserving leather, wood, metal, glass and other materials (5543). Foreign tariffs of the second scenario on U. S. exports average 2.5 percentage points greater; the foreign tariffs on Soaps (5541) average 13.4 percent and on Polishes, pastes, powder and similar preparations for polishing and preserving leather, wood, metal, glass and other materials (5543) average 10.6 percent.

Elimination of the 8.6 percent U. S. tariff on 5542, which issues

from the Kennedy Round without approval of the separate ASP package, causes a 5.5 percent fall in the U. S. price and a 2.6 percent increase in the duty-free price. The quantity of imports would increase by 5.3 percent. Elimination of foreign tariffs on Surface-acting agents and washing preparations (5542), which average 12.8 percent under the second scenario, would increase the U. S. price by 11.1 percent and increase the quantity of exports by 1.8 percent. The percentage figures for the U. S. trade effect are deceptive; multilateral movement to free trade from the post-Kennedy Round rates of the second scenario would yield a short-run increase in imports of $0.748 million and in exports of $10.067 million for the U. S.

Estimation of the effects of approval of the separate ASP package on Soaps, cleansing and polishing preparations (SITC 554) as a whole, indicate that ratification would beget increased U. S. imports valued at $0.072 million and increased U. S. exports of $2.403 million. In the case of Fertilizers, manufactured (SITC 561), the data indicate that the average of U. S. tariffs is not altered by the ratification assumed under the first scenario. The foreign tariffs averaged 2.2 percentage points greater under the second scenario. Thus, ratification would not alter U. S. imports and would increase U. S. exports, by reducing foreign tariffs 2.2 percentage points, $16.583 million.

The U. S. tariffs on Explosives and pyrotechnic products (SITC 571) range from 3.6 percent on Fuses, primers and detonators (5712) to 14.8 percent on Pyrotechnical articles (5713) and average for the group 0.3 of a percentage point greater than those of the first scenario. The foreign tariffs on the corresponding subgroups average 14.4 percent and 11.2 percent. The post-Kennedy Round foreign tariff average without

ratification is 11.3 percent for the group as a whole compared to the group average of 10.1 percent of the first scenario.

Ratification of the Supplemental Agreement would reduce tariff averages in the U. S. and abroad from those of the second scenario to those of the first. It would increase U. S. imports of Fuses, primers and detonators (5712) by $0.002 million and of Pyrotechnical articles (5713) by $0.028 million; and it would increase U. S. exports by $0.313 million and $0.274 million, respectively.

Inaction upon the separate ASP package left intact negotiated tariffs on Plastic materials, regenerated cellulose and artificial resins (SITC 581) which vary from 7.9 percent to 11.4 percent on U. S. imports of Other artificial resins and plastic materials (5819) and Products of condensation, polycondensation and polyaddition (5811), respectively, and from 9.3 percent to 14.4 percent on U. S. exports of Other artificial resins and plastic materials (5819) and Products of polymerization and copolymerization (5812), respectively. Ratification would further reduce, in the case of U. S. exports, the foreign tariff averages to 7.3 percent on Other artificial resins and plastic materials (5819) and to 11.2 percent on Products of polymerization and copolymerization (5812). Hence, it is estimated for SITC 581 that ratification would increase U. S. exports by $29.641 million with no effect on U. S. imports.

For the final group, Chemical materials and products, n. e. s. (SITC 599), the second scenario indicates U. S. tariff averages which average 0.2 of a percentage point greater than those which issue from ratification and foreign tariff averages which are 1.3 percentage points greater than those of the first scenario. The U. S. tariffs of the second scenario range from 5.7 percent on Wood and resin-based

chemical products (5996) to 10.6 percent on Organic chemical products, n. e. s. (5997). The corresponding tariffs on U. S. exports which are 5.1 percent and 10.2 percent are also the extremities of the range of foreign tariffs. The ratification by the U. S. Congress of the Supplemental Agreement would increase U. S. imports and exports of Chemical materials and products, n. e. s. (SITC 599) by $0.439 million and $16.712 million, respectively.

Effects on the Balance of Trade -- A Summary

The entire set of price and trade results, which is presented and discussed in the preceding section, forms a massive quantity of numbers to be assimilated by the reader. Because the net effects on the balance of trade are of particular interest, the section will condense the entire set of results into a presentation of the net short-run trade balance effects for each scenario at the four-digit level. Each of the trade balance effects presented in Table XIV is the difference between the change in the value of exports ($dV_X$) and the change in the value of imports ($dV_M$) for the short-run which are separately presented in Tables IX and X for the first scenario and in Tables XI and XII for the second scenario. Table XIV also displays the 1972 value of imports and value of exports for each SITC category.

The data reveal that all but one of the three-digit SITC groups show a positive net trade balance effect, i. e., the increase in U. S. exports exceeds the increase in U. S. imports, in both scenarios. In the case of the first scenario, the positive trade balance effects range from $68.5 million for Plastic materials, regenerated cellulose and artificial resins (SITC 581) to $0.9 million for Mineral tar and crude chemicals from coal, petroleum and natural gas (SITC 521). The

TABLE XIV

U.S. VALUE OF EXPORTS AND IMPORTS, AND THE SHORT-RUN TRADE BALANCE EFFECTS (million $)

| SITC | $V_X$ (1972) | $V_M$, f.o.b. (1972) | $V_X - V_M$ (1972) | 1st Scenario $[dV_X - dV_M]$ | 2nd Scenario $[dV_X - dV_M]$ |
|---|---|---|---|---|---|
| 512 | 1102.711 | 508.960 | +593.751 | +66.820 | +114.617 |
| 5121 | --- | --- | --- | --- | --- |
| 5122 | --- | --- | --- | --- | --- |
| 5123 | --- | --- | --- | --- | --- |
| 5124 | --- | --- | --- | --- | --- |
| 5125 | --- | --- | --- | --- | --- |
| 5126 | --- | --- | --- | --- | --- |
| 5127 | --- | --- | --- | --- | --- |
| 5128 | --- | --- | --- | --- | --- |
| 5129 | --- | --- | --- | --- | --- |
| 513 | 262.089 | 348.079 | -85.990 | +18.997 | +28.347 |
| 5131 | 5.690 | --- | --- | --- | --- |
| 5132 | 42.899 | 33.617 | +9.282 | +2.135 | +3.572 |
| 5133 | 19.780 | 16.930 | +2.850 | +1.729 | +2.792 |
| 5134 | 2.447 | --- | --- | --- | --- |
| 5135 | 15.283 | 53.661 | -38.378 | -1.884 | -1.312 |
| 5136 | 175.990 | 243.871 | -67.881 | +16.807 | +23.785 |
| 514 | 152.054 | 78.310 | +73.744 | +11.057 | +15.197 |
| 5141 | --- | --- | --- | --- | --- |
| 5142 | --- | --- | --- | --- | --- |
| 5143 | --- | --- | --- | --- | --- |
| 5149 | --- | --- | --- | --- | --- |
| 515 | 181.332 | 110.104 | +71.228 | +2.138 | +4.553 |
| 5151 | 112.520 | --- | --- | --- | --- |
| 5152 | 19.054 | --- | --- | --- | --- |
| 5153 | 49.758 | --- | --- | --- | --- |
| 521 | 30.855 | 7.959 | +22.896 | +0.927 | +1.301 |
| 5211 | 0.203 | 1.018 | -0.815 | +0.001 | +0.002 |
| 5213 | 0.019 | --- | --- | --- | --- |
| 5214 | 30.633 | 6.941 | +23.692 | +1.019 | +1.434 |
| 531 | 53.229 | 103.890 | -50.661 | -19.522 | -19.920 |
| 5310 | | | | | |
| 532 | 3.615 | 9.794 | -6.179 | +0.187 | +0.469 |
| 5321 | 1.119 | --- | --- | --- | --- |

--- Necessary data not available.

TABLE XIV (Continued)

| SITC | $V_X$ (1972) | $V_M$, f.o.b. (1972) | $V_X - V_M$ (1972) | 1st Scenario $[dV_X - dV_M]$ | 2nd Scenario $[dV_X - dV_M]$ |
|---|---|---|---|---|---|
| 5323 | 1.779 | --- | --- | --- | --- |
| 5324 | --- | 8.712 | --- | --- | --- |
| 5325 | --- | --- | --- | --- | --- |
| 533 | 99.950 | 15.888 | +84.062 | +6.735 | +9.869 |
| 5331 | 15.991 | 6.079 | +9.912 | +0.774 | +1.338 |
| 5332 | 10.302 | 2.982 | +7.320 | +0.848 | +1.171 |
| 5333 | 73.657 | 6.827 | +66.830 | +5.573 | +7.793 |
| 541 | 473.516 | 148.983 | +324.533 | +35.643 | +50.508 |
| 5411 | 9.931 | 28.482 | -18.551 | -0.940 | -0.620 |
| 5413 | 136.467 | 30.139 | +106.328 | +11.024 | +15.444 |
| 5414 | 2.868 | 20.513 | -17.645 | -1.755 | -1.704 |
| 5415 | 32.074 | 32.823 | -0.749 | -0.133 | +1.167 |
| 5416 | 57.317 | 11.264 | +46.053 | +3.232 | +4.826 |
| 5417 | 181.470 | 14.559 | +166.911 | +21.055 | +25.836 |
| 5419 | 40.931 | 1.664 | +39.267 | +4.111 | +5.485 |
| 551 | 59.874 | 72.655 | -12.781 | +3.805 | +5.561 |
| 5511 | 36.643 | 48.969 | -12.326 | +3.261 | +4.097 |
| 5512 | 23.231 | 23.686 | -0.455 | +0.964 | +1.737 |
| 553 | 41.887 | 26.974 | +14.913 | +4.209 | +5.527 |
| 5530 | | | | | |
| 554 | 93.443 | 14.057 | +79.386 | +8.701 | +11.032 |
| 5541 | 7.390 | 3.260 | +4.130 | +0.631 | +0.824 |
| 5542 | 76.823 | 9.304 | +67.519 | +7.539 | +9.319 |
| 5543 | 9.230 | 1.493 | +7.737 | +0.654 | +0.881 |
| 561 | 298.435 | 231.664 | +66.771 | +8.045 | +24.413 |
| 5611 | 46.657 | 57.731 | -11.074 | +0.180 | +7.299 |
| 5612 | 52.465 | 11.077 | +41.388 | +2.868 | +3.894 |
| 5613 | 45.332 | 116.318 | -70.986 | +0.409 | +1.323 |
| 5619 | 153.981 | 46.538 | +107.443 | +11.516 | +19.258 |
| 571 | 28.000 | 21.058 | +6.942 | +2.460 | +2.908 |
| 5711 | 6.289 | 4.170 | +2.119 | +0.488 | +0.725 |
| 5712 | 4.796 | 1.470 | +3.326 | +0.686 | +0.997 |
| 5713 | 6.096 | 8.933 | -2.837 | -0.448 | -0.202 |
| 5714 | 10.819 | 6.485 | +4.334 | +1.208 | +1.624 |

TABLE XIV (Continued)

| SITC | $V_X$ (1972) | $V_M$, f.o.b. (1972) | $V_X - V_M$ (1972) | 1st Scenario $[dV_X - dV_M]$ | 2nd Scenario $[dV_X - dV_M]$ |
|---|---|---|---|---|---|
| 581 | 696.308 | 176.610 | +519.698 | +68.513 | +98.154 |
| 5811 | 211.762 | --- | --- | --- | --- |
| 5812 | 348.476 | --- | --- | --- | --- |
| 5813 | 98.091 | 12.127 | +85.964 | +9.026 | +11.917 |
| 5819 | 37.979 | 1.583 | +36.396 | +3.320 | +4.312 |
| 599 | 556.351 | 139.603 | +416.748 | +31.062 | +39.905 |
| 5992 | 96.633 | 25.491 | +71.142 | +5.497 | +7.734 |
| 5995 | 34.145 | 79.753 | -45.608 | -3.528 | -3.500 |
| 5996 | 63.733 | 3.031 | +60.702 | +2.835 | +3.747 |
| 5997 | 178.568 | 6.507 | +172.061 | +15.958 | +21.744 |
| 5999 | 183.272 | 24.821 | +158.451 | +11.192 | +13.014 |

exceptional three-digit group is Synthetic organic dyestuffs, natural indigo and color lakes (SITC 531) with a net trade balance effect of $-19.5 million for the first scenario.

## Labor Dislocation

The price and trade effects, which are discussed above, cause adjustments in the quantity of output by domestic producers. Output adjustments entail changes in the required quantities of the factors of production, for which labor is used as a proxy in this field. This portion of the text recounts the outcome of the analysis which estimates the labor dislocation caused by production adjustments to free trade.

As previously discussed, the analysis for each scenario (approval and non-ratification of the ASP package) focuses on two alternative treatments of the labor markets for each three-digit sector.[12] One assumes that the import and export markets are segregated to an extent that there is no special interaction between their respective labor adjustments. The second alternative assumes that chemical workers dislocated by import expansion are easily re-absorbed by export expansion and only the net labor effect is truly dislocated.

### Tariff Elimination for the First Scenario

#### Segregated Markets

The results for separate treatment of the import and export markets, assuming ratification of the Supplement Agreement on chemicals, are shown at the three-digit level of aggregation in Table XV. The analysis reveals that the removal of U. S. tariffs, which creates import expansion and consequent reduction in domestic output, causes for SITC 5 a total of 2944 jobs per year to be eliminated for the

TABLE XV

ESTIMATED TOTAL LOSS FROM LABOR DISPLACEMENT ASSUMING SEGREGATED MARKETS: FIRST SCENARIO

| SITC | Total Annual $\Delta L_M$ (# of Jobs) | Total Annual $\Delta L_X$ (# of Jobs) | VARIANT I | | VARIANT II | |
|---|---|---|---|---|---|---|
| | | | Annual $TLL_M$[a] (thous. $) | Annual $TLL_X$[b] (thous. $) | Annual $TLL_M$[c] (thous. $) | Annual $TLL_X$[d] (thous. $) |
| 512 | -489 | +672 | 1653.454 | 1136.584 | 3306.908 | 2272.231 |
| 513 | -136 | +265 | 391.587 | 381.667 | 783.173 | 763.018 |
| 514 | -125 | +191 | 383.416 | 293.051 | 766.832 | 585.860 |
| 515 | -71 | +61 | 208.069 | 89.419 | 416.138 | 178.764 |
| 521 | -3 | +5 | 9.232 | 7.696 | 18.463 | 15.386 |
| 531 | -1253 | +650 | 3855.796 | 1000.519 | 7711.591 | 2000.213 |
| 532[e] | --- | --- | --- | --- | --- | --- |
| 533 | -33 | +55 | 93.648 | 78.072 | 187.296 | 156.080 |
| 541 | -178 | +232 | 524.980 | 342.263 | 1049.959 | 684.243 |
| 551 | -12 | +24 | 35.053 | 35.068 | 70.107 | 70.107 |
| 553 | -12 | +25 | 32.149 | 33.503 | 64.299 | 66.978 |
| 554 | -10 | +16 | 31.157 | 24.936 | 62.314 | 49.851 |
| 561 | -38 | +96 | 92.374 | 116.731 | 184.748 | 233.366 |
| 571 | -78 | +128 | 217.455 | 178.498 | 434.910 | 356.849 |
| 581 | -277 | +378 | 831.959 | 567.888 | 1663.917 | 1135.308 |
| 599 & 532 | -229 | +334 | 630.014 | 459.632 | 1260.028 | 918.885 |

--- Necessary data not available

[a] Average Duration = 0.2423 years

[b] Average Duration = 0.1212 years

[c] Average Duration = 0.4846 years

[d] Average Duration = 0.2423 years

[e] Included with SITC 599

two-year adjustment period. The group with the largest number of workers dislocated is Synthetic organic dyestuffs, natural indigo and color lakes (SITC 531); the loss of 1253 jobs per year reflects the large estimated price change caused by the extremely high elasticity of import supply estimate. The second highest dislocation, 489 jobs per year, is the Organic chemicals (SITC 512). Under Variant I, which assumes the national average duration of unemployment holds, the number of dislocated workers in SITC groups 531 and 512 translates to an annual dollar loss of $3855.796 thousand and $1653.454 thousand, respectively.

Given that the labor markets are localized sufficiently to incur an above average unemployment duration, these losses would be even greater. The assumption of a duration of unemployment equal to twice the national average, i. e., Variant II, increases these losses to $7711.591 thousand and $3306.908 thousand, respectively.

The group which incurs the smallest dislocation is Mineral tar and crude chemicals from coal, petroleum and natural gas (SITC 521), which loses three jobs per year. The annual dollar equivalent of this loss, incorporating the duration of unemployment, is $9.232 thousand under Variant I and $18,463 thousand under Variant II.

The elimination of the foreign tariffs which result from the approval of both Kennedy Round packages increases the demand for U. S. exports. Production expansion to meet this demand creates jobs. It is estimated that for the chemical industry, SITC 5, the number of newly created jobs would total 3132 per year for the two-year adjustment period. The largest increase in the number of jobs is 672 jobs per year for two years in Organic chemicals (SITC 512). This increase requires, given a full employment economy, that other workers leave their

jobs to fill these positions. The duration of their frictional unemployment is less than the unemployment of workers dislocated in the import markets; the duration used in this study is one-half that used for the import markets. The annual cost of this dislocation created by expansion of U. S. exports of Organic chemicals (SITC 512) is $1136.584 thousand for Variant I and $2272.231 thousand for the localized labor market assumed in Variant II.

As in the import markets, the export market for Mineral tar and crude chemicals from coal, petroleum, and natural gas (SITC 521) has the smallest change in jobs; an increase equal to five jobs per year. The increase has an annual cost of $7.696 thousand assuming a large labor market (Variant I) and of $15.386 thousand given a localized labor market (Variant II).

Given a large labor market (Variant I), the totals of the total losses from labor dislocation for each three-digit group within SITC 5 are $8990.343 thousand for the import market and $4745.527 thousand for the export market. Given localized labor markets (Variant II), for which the double durations are assumed, the totals are twice those of Variant I.

Netted Markets

The alternative treatment of labor dislocation under the first scenario (approval of the Supplemental Agreement) is to evaluate the dislocation after combination of the job changes in the import and export markets. The results are shown in Table XVI.

The alternative treatment yields in 14 of the 16 SITC three-digit groups a net increase in jobs. These sectors are evaluated as export markets; that is, the job changes are regarded as causing only frictional unemployment with durations equal to 0.1212 years for a large,

TABLE XVI

ESTIMATED TOTAL LOSS FROM LABOR DISPLACEMENT
ASSUMING NETTED MARKETS: FIRST SCENARIO

| SITC | Annual $\Delta L_N$ (# of Jobs) | Avg. Total Lbr.Cost Per Employee | VARIANT I[a] Annual $TLL_N$ (thous. $) | VARIANT II[b] Annual $TLL_N$ (thous. $) |
|---|---|---|---|---|
| 512 | +183 | 13955.00 | 309.516 | 618.777 |
| 513 | +130 | 11883.26 | 187.233 | 374.311 |
| 514 | +66 | 12659.22 | 101.264 | 202.444 |
| 515 | -10 | 12094.73 | 29.305[c] | 58.611[c] |
| 521 | +2 | 12700.17 | 3.078 | 6.155 |
| 531 | -603 | 12700.17 | 1855.582[c] | 3711.165[c] |
| 532[d] | --- | --- | --- | --- |
| 533 | +22 | 11712.00 | 31.229 | 62.432 |
| 541 | +54 | 12172.20 | 79.665 | 159.263 |
| 551 | +11 | 12055.76 | 16.073 | 32.132 |
| 553 | +14 | 11057.04 | 18.761 | 37.508 |
| 554 | +6 | 12858.94 | 9.351 | 18.694 |
| 561 | +58 | 10032.61 | 70.525 | 140.992 |
| 571 | +50 | 11505.92 | 69.726 | 139.394 |
| 581 | +101 | 12395.63 | 151.737 | 303.349 |
| 599 & 532 | +104 | 11354.33 | 143.119 | 286.120 |

--- Necessary data not available.

[a] If $\Delta L_N > 0$, like Export Market and Average Duration = 0.1212 years; if $\Delta L_N < 0$, Average Duration = 0.2423 years.

[b] If $\Delta L_N > 0$, like Export Market and Average Duration = 0.2423 years; if $\Delta L_N < 0$, Average Duration = 0.4846 years.

[c] Treated like Import Market because $\Delta L_N < 0$ .

[d] Included with SITC 599.

mobile labor market (one-half the national average) and 0.2423 years for a localized labor market. The greatest net increase in jobs is in the sector, Organic chemicals (SITC 512) for which the annual net increase is estimated to be 183 jobs. The smallest increase for a three-digit SITC group equals two jobs per year for Mineral tar and crude chemicals from coal, petroleum, and natural gas (SITC 521).

Radioactive and associated materials (SITC 515) and Synthetic organic dyestuffs, natural indigo and color lakes (SITC 531) have negative net annual changes in jobs, equal to -10 and -603, respectively. Thus, they are treated as import markets, for which the duration of unemployment for Variant I is 0.2423 years and 0.4846 for Variant II. The sum of the net annual changes in the number of jobs for all 16 of the groups is +188.

The net annual change in jobs is converted to a dollar magnitude for each group. If the three-digit sector's net job change is positive, it is treated as an export market; if it is negative, the dollar magnitude is calculated using the longer unemployment durations of an import market. The assumption of a large, mobile labor market (Variant I) yields a range of estimated total losses from labor dislocation. The group least affected is Mineral tar and crude chemicals from coal, petroleum, and natural gas (SITC 521) whose annual loss is equal to $3.078 thousand. The group having the second largest loss, $309.516 thousand per year, is Organic chemicals (SITC 512). The high net job loss estimate for Synthetic organic dyestuffs, natural indigo and color lakes (SITC 531) in combination with the longer unemployment durations used for a net import market yield an estimate of $1855.582 thousand for the largest annual total loss from labor dislocation for any three-digit sector.

These estimated dislocation losses for each three-digit industry group combine for a total annual labor loss for each of the two years of the adjustment period of $3076.164 thousand. If localized labor markets prevail (Variant II) the losses, both disaggregated and total, are each doubled.

Tariff Elimination for the Second Scenario

The estimates of labor displacement caused by the elimination of the tariffs assumed in the second scenario reflect the same relationship to those estimates of the first scenario as exists between the tariffs of the two assumptions, i. e., they are either greater than or equal to those of the first scenario.

The results for separate treatment of the import and export markets, assuming that the Supplemental Agreement on chemicals was never ratified, are shown at the three-digit level of aggregation in Table XVII. The alternative treatment of labor dislocation under the second scenario evaluates the net dislocation subject to the assumption that displaced workers in the import markets are easily transferred to the expanded export markets. Thus, the analysis considers only the net effects in the labor markets. The labor market effects from the elimination of post-Kennedy Round tariffs without implementation of the Supplemental Agreement on Chemicals are presented in Table XVIII and are discussed here.

The positive net changes in the number of jobs from tariff elimination, given the assumptions of the second scenario, range from +3 for Mineral tar and crude chemicals from coal, petroleum, and natural gas (SITC 521) to +435 for Organic chemicals (SITC 512).

TABLE XVII

ESTIMATED TOTAL LOSS FROM LABOR DISPLACEMENT ASSUMING SEGREGATED MARKETS: SECOND SCENARIO

| SITC | Total Annual $\Delta L_M$ (# of Jobs) | Total Annual $\Delta L_X$ (# of Jobs) | VARIANT I | | VARIANT II | |
|---|---|---|---|---|---|---|
| | | | Annual $TLL_M$[a] (thous. $) | Annual $TLL_X$[b] (thous. $) | Annual $TLL_M$[c] (thous. $) | Annual $TLL_X$[d] (thous. $) |
| 512 | -508 | +943 | 1717.699 | 1594.939 | 3435.397 | 3188.563 |
| 513 | -141 | +337 | 405.983 | 485.365 | 811.967 | 970.329 |
| 514 | -132 | +241 | 404.887 | 369.766 | 809.775 | 739.226 |
| 515 | -71 | +83 | 208.069 | 121.668 | 416.138 | 243.236 |
| 521 | -3 | +6 | 9.232 | 9.236 | 18.463 | 18.464 |
| 531 | -1369 | +731 | 4212.757 | 1125.199 | 8425.514 | 2249.471 |
| 532[e] | --- | --- | --- | --- | --- | --- |
| 533 | -38 | +75 | 107.838 | 106.462 | 215.675 | 212.836 |
| 541 | -178 | +300 | 524.980 | 442.581 | 1049.959 | 884.797 |
| 551 | -13 | +30 | 37.974 | 43.835 | 75.949 | 87.633 |
| 553 | -12 | +31 | 32.149 | 41.544 | 64.299 | 83.053 |
| 554 | -10 | +20 | 31.157 | 31.170 | 62.314 | 62.314 |
| 561 | -38 | +255 | 92.374 | 310.068 | 184.748 | 619.880 |
| 571 | -81 | +144 | 225.819 | 200.810 | 451.637 | 401.455 |
| 581 | -277 | +487 | 831.959 | 731.645 | 1663.917 | 1462.685 |
| 599 & 532 | -236 | +400 | 649.272 | 550.458 | 1298.545 | 1100.462 |

--- Necessary data not available.

[a] Average Duration = 0.2423 years

[b] Average Duration = 0.1212 years

[c] Average Duration = 0.4846 years

[d] Average Duration = 0.2423 years

[e] Included with SITC 599

TABLE XVIII

ESTIMATED TOTAL LOSS FROM LABOR DISPLACEMENT
ASSUMING NETTED MARKETS: SECOND SCENARIO

| SITC | Annual $\Delta L_N$ (# of Jobs) | Avg. Total Lbr.Cost Per Employee | VARIANT I[a] Annual TLL (thous. $)$^N$ | VARIANT II[b] Annual TLL (thous. $)$^N$ |
|---|---|---|---|---|
| 512 | +435 | 13955.00 | 735.735 | 1471.470 |
| 513 | +196 | 11883.26 | 282.289 | 564.578 |
| 514 | +110 | 12659.22 | 168.773 | 337.545 |
| 515 | +12 | 12094.73 | 17.590 | 35.181 |
| 521 | +3 | 12700.17 | 4.618 | 9.236 |
| 531 | -638 | 12700.17 | 1963.286[c] | 3926.572[c] |
| 532[d] | --- | --- | --- | --- |
| 533 | +38 | 11712.00 | 53.941 | 107.882 |
| 541 | +122 | 12172.20 | 179.983 | 359.966 |
| 551 | +17 | 12055.76 | 24.840 | 49.679 |
| 553 | +18 | 11057.04 | 24.122 | 48.244 |
| 554 | +10 | 12858.94 | 15.585 | 31.170 |
| 561 | +218 | 10032.61 | 265.078 | 529.936 |
| 571 | +63 | 11505.92 | 87.855 | 175.709 |
| 581 | +210 | 12395.63 | 315.494 | 630.987 |
| 599 & 532 | +164 | 11354.33 | 225.688 | 451.375 |

--- Necessary data not available.

[a] If $\Delta L_N > 0$, like Export Market and Average Duration = 0.1212 years; if $\Delta L_N < 0$, Average Duration = 0.2423 years.

[b] If $\Delta L_N > 0$, like Export Market and Average Duration = 0.2423 years; if $\Delta L_N < 0$, Average Duration = 0.4846 years.

[c] Treated like Import Market because $\Delta L_N < 0$ .

[d] Included with SITC 599.

The estimates show that all but one of the subsectors experience net job creation as a result of multilateral tariff elimination. The sole sector with net job elimination, Synthetic organic dyestuffs, natural indigo, and color lakes (SITC 531) suffers an annual net loss of 638 jobs for the two-year adjustment period. Furthermore, the signs (+ or -) of the net changes in the number of jobs are the same as they are in Table XVI with the exception of Radioactive and associated materials (SITC 515). In the case of that subsector, tariff elimination following ratification results in a net loss of jobs, whereas elimination of post-Kennedy Round tariffs without the implementation of the Supplemental Agreement results in the net creation of jobs; this reflects the fact that the Supplemental Agreement would have no impact on the employment in the import market for Radioactive and associated materials (SITC 515) but would create 22 jobs in the export market.

Impact of the Supplemental Agreement

The preceding description for the second scenario obscures the interesting evaluation that can be made of the economic effects which approval of the Supplemental Agreement would have had on the labor markets. Such an evaluation can be obtained by comparing XVII, Estimated Total Losses from Labor Displacement -- Segregated Markets, to its counterpart of the first scenario which reflects post-Kennedy Round tariffs with ASP having been eliminated, i. e., Table XV, and by comparing Table XVIII, Estimated Total Losses from Labor Displacement -- Netted Markets, to its counterpart of the first scenario, Table XVI. The differences between the estimates of the two scenarios is a measurement of the impact on labor resultant from the ratification of the

Supplemental Agreement on chemicals.

Segregated Markets

The differences between the estimates of labor dislocation caused by tariff elimination for the second scenario and those for the first scenario, i. e., Table XVII less Table XV, are shown in Table XIX in the case of segregated import and export labor markets. The estimates reveal that, for the chemical industry (SITC 5), ratification of the Supplemental Agreement would have eliminated 163 jobs per year because of increased imports and would have created 951 jobs per year because of increased exports for each of the two years required for labor adjustments.

The import sector most severely hurt by ratification of the Supplemental Agreement would be Synthetic organic dyestuffs, natural indigo and color lakes (SITC 531) whose employment would be reduced by 116 jobs.[13] The second largest quantity of jobs eliminated is in the largest chemical subgroup, Organic chemicals (SITC 512) and equals 19 jobs per year for the two-year time horizon of the short-run. Next in the rank is the estimated seven jobs that would be eliminated annually in both Other inorganic chemicals (SITC 514) and the combined category of Dyeing and tanning extracts and synthetic tanning materials (SITC 532) and Chemical materials and products, n. e. s. (SITC 599).

The export markets, in which the reduced foreign tariffs from ratification would cause expansion, display estimates of the number of jobs created which extend from a low of one job per year in Mineral tar and

TABLE XIX

IMPACT OF THE SUPPLEMENTAL AGREEMENT ON
SEGREGATED LABOR MARKETS

| SITC | Total Annual $\Delta L_M$ (# of Jobs) | Total Annual $\Delta L_M$ (# of Jobs) | VARIANT I | | VARIANT II | |
|---|---|---|---|---|---|---|
| | | | Annual $TLL_M$ (thous. $) | Annual $TLL_X$ (thous. $) | Annual $TLL_M$ (thous. $) | Annual $TLL_X$ (thous. $) |
| 512 | -19 | +271 | 64.245 | 458.355 | 128.489 | 916.332 |
| 513 | -5 | +72 | 14.396 | 103.698 | 28.794 | 207.311 |
| 514 | -7 | +50 | 21.471 | 76.715 | 42.943 | 153.366 |
| 515 | 0 | +22 | 0.000 | 32.249 | 0.000 | 64.472 |
| 521 | 0 | +1 | 0.000 | 1.540 | 0.000 | 3.078 |
| 531 | -116 | +81 | 356.961 | 124.680 | 713.923 | 249.258 |
| 532[a] | --- | --- | --- | --- | --- | --- |
| 533 | -5 | +20 | 14.190 | 28.390 | 28.379 | 56.756 |
| 541 | 0 | +68 | 0.000 | 100.318 | 0.000 | 200.554 |
| 551 | -1 | +6 | 2.921 | 8.767 | 5.842 | 17.526 |
| 553 | 0 | +6 | 0.000 | 8.041 | 0.000 | 16.075 |
| 554 | 0 | +4 | 0.000 | 6.234 | 0.000 | 12.463 |
| 561 | 0 | +159 | 0.000 | 193.337 | 0.000 | 386.514 |
| 571 | -3 | +16 | 8.364 | 22.312 | 16.727 | 44.606 |
| 581 | 0 | +109 | 0.000 | 163.757 | 0.000 | 327.377 |
| 599 & 532 | -7 | +66 | 19.258 | 90.826 | 38.517 | 181.577 |
| Total for SITC 5 | -163 | +951 | 501.806 | 1419.219 | 1003.614 | 2837.265 |

--- Necessary data not available.

[a]Included with SITC 599.

crude chemicals from coal, petroleum, and natural gas (SITC 521) to a high of 271 jobs per year in Organic chemicals (SITC 521). The median sector is Other inorganic chemicals (SITC 514) for which the number of jobs created by export expansion equals 50 per year for two years.

The magnitudes of the annual loss to society caused by job changes in each export sector are $1.540 thousand for Mineral tar and crude chemicals from coal, petroleum, and natural gas (SITC 521) and $458.355 thousand for Organic chemicals (SITC 512).[14] In the case of Other inorganic chemicals (SITC 514), which had the median number of newly created jobs, the estimated loss from such frictional unemployment in a full-employment economy is $76.715 thousand as a result of implementation of the ASP package. The total loss from the export markets of the chemical industry, SITC 5, is $1419.219 thousand.

Unemployment created in the import markets of the chemical industry produce a total annual loss of $501.806 thousand, assuming the shorter durations of a large labor market (Variant I). The comparison of disaggregated results of each scenario yields estimates of the job displacement losses to society from the ASP package. The losses in the import markets range from $356.961 thousand for Synthetic organic dyestuffs, natural indigo and color lakes (SITC 531) and $64.245 thousand for Organic chemicals (SITC 512) to zero in sectors unaffected by the provisions of the ASP package.

Netted Markets

Focusing upon Table XX, which shows the differences between Table XVIII and Table XVI, the estimates indicate that implementation of the Supplemental Agreement would have resulted in a net increase in jobs in all sectors except Synthetic organic dyestuffs, natural indigo and color lakes (SITC 531), whose annual net job loss equals 35. The net increases vary from 252 jobs per year for Organic chemicals (SITC 512) to 1 job per year for Mineral tar and crude chemicals from coal, petroleum, and natural gas (SITC 521). Overall, the net effect of ratification on the chemical industry would have been 790 jobs created per year for the two-year adjustment period. Given a full-employment economy, the job changes in the chemical industry would create an annual loss to society from frictional unemployment, assuming a large labor market, which totals $1332.677 thousand.

## Estimated Changes in Social Welfare

### Introduction

The impact of free trade on the social welfare derives from many factors: the changes in consumers' and producers' surpluses, the elimination of tariff revenue, and the social cost of transitional job dislocations. In addition these effects are flows through time. Therefore, the quantification of these flows is influenced by the time horizon and the discount rate appropriate to the analysis.

The procedure is to estimate for each three-digit group the traditional welfare effects (excluding the labor market) for both the short-run and long-run in the two types of markets. Then for each time

TABLE XX

IMPACT OF THE SUPPLEMENTAL AGREEMENT ON NETTED LABOR MARKETS

| SITC | Annual $\Delta L_N$ (# of Jobs) | VARIANT I Annual $TLL_N$ (thous. $) | VARIANT II Annual $TLL_N$ (thous. $) |
|---|---|---|---|
| 512 | +252 | 426.219 | 852.693 |
| 513 | +66 | 95.056 | 190.267 |
| 514 | +44 | 67.509 | 135.101 |
| 515 | +22 | 32.249 | 64.472 |
| 521 | +1 | 1.540 | 3.081 |
| 531 | -35 | 107.704 | 215.407 |
| 532[a] | -- | --- | --- |
| 533 | +16 | 22.712 | 45.450 |
| 541 | +68 | 100.318 | 200.703 |
| 551 | +6 | 8.767 | 17.547 |
| 553 | +4 | 5.361 | 10.736 |
| 554 | +4 | 6.234 | 12.476 |
| 561 | +160 | 194.553 | 388.944 |
| 571 | +13 | 18.129 | 36.315 |
| 581 | +109 | 163.757 | 327.638 |
| 599 & 532 | +60 | 82.569 | 165.255 |
| Total for SITC 5 | +790 | 1332.677 | 2666.085 |

--- Necessary data not available.

[a]Included with SITC 599.

horizon the welfare effects of the import and export markets are combined and, in the case of the short-run (assumed to be two years), the loss caused by labor dislocation is subtracted from the traditional welfare gain. Thus, the flow of welfare effects over the five-year time horizon is composed of the net short-run welfare effect, which includes labor dislocation, for the first two years and the long-run welfare effect for the remaining three years.

The social welfare effects are estimated for each of the two scenarios of this study. Within each scenario, two sets of estimates are presented: the large labor market alternative (Variant I) and the localized market alternative which has an above average unemployment duration (Variant II). In addition, for each set of estimates, the present values of the welfare flows are calculated using, first, an assumed discount rate of 10 percent and, second, a rate of 5 percent. The lower discount rate is equivalent to a 10 percent market rate of discount partially offset by a 5 percent rate of growth, as discussed previously.

## The Present Values of the Estimated Flows of Net Social Welfare Effects

The estimated effects on social welfare from elimination of post-Kennedy Round tariff rates are presented in Table XXI, which assumes implementation of the Supplemental Agreement on chemicals, and in Table XXII, which assumes non-ratification of the separate ASP package.

The welfare gains from free trade in the chemical industry total $880.450 million for a five-year period; this estimate is conditioned upon the assumptions of implementation of the Supplemental Agreement, a large labor market with average durations of unemployment (Variant I),

TABLE XXI

EFFECTS ON SOCIAL WELFARE: FIRST SCENARIO
(Present Values of 5 Year Flows)

| SITC | VARIANT I d = 10% (million $) | VARIANT I d = 5% (million $) | VARIANT II d = 10% (million $) | VARIANT II d = 5% (million $) |
|---|---|---|---|---|
| 512 | 199.561 | 228.530 | 199.023 | 227.953 |
| 513 | 28.578 | 32.817 | 28.254 | 32.469 |
| 514 | 32.293 | 36.958 | 32.117 | 36.770 |
| 515 | 6.956 | 7.967 | 6.904 | 7.912 |
| 521 | 2.772 | 3.169 | 2.767 | 3.163 |
| 531 | 76.640 | 89.754 | 73.421 | 86.305 |
| 532[a] | --- | --- | --- | --- |
| 533 | 20.601 | 23.564 | 20.547 | 23.507 |
| 541 | 123.857 | 141.664 | 123.720 | 141.517 |
| 551 | 7.264 | 8.331 | 7.237 | 8.302 |
| 553 | 11.872 | 13.594 | 11.841 | 13.561 |
| 554 | 30.495 | 34.848 | 30.477 | 34.830 |
| 561 | 12.058 | 13.791 | 11.935 | 13.659 |
| 571 | 6.404 | 7.348 | 6.285 | 7.220 |
| 581 | 229.944 | 263.138 | 229.682 | 262.857 |
| 599 & 532 | 91.155 | 104.288 | 90.907 | 104.022 |

--- Necessary data not available.

[a]Included with SITC 599.

TABLE XXII

EFFECTS ON SOCIAL WELFARE: SECOND SCENARIO
(Present Values of 5 Year Flows)

| SITC | VARIANT I d = 10% (million $) | VARIANT I d = 5% (million $) | VARIANT II d = 10% (million $) | VARIANT II d = 5% (million $) |
|---|---|---|---|---|
| 512 | 318.790 | 365.130 | 317.514 | 363.764 |
| 513 | 43.027 | 49.413 | 42.536 | 48.887 |
| 514 | 42.195 | 48.303 | 41.904 | 47.991 |
| 515 | 11.072 | 12.673 | 11.042 | 12.642 |
| 521 | 3.604 | 4.120 | 3.597 | 4.113 |
| 531 | 93.038 | 108.949 | 89.509 | 105.298 |
| 532[a] | --- | --- | --- | --- |
| 533 | 29.168 | 33.374 | 29.074 | 33.273 |
| 541 | 165.837 | 189.704 | 165.525 | 189.370 |
| 551 | 10.678 | 12.248 | 10.635 | 12.201 |
| 553 | 15.172 | 17.376 | 15.130 | 17.332 |
| 554 | 38.459 | 43.954 | 38.433 | 43.926 |
| 561 | 36.257 | 41.512 | 35.797 | 41.019 |
| 571 | 7.443 | 8.542 | 7.291 | 8.378 |
| 581 | 305.318 | 349.462 | 304.769 | 348.874 |
| 599 & 532 | 113.494 | 129.867 | 113.104 | 129.449 |

--- Necessary data not available.

[a]Included with SITC 599.

and a discount rate of 10 percent.[15] Given these same three assumptions, elimination of tariffs on products of Plastic materials, regenerated cellulose and artificial resins (SITC 581) would yield a gain to society equal to $229.944 million, which is greater than any other three-digit chemical group. Society would benefit the least from trade liberalization of Mineral tar and crude chemicals from coal, petroleum and natural gas (SITC 521), for which the potential gain is estimated to equal $2.772 million.

The incorporation of a 5 percent annual growth rate reduces the effective discount rate from 10 percent to 5 percent. This single alteration in the set of assumptions increases the total of the welfare gains for chemicals to $1009.761 million. Likewise, the welfare gains for individual groups extend from $263.138 million for Plastic materials, regenerated cellulose and artificial resins (SITC 581) to $3.169 million for Mineral tar and crude chemicals from coal, petroleum, and natural gas (SITC 521).

Allowance for localized labor markets by doubling the average duration of unemployment (Variant II) has a relatively small effect on the predictions concerning social welfare over the five-year time horizon. Given the ratification of the Supplemental Agreement, a 5 percent discount rate and localized labor markets, the welfare gain for Plastic materials, regenerated cellulose and artificial resins (SITC 581) is $262.857 million and for Mineral tar and crude chemicals from coal, petroleum, and natural gas (SITC 521) equals $3.163 million. For the chemical industry as a whole, allowance for localized labor markets, under the given assumptions, decreases the welfare gain from free trade by $5.714 million to a total of $1004.047 million.

Without implementation of the Supplemental Agreement, the post-Kennedy Round tariff rates exceed those of the first scenario. Therefore, their elimination yields social benefits which exceed those of the preceding discussion. Assuming a large labor market (Variant I) and a 10 percent discount rate, the estimated welfare effects in the chemical industry total $1237.177 million under the second scenario.[16] This figure exceeds the comparable total of the first scenario by $356.727 million and is the sum of estimated welfare gains which extend from $318.790 million for Organic chemicals (SITC 512) to $3.604 million for Mineral tar and crude chemicals from coal, petroleum, and natural gas (SITC 521).

The corresponding estimates discounted instead at a 5 percent rate are $1416.703 million, $465.130 million, and $4.120 million for the industry total, group high (Plastic materials, regenerated cellulose and artificial resins (SITC 581)), and group low (Mineral tar and crude chemicals from coal, petroleum, and natural gas (SITC 521)), respectively.

Under Variant II of the second scenario, i. e., small labor markets without ratification, the elimination of tariffs would increase social welfare over a five year time period by $317.514 million in the Organic chemicals group (SITC 512) and by $3.597 for Mineral tar and crude chemicals from coal, petroleum and natural gas (SITC 521), using a 10 percent discount rate.

## The Components of the Welfare Effects

Although the net welfare effect is the relevant measure of society's overall well-being, it is of interest to look at the

distribution of the components of the welfare effect among the sectors of society. In this study, the net welfare effect is composed of the changes in producers' surplus, consumers' surplus, government tariff revenue (for the import market only), and the social cost of labor dislocation. These separate welfare components are computed at the three-digit SITC level under two selected sets of assumptions: (1) tariff elimination under the second scenario; integration of the labor effects of the import and export markets within each sector; a large mobile labor market with shorter unemployment durations, i. e., labor Variant I; and a discount rate of 5 percent; and (2) ratification of the Supplemental Agreement on Chemicals; labor market integration; labor Variant I; and a 5 percent discount rate.

The former set of estimates, presented in Table XXIII, includes the loss of producers' surplus, the gain of consumers' surplus, and the loss of tariff revenue for the import market; the gain of producers' surplus and the loss of consumers' surplus in the export market; and the social cost of the net labor dislocation. For each of these, where applicable, the short-run annual value, the long-run annual value, and the present value of their flows over the time horizon are displayed. For each of these welfare components, the industry total of the discounted SITC group results also is shown.

The aggregated results reveal that, because of import expansion at lower prices resulting from free trade, the producers' sector would lose a total of $9145.553 million, the consumers' sector would gain a total benefit flow of $9662.063 million, and the government would lose $713.094 million, all discounted over the five-year time horizon. For the export market with increased exports at higher prices, the present

TABLE XXIII

THE COMPONENTS OF THE WELFARE EFFECT: SECOND SCENARIO, LABOR VARIANT I, d = 5% (million $)

| SITC | | Import Market | | | Export Market | | Labor Mkt. |
|---|---|---|---|---|---|---|---|
| | | Producers' Surplus | Consumers' Surplus | Tariff Revenue | Producers' Surplus | Consumers' Surplus | $TLL_N$ |
| 512 | Short-Run | -330.324 | 359.858 | ••• | 703.887 | -597.221 | -0.736 |
| | Long-Run | -329.224 | 360.457 | -56.352 | 708.109 | -595.422 | ••• |
| | Present Value | -1427.421 | 1559.485 | -243.976 | 3057.908 | -2581.225 | -1.369 |
| 513 | Short-Run | -47.451 | 57.049 | ••• | 132.545 | -115.735 | -0.282 |
| | Long-Run | -47.282 | 57.150 | -15.707 | 133.688 | -115.233 | ••• |
| | Present Value | -205.022 | 247.243 | -68.003 | 576.677 | -499.835 | -0.524 |
| 514 | Short-Run | -80.369 | 83.994 | ••• | 162.954 | -150.946 | -0.168 |
| | Long-Run | -80.260 | 84.049 | -4.735 | 163.368 | -150.760 | ••• |
| | Present Value | -347.688 | 362.107 | -20.500 | 706.532 | -653.061 | -0.312 |
| 515 | Short-Run | -7.438 | 9.494 | ••• | 13.161 | -9.103 | -0.017 |
| | Long-Run | -7.391 | 9.524 | -3.252 | 13.263 | -9.067 | ••• |
| | Present Value | -32.087 | 41.178 | -14.080 | 57.232 | -39.322 | -0.032 |
| 521 | Short-Run | -25.407 | 25.547 | ••• | 53.431 | -52.402 | -0.005 |
| | Long-Run | -25.404 | 25.549 | -0.218 | 53.445 | -52.395 | ••• |
| | Present Value | -109.992 | 110.611 | -0.944 | 231.364 | -226.857 | -0.009 |
| 531 | Short-Run | -125.489 | 153.775 | ••• | 77.442 | -69.700 | -1.963 |
| | Long-Run | -117.150 | 158.642 | -27.558 | 80.097 | -68.473 | ••• |
| | Present Value | -522.706 | 677.791 | -119.312 | 341.843 | -298.735 | -3.650 |

••• Not applicable

TABLE XXIII (Continued)

| SITC | | Import Market: Producers' Surplus | Import Market: Consumers' Surplus | Import Market: Tariff Revenue | Export Market: Producers' Surplus | Export Market: Consumers' Surplus | Labor Mkt. $TLL_N$ |
|---|---|---|---|---|---|---|---|
| 532 | Short-Run | -0.062 | 0.527 | ••• | 0.318 | -0.089 | --- |
| | Long-Run | -0.052 | 0.567 | -0.458 | 0.380 | -0.079 | ••• |
| | Present Value | -0.244 | 2.380 | -1.983 | 1.530 | -0.361 | --- |
| 533 | Short-Run | -186.952 | 187.673 | ••• | 396.390 | -387.915 | -0.054 |
| | Long-Run | -186.899 | 187.703 | -1.738 | 396.621 | -387.786 | ••• |
| | Present Value | -809.278 | 812.604 | -7.525 | 1716.741 | -1679.159 | -0.100 |
| 541 | Short-Run | -412.222 | 421.439 | ••• | 736.229 | -689.459 | -0.180 |
| | Long-Run | -411.839 | 421.634 | -13.914 | 737.370 | -688.924 | ••• |
| | Present Value | -1783.769 | 1825.102 | -60.241 | 3190.322 | -2983.858 | -0.335 |
| 551 | Short-Run | -48.030 | 50.304 | ••• | 111.439 | -107.262 | -0.025 |
| | Long-Run | -47.987 | 50.327 | -3.896 | 111.663 | -107.154 | ••• |
| | Present Value | -207.840 | 217.850 | -16.868 | 483.028 | -464.124 | -0.046 |
| 553 | Short-Run | -193.422 | 194.780 | ••• | 471.533 | -466.727 | -0.024 |
| | Long-Run | -193.386 | 194.798 | -2.375 | 471.742 | -466.623 | ••• |
| | Present Value | -837.332 | 843.344 | -10.282 | 2042.018 | -2020.437 | -0.045 |
| 554 | Short-Run | -274.027 | 274.880 | ••• | 568.576 | -558.204 | -0.016 |
| | Long-Run | -273.998 | 274.894 | -1.188 | 568.701 | -558.142 | ••• |
| | Present Value | -1186.328 | 1190.128 | -5.143 | 2461.958 | -2416.591 | -0.030 |

--- Necessary data not available

TABLE XXIII (Continued)

| SITC | | Import Market: Producers' Surplus | Import Market: Consumers' Surplus | Import Market: Tariff Revenue | Export Market: Producers' Surplus | Export Market: Consumers' Surplus | Labor Mkt. $TLL_N$ |
|---|---|---|---|---|---|---|---|
| 561 | Short-Run | -11.712 | 12.938 | ••• | 84.729 | -74.898 | -0.265 |
| | Long-Run | -11.704 | 12.942 | -1.630 | 85.119 | -74.725 | ••• |
| | Present Value | -50.687 | 56.025 | -7.057 | 367.798 | -323.843 | -0.493 |
| 571 | Short-Run | -12.446 | 13.610 | ••• | 24.853 | -22.211 | -0.088 |
| | Long-Run | -12.410 | 13.630 | -1.974 | 24.981 | -22.152 | ••• |
| | Present Value | -53.796 | 58.974 | -8.546 | 107.917 | -96.017 | -0.164 |
| 581 | Short-Run | -253.493 | 267.077 | ••• | 521.992 | -438.988 | -0.315 |
| | Long-Run | -252.609 | 267.542 | -19.304 | 525.131 | -437.662 | ••• |
| | Present Value | -1095.314 | 1157.458 | -83.577 | 2267.718 | -1897.323 | -0.586 |
| 599 | Short-Run | -110.094 | 115.363 | ••• | 228.324 | -194.306 | -0.224 |
| | Long-Run | -109.850 | 115.492 | -10.407 | 229.213 | -193.921 | ••• |
| | Present Value | -476.049 | 499.783 | -45.057 | 990.725 | -840.297 | -0.416 |
| 599 + 532 | Short-Run | -110.156 | 115.890 | ••• | 228.642 | -194.395 | -0.226 |
| | Long-Run | -109.902 | 116.059 | -10.865 | 229.593 | -194.000 | ••• |
| | Present Value | -476.293 | 502.163 | -47.040 | 992.555 | -840.657 | -0.420 |
| Total for SITC 5 of the discounted present values | | -9145.553 | 9662.063 | -713.094 | 18601.611 | -17021.044 | -8.115 |

value of the increase in producers' surplus totals $18,601.611 million while the consumers lose an estimated $17,021.044 million in benefits over a five-year period. The present value of the labor market effects, derived by netting out the domestic production effects in the import and export markets and assuming the relatively short unemployment durations of a large labor market, yield a total social cost of labor dislocation of $8.115 million over a two-year time horizon.

Combining the industry totals for the import, export, and labor markets, the net social welfare effect of tariff elimination under the second scenario is a net gain of $1375.868 million, which is composed of a net gain for producers of $9456.058 million, a net loss for consumers of $7358.981 million, a loss for the government of $713.094 million, and a social cost of labor dislocation of $8.115 million.[17]

The set of estimates derived from the second set of assumptions is presented in Table XXIV. The tabular format is identical to that of the table immediately preceding, described above. Aggregating the industry's group results which are at the three-digit SITC level, the component welfare effects of ratification of the Supplemental Agreement for the import market reveal a discounted loss of producers' surplus equal to $374.204 million, a gain of consumers' surplus equal to a present value of $403.095 million, and a discounted loss of tariff revenue of $31.333 million. In the expansion of the U. S. export market resulting from ratification of the ASP package, the totals of the present-value estimates are a producers' surplus gain of $4317.484 million and a loss of consumers' surplus equal to $3914.726 million. The social cost of the resultant net labor dislocation is $3.331 million.

The sum of all the component effects of the Supplemental

TABLE XXIV

THE COMPONENTS OF THE WELFARE EFFECT: SUPPLEMENTAL AGREEMENT, LABOR VARIANT I, d = 5%
(million $)

| SITC | | Import Market | | | Export Market | | Labor Mkt. |
|---|---|---|---|---|---|---|---|
| | | Producers' Surplus | Consumers' Surplus | Tariff Revenue | Producers' Surplus | Consumers' Surplus | $TLL_N$ |
| 512 | Short-Run | -12.684 | 13.851 | ••• | 202.613 | -171.358 | -0.426 |
| | Long-Run | -12.602 | 13.897 | -2.250 | 204.690 | -170.473 | ••• |
| | Present Value | -54.573 | 60.082 | -9.741 | 882.343 | -739.708 | -0.793 |
| 513 | Short-Run | -1.895 | 2.284 | ••• | 28.343 | -24.623 | -0.095 |
| | Long-Run | -1.881 | 2.292 | -0.728 | 28.778 | -24.432 | ••• |
| | Present Value | -8.170 | 9.908 | -3.152 | 123.785 | -106.133 | -0.177 |
| 514 | Short-Run | -3.918 | 4.098 | ••• | 33.895 | -31.350 | -0.067 |
| | Long-Run | -3.907 | 4.103 | -0.251 | 34.049 | -31.281 | ••• |
| | Present Value | -16.936 | 17.755 | -1.087 | 147.129 | -135.559 | -0.126 |
| 515 | Short-Run | -0.000 | 0.000 | ••• | 3.600 | -2.479 | -0.032 |
| | Long-Run | -0.000 | 0.000 | -0.002 | 3.647 | -2.462 | ••• |
| | Present Value | -0.000 | 0.000 | -0.009 | 15.702 | -10.691 | -0.060 |
| 521 | Short-Run | -0.000 | 0.000 | ••• | 11.335 | -11.115 | -0.002 |
| | Long-Run | -0.000 | 0.000 | -0.000 | 11.340 | -11.112 | ••• |
| | Present Value | -0.000 | 0.000 | -0.000 | 49.087 | -48.115 | -0.003 |

••• Not Applicable

TABLE XXIV (Continued)

| SITC | | Import Market | | | Export Market | | Labor Mkt. |
|---|---|---|---|---|---|---|---|
| | | Producers' Surplus | Consumers' Surplus | Tariff Revenue | Producers' Surplus | Consumers' Surplus | $TLL_N$ |
| 531 | Short-Run | -10.290 | 13.196 | ••• | 8.656 | -7.614 | -0.108 |
| | Long-Run | -8.940 | 13.983 | -2.873 | 9.208 | -7.358 | ••• |
| | Present Value | -41.216 | 59.076 | -12.439 | 38.840 | -32.332 | -0.200 |
| 532 | Short-Run | -0.006 | 0.058 | ••• | 0.078 | -0.019 | --- |
| | Long-Run | -0.004 | 0.066 | -0.053 | 0.102 | -0.015 | ••• |
| | Present Value | -0.021 | 0.271 | -0.229 | 0.397 | -0.072 | --- |
| 533 | Short-Run | -18.693 | 18.769 | ••• | 105.089 | -102.808 | -0.023 |
| | Long-Run | -18.683 | 18.774 | -0.188 | 105.196 | -102.749 | ••• |
| | Present Value | -80.907 | 81.273 | -0.814 | 455.247 | -444.961 | -0.042 |
| 541 | Short-Run | -0.000 | 0.000 | ••• | 167.080 | -156.325 | -0.100 |
| | Long-Run | -0.000 | 0.000 | -0.000 | 167.539 | -156.110 | ••• |
| | Present Value | -0.000 | 0.000 | -0.000 | 724.507 | -676.278 | -0.187 |
| 551 | Short-Run | -3.201 | 3.354 | ••• | 23.340 | -22.404 | -0.009 |
| | Long-Run | -3.195 | 3.357 | -0.234 | 23.388 | -22.364 | ••• |
| | Present Value | -13.844 | 14.528 | -1.013 | 101.169 | -96.899 | -0.016 |
| 553 | Short-Run | -12.613 | 12.703 | ••• | 84.977 | -84.087 | -0.005 |
| | Long-Run | -12.609 | 12.706 | -0.176 | 85.045 | -84.053 | ••• |
| | Present Value | -54.598 | 55.005 | -0.762 | 368.076 | -363.971 | -0.010 |

--- Necessary data not available

TABLE XXIV (Continued)

| SITC | | Import Market: Producers' Surplus | Import Market: Consumers' Surplus | Import Market: Tariff Revenue | Export Market: Producers' Surplus | Export Market: Consumers' Surplus | Labor Mkt. $TLL_N$ |
|---|---|---|---|---|---|---|---|
| 554 | Short-Run | -20.297 | 20.362 | ••• | 113.726 | -111.636 | -0.006 |
| | Long-Run | -20.293 | 20.364 | -0.093 | 113.771 | -111.614 | ••• |
| | Present Value | -87.866 | 88.162 | -0.403 | 492.488 | -483.274 | -0.012 |
| 561 | Short-Run | -0.000 | 0.000 | ••• | 53.001 | -46.791 | -0.195 |
| | Long-Run | -0.000 | 0.000 | -0.000 | 53.336 | -46.642 | ••• |
| | Present Value | -0.000 | 0.000 | -0.000 | 230.295 | -202.214 | -1.213 |
| 571 | Short-Run | -0.487 | 0.534 | ••• | 2.738 | -2.438 | -0.018 |
| | Long-Run | -0.486 | 0.536 | -0.091 | 2.764 | -2.425 | ••• |
| | Present Value | -2.106 | 2.317 | -0.394 | 11.918 | -10.523 | -0.034 |
| 581 | Short-Run | -0.000 | 0.000 | ••• | 117.271 | -98.279 | -0.164 |
| | Long-Run | -0.000 | 0.000 | -0.000 | 118.520 | -97.751 | ••• |
| | Present Value | -0.000 | 0.000 | -0.000 | 510.810 | -424.195 | -0.304 |
| 599 | Short-Run | -3.234 | 3.396 | ••• | 38.115 | -32.357 | -0.081 |
| | Long-Run | -3.220 | 3.402 | -0.298 | 38.387 | -32.240 | ••• |
| | Present Value | -13.967 | 14.718 | -1.290 | 165.691 | -139.801 | -0.151 |
| 599 + 532 | Short-Run | -3.240 | 3.454 | ••• | 38.193 | -32.376 | -0.083 |
| | Long-Run | -3.224 | 3.468 | -0.351 | 38.489 | -32.255 | ••• |
| | Present Value | -13.988 | 14.989 | -1.519 | 166.088 | -139.873 | -0.154 |
| Total for SITC 5 of the discounted present values | | -374.204 | 403.095 | -31.333 | 4317.484 | -3914.726 | -3.331 |

Agreement's ratification is a net social gain of $396.985 million of which the producers' sector reaps net benefits of $3943.280 million, the consumers' sector suffers a net loss of $3511.631 million, the government loses $31.333 million and the loss due to labor dislocation totals $3.331 million.

## Comparison of Results from Disaggregated Data and from Aggregate Data

This section compares the estimates of the trade effects obtained from the disaggregated three-digit SITC data used in this study to the trade effects estimated using aggregate data at the one-digit SITC level and apportioned among the three-digit SITC groups according to market shares. The estimates used for this comparison are those resulting from the elimination of the tariffs of the first scenario. The trade effects, i. e., the change in the value of imports and the change in the value of exports, from both estimation methods are displayed in Table XXV for both SITC 5, the chemical industry, and the three-digit groups contained within the chemical industry. In addition, the table shows for each group the ratio of the aggregate estimate to the disaggregated estimate in both the import and export markets.

These ratios demonstrate that the aggregate estimates and their apportionment do obscure much of the variation revealed by the disaggregated estimates. In the import market, the ratio of the aggregate to the sum of the disaggregated estimates for SITC 5 is approximately 1.6; whereas, for the three-digit product groups within the chemical industry, the ratios of aggregate to disaggregated import changes vary from 0.285 for Synthetic organic dyestuffs, natural indigo and color lakes (SITC 531) to 13.773 for Manufactured fertilizers (SITC 561). For

TABLE XXV

COMPARISON OF TRADE EFFECTS ESTIMATED FROM DISAGGREGATED DATA AND THOSE FROM AGGREGATE DATA: FIRST SCENARIO
(million $)

| SITC | Apportionment of Aggregate $dV_M$ | Disaggregated $dV_M$ | Ratio of Aggregate $dV_M$ / Disaggregated $dV_M$ | Apportionment of Aggregate $dV_X$ | Disaggregated $dV_X$ | Ratio of Aggregate $dV_X$ / Disaggregated $dV_X$ |
|---|---|---|---|---|---|---|
| 5 | 339.033 | 212.570 | 1.595 | 895.121 | 462.347 | 1.936 |
| 512 | 86.794 | 56.447 | 1.538 | 238.786 | 123.267 | 1.937 |
| 513 | 59.560 | 15.833 | 3.762 | 56.754 | 34.830 | 1.629 |
| 514 | 13.598 | 4.833 | 2.814 | 32.926 | 15.890 | 2.072 |
| 515 | 17.624 | 5.552 | 3.174 | 39.266 | 7.690 | 5.106 |
| 521 | 1.351 | 0.369 | 3.661 | 6.681 | 1.296 | 5.155 |
| 531 | 16.973 | 59.484 | 0.285 | 11.526 | 39.962 | 0.288 |
| 532 | 1.817 | 1.064 | 1.708 | 0.783 | 1.251 | 0.626 |
| 533 | 2.674 | 2.754 | 0.971 | 21.644 | 9.489 | 2.281 |
| 541 | 24.218 | 14.137 | 1.713 | 102.537 | 49.780 | 2.060 |
| 551 | 11.756 | 3.529 | 3.331 | 12.965 | 7.334 | 1.768 |
| 553 | 4.554 | 2.117 | 2.151 | 9.070 | 6.326 | 1.434 |
| 554 | 2.418 | 1.043 | 2.318 | 20.235 | 9.744 | 2.077 |
| 561 | 38.359 | 2.785 | 13.773 | 64.625 | 10.830 | 5.967 |
| 571 | 3.502 | 1.805 | 1.940 | 6.063 | 4.265 | 1.422 |
| 581 | 30.315 | 25.374 | 1.195 | 150.782 | 93.887 | 1.606 |
| 599 | 23.518 | 15.444 | 1.523 | 120.475 | 46.506 | 2.590 |

the estimated changes in exports, the aggregate-disaggregate ratios at the three-digit level range from 0.288 for Synthetic organic dyestuffs natural indigo and color lakes (SITC 531) to 5.967 for Manufactured fertilizers (SITC 561). The export market's ratio for the industry, SITC 5, is 1.936.

The comparison also reveals that, in general, the estimates obtained from aggregate data exceed the disaggregated estimates in both the import and the export markets. There are two groups within each market for which this is not true. In the import market, they are Synthetic organic dyestuffs, natural indigo and color lakes (SITC 531) and Pigments, paints, varnishes and related materials (SITC 533). In the export market, the exceptions and Synthetic organic dyestuffs, natural indigo, and color lakes (SITC 531) and Dyeing and tanning extracts, and synthetic tanning materials (SITC 532).

## Summary

This chapter presents the empirical results from the analysis. One of the hypothesized advantages of this study is that the analysis is conducted on the most disaggregated level feasible given the limitations imposed by the available data. As the survey of the literature in Chapter III revealed, previous studies have been limited to aggregate data. Hence, this chapter concludes with a comparison of the trade effects obtained from disaggregated data to those obtained by apportionment among the three-digit groups of the estimates from aggregate data. The comparison reveals that the aggregate estimates for the chemical industry exceed the sum of the disaggregated estimates for the industry. For the import market, the aggregate estimate is 59 percent larger than the import expansion estimate obtained from disaggregated data; for the export market, the aggregate data is 94 percent larger. Furthermore, the comparison demonstrates that, holding the difference in magnitude constant,

the apportionment of the aggregate estimates does distort the variation revealed by estimates obtained from the disaggregated data.

Although it is difficult to summarize the disaggregated estimates computed in this study, an attempt at formulating a condensation of the results seems warranted in view of the multitude of results displayed in the chapter. Since one of the purposes of this study is to proceed with an analysis of a disaggregated level, a summary in terms of averages and industry totals of the results is rather abhorrent. But averages and totals seem a necessity for a succinct description of the diverse results. The averages presented in this summary are simple, unweighted averages of the 16 three-digit SITC estimates. The usual warnings that averages conceal much variation and that unweighted averages yield biased figures apply to these summary averages.

The chapter begins with the presentation of the price elasticity estimates for each of the 16 three-digit SITC groups. For the U. S., these are supply and demand price elasticities for each group's import market, export market, and domestic market. For the other countries of this study, only import demand and export supply elasticities are estimated. The elasticities are derived from trade shares and independently estimated values of the elasticity of import demand. The unweighted average of the U. S. import demand elasticities for the three-digit SITC sectors is -1.73 and the average elasticity of import supply is 6.54.[18] For the export markets, the export demand elasticities average -29.90 and the average of the export supply elasticities is computed to be 1.57. Disregarding the two "suspect" sectors (SITC 531 and SITC 532), the averages become -1.54, 2.21, -3.82 and 0.85, respectively. In the domestic market, the unweighted averages for the industry are -0.17 for the domestic price elasticity of demand and 0.34

for the price elasticity of domestic supply.

The empirical estimates of the effects of free trade on the United States' chemical industry are derived in this study under two alternative scenarios. The first scenario assumes that both concession packages issued from the Kennedy Round of GATT became effective; that is, the first scenario eliminates post-Kennedy Round tariff duties which include ratification of the ASP package. The second scenario employs tariff rates which issue from only the so-called Kennedy Round concession package; hence, the additional concessions of the ASP package, which include elimination of ASP by the United States, are not reflected in the tariff rates of the second scenario. The economic impact of the Supplemental Agreement on Chemicals is measured by the differences between the estimates obtained under the two scenarios; the Congressional approval of the ASP package necessary for it to become effective was never received.

The chapter presents the price effects as well as the long- and short-run effects on trade quantities and values at both the four- and three-digit SITC levels. The price and trade effects cause production adjustments and, consequently, resource-use adjustments, in the domestic markets. Estimates of the resultant labor dislocation, which is used as a proxy for resource-use adjustment, are presented in the chapter for the three-digit SITC groups in terms of both the number of job changes and the social cost of such job changes.

The labor market effects are treated in two alternative ways in the study. One assumes that the import and export markets are without interaction and, in effect, are segregated. The second alternative assumes that labor dislocated by import expansion is quickly reabsorbed

in the same three-digit sector because of export expansion. Only the cost of this net labor effect is summarized here, although the results of both alternatives are fully presented in the chapter.

The changes in the import, export and labor markets caused by free trade have implications for the social welfare. The impact on social welfare derives from changes in consumers' and producers' surpluses, the elimination of tariff revenue and the social cost of transitional labor dislocation. Each of these effects is a flow through time and is, therefore, discounted assuming time horizons of a two-year short-run and a five-year long-run. The social welfare effects are presented in the chapter at the three-digit SITC level.

The first scenario has an average U. S. tariff of 7.6 percent on chemical imports. Its reduction to zero would reduce the U. S. price of the chemical imports by 4.6 percent on average, while foreign producers would find their chemical prices increased by 2.5 percent as a result of increased demand for their products. The foreign tariffs on U. S. chemical exports average, in the first scenario, 7.2 percent. Their elimination would increase the foreign demand for U. S. chemicals and increase U. S. prices by an average of 6.0 percent. In the short-run, the value of U. S. imports would increase by a total of $212.570 million while U. S. exports would increase by $462.347 million. Using long-run elasticities, the increases become, respectively, $524.433 million and $875.611 million.

Under the first scenario, the sum of the net annual changes in the number of jobs for the 16 groups over a two-year period is +188. Of the 16 SITC three-digit groups 14 show a net increase in jobs. The job changes to fill these net increases result in frictional unemployment

of relatively short duration, i. e., 0.1212 years if the labor market is large and mobile, and 0.2423 years for localized labor markets. The net job loss in the remaining two sectors is assumed to create unemployment of longer duration, specifically, twice as long. The total annual cost of the labor dislocation from free trade, assuming the first scenario, is estimated to be $3.076 million given a large, mobile larger market and twice that amount if localized labor markets prevail.

Given the tariffs of the first scenario, large labor markets, and a 5 percent discount rate, the social welfare gain for the U. S. from free trade totals $1009.761 million. Application of a 10 percent discount rate to the same social welfare flows, which assume large labor markets and tariffs of the first scenario, reduces the net welfare gain to $880.450 million. Allowance for localized labor markets with longer unemployment durations, given the tariffs of the first scenario and a 5 percent discount rate, yields a net welfare gain to the industry of $1004.047 million.

The second scenario with its assumption of the non-ratification of the Supplemental Agreement analyzes the effects of the elimination of a set of higher tariffs than those of the first set. Since Congress allowed the agreement to die, the second scenario is the "true" starting data if tariff elimination were effectuated today. The U. S. tariffs average 8.1 percent. Their elimination would decrease the U. S. price of imported chemicals by 4.9 percent while the average price received by foreign producers would increase 2.6 percent. The elimination of the tariffs faced by U. S. chemical exports to the rest-of-the-world, which average 9.2 percent, would increase U. S. prices by 7.6 percent on the average. The short-run increases in the U. S. imports and exports

resulting from the replacement of the present tariff barriers with free trade are $222.768 million and $615.424 million, respectively. Given time for complete adjustment, these increases in the value of trade would be $550.963 million of imports and $1163.521 million of exports.

For the second scenario, the sum of the net annual changes in the number of jobs for the 16 groups which would occur over a two-year period is +978. The resultant job changes would cost society an estimated $4.365 million if the labor markets were large and mobile. Assuming a large labor market and a 5 percent discount rate, the net social welfare gain for the U. S. resulting from the elimination of the higher tariffs of the second scenario totals $1416.703 million.

Comparison of the effects of tariff elimination assuming the tariff data of the first scenario to those resulting from the second scenario show that approval by Congress of the Supplemental Agreement on Chemicals, i. e., the ASP package, would have reduced the average foreign tariff on chemicals from 9.2 percent to 7.2 percent in response to a U. S. reduction from an 8.1 percent average to a 7.6 percent average. The difference between the estimated effects in the short-run on trade volume indicate that the ratification of the ASP package would have increased imports by $10.198 million and exports by $153.077 million. The difference between the estimated net social welfare effects indicates a gain of $406.942 million which includes the social cost of labor dislocation.

A remaining section of the chapter separates the net social welfare effects into the component parts: producers' surplus, consumers' surplus, tariff revenue, and labor dislocation. Assuming large, integrated labor markets and a 5 percent discount rate, the chapter presents, at

the three-digit SITC level, the component welfare effects for the impact of tariff elimination under the second scenario and for the impact of Congressional approval of the supplemental ASP agreement.

For the latter set of results, i. e., the impact of the ASP package, this study finds for the chemical industry that the present values of the welfare components for the import and export markets combined are: a net gain in producers' surplus of $3943.280 million, a net loss in the consumers' sector of $3511.631 million, a revenue loss for the government sector of $31.333 million, and a loss due to labor dislocation of $3.331 million; the sum of these component effects is a net social welfare gain due to the implementation of the ASP package of $396.985 million.

The components for the import market, disregarding export expansion and its consequences, reveal very different outcomes for producers' and consumers' surpluses. In the import market, there is a loss in producers' surplus of $374.204 million and a gain in consumers' surplus of $403.095 million.

## ENDNOTES

[1]The extremely large elasticities are a result of a chain of contributing factors, which can be demonstrated with reference to the elasticity equations in Chapter IV. The very large estimates of the elasticity of demand for U. S. exports result primarily from the very small share of world exports originating from the U. S., i. e., the export ratios in Equation 4.10 are relatively large. Additionally, the world import demand and the rest-of-the-world export supply elasticities are well above average. These high estimates reflect, in turn, the combination of somewhat large import demand, export supply, and domestic demand and supply elasticities and of relatively large import and export shares for the EEC.

[2]Mordechai E. Kreinin, "Price Elasticities in International Trade," Review of Economics and Statistics, 49 (1967), p. 515.

[3]Mordechai E. Kreinin, "Disaggregated Import Demand Functions--Further Results," Southern Economic Journal, 40 (1973), p. 24.

[4]Kreinin, using data from the 1955-56 GATT negotiations, compares changes in price and volume of imports of commodities with tariff rate reductions to immediate substitutes which had no reductions. He finds that "close to half of the benefit from tariff concessions granted by the United States accrued to foreign exporters in the form of increased export prices." Mordechai E. Kreinin, "Effect of Tariff Changes on the Prices and Volume of Imports," American Economic Review (1961), p. 317.

[5]The explanation for the long-run increases in the value of imports being less than three times those of the short-run rests on the fact that the percentage price changes are the same for either time horizon. This is demonstrated with Equation 3.4:

$$dV_M = V_M \left[ \left(\frac{dP}{P}\right) + \left(\frac{dM}{M}\right) + \left(\frac{dP}{P}\right)\left(\frac{dM}{M}\right) \right] .$$

Thus, for the long-run:

$$dV_M^* = V_M \left[ \left(\frac{dP}{P}\right) + \left(\frac{dM}{M}\right)^* + \left(\frac{dP}{P}\right)\left(\frac{dM}{M}\right)^* \right] ,$$

i. e.,

$$dV_M^* = V_M \left[ \left(\frac{dP}{P}\right) + 3\left(\frac{dM}{M}\right) + 3\left(\frac{dP}{P}\right)\left(\frac{dM}{M}\right) \right] < 3dV_M .$$

[6]As discussed in the preceding section, which describes the first scenario, the percentage increases in the quantity of imports are estimates for the short-run. The long-run estimates are three times those of the short-run. They are neither described in the text nor displayed in Table VI.

[7]SITC group 553 is not discussed here as it is composed of only 5530.

[8]Comparable data to estimate the probable increase in the value of imports are not available.

[9]That is, a discussion of the comparison of Table XI to Table IX for the import markets and of Table XII to Table X for the export markets.

[10]Comparable disaggregated data on the value of imports are not available.

[11]The considerable difference between the magnitudes of the effects in the import and export markets for Organic chemicals (SITC 512) reflects two factors. First, ratification of the Supplemental Agreement would have resulted in the reduction of U. S. tariffs by only 0.4 percentage points compared to a reduction in the composite foreign tariff of 3.6 percentage points. Furthermore, the U. S. tariff reduction is applicable to U. S. imports which total $509.0 million whereas U. S. 1972 exports total $1102.7 million.

[12]The discussion of the theoretical basis for the analysis of resource dislocation begins on page 43.

[13]This is the difference between the estimates of Table XVII and Table XV. The large magnitude reflects both the predominance in this sector of the ASP system of valuation and the large estimate of the decrease in the U. S. price of the imported commodity (which in itself reflects the large elasticity of import supply estimate).

[14]These results assume the shorter durations of unemployment of a larger labor market (Variant I).

[15]See the first column of Table XXI.

[16]See the first column of Table XXII.

[17]The net gain in social welfare obtained from the sum of the estimates of the component parts differs somewhat in magnitude from the net social welfare effect obtained from direct estimation. In this example, the net welfare gain from the component parts equals $1375.868 million compared to the $1373.115 million total gain resultant from the direct estimation (see Table XXII).

[18]It is of interest to compare the unweighted average of the import demand elasticities to the weighted averages; the weighted-by-world imports average of the U. S. import demand price elasticities is -1.54 and the weighted-by-U. S. imports average equals -1.53. The averages of this study's disaggregated import demand elasticities for the chemical industry either approximate or are less than the unadjusted estimates of the import demand elasticities for the chemical industry obtained by other studies, which indicates adjustment of the disaggregate elasticities by three standard errors is realistic. See Kreinin, "Price Elasticities in International Trade," p. 515; $\eta_M = -2.0$ and J. David Richardson, "The Response of Imports and Domestic Demand to Price, Tariff and Exchange Rate Changes: A Structural Estimation Study for Selected U. S. Manufactures," (unpublished paper, 1972), p. 27; $\eta_M = -1.70$.

# CHAPTER VI

## SUMMARY AND CONCLUSIONS

The debate between those espousing the gains from free trade and those concerned with protecting domestic industry has had a long history. Although international trade negotiations under the auspices of GATT have made much progress toward the goal of free trade, formidable problems remain for future negotiations of trade agreements. The present study has estimated the economic impact of trade liberalization for the United States chemical industry.

### Summary

This study began with a discussion of the chemical industry, the barriers incurred by internationally traded chemical products, and a history of U. S. participation in international trade negotiations. Thus, Chapter II established a frame of reference for the analysis of the study. The chapter found that the chemical industry is predominantly oligopolistic in structure and behavior. Additionally, the industry is extremely international in outlook. Chemicals comprise a sector of major significance in world trade as well as in the trade of each of the major industrial countries of the world.

The United States tariff structure on chemicals was the cause of heated controversy during the Kennedy Round of the GATT negotiations because of its American Selling Price system of customs valuation. ASP

for chemicals applies only to certain benzenoid chemicals; thus, although it has both tariff and non-tariff barrier effects, the value of trade affected is relatively small. Still, the discussion became polarized to such an extent that only separate treatment for the chemical sector and a "two-package" approach within the chemical negotiations rescued the negotiations from failure. The first Kennedy Round package contained major tariffs reductions on chemicals by the U. S. and lesser reductions by the other major chemical trading nations. The second package contained the elimination of ASP by the U. S. and significant tariff reductions by the other major chemical trading countries; it also required, but never received, Congressional approval.

The most recent U. S. trade legislation of major significance is the Trade Act of 1974. It includes authorization for the President to enter into new trade agreements between 1975 and 1979 and to reduce most tariff duties by up to 60 percent. In contrast to that legislation, this study considered, in the case of the second scenario, the effect of the elimination of the post-Kennedy Round tariff duties.

The study proceeded, in Chapter III, with a review of other studies relevant to the analysis of this research and with a presentation of the theoretical model used in the analysis. The estimated economic effects, which were obtained from separate analyses of both the import and export markets, were changes in prices and in the quantities and values of trade. These static trade effects were utilized to calculate the resultant adjustments in the labor markets. Lastly, the net social welfare effects, i. e., the welfare gains from trade expansion less the social costs of labor dislocation, were derived. These net welfare flows were discounted over appropriate time horizons to obtain their

present values.

The estimates were made at a disaggregated level. The collection of the data presented a challenge because of the variety of sources and, most especially, the variety of classification systems used. For this study, all data were transformed to the four- and three- digit levels of the Standard International Trade Classification, Revised (SITC). Their sources and adjustments were described in detail in Chapter IV.

The model was applied to two sets of tariff data. One set was composed of tariff rates which would have resulted had both Kennedy Round packages become effective; this set is called the first scenario. The other set of tariff data, that of this study's second scenario, was composed of tariff rates resultant from only the so-called Kennedy Round package. The economic impact of the ASP package had it become effective is indicated by the differences between the estimated effects of the two scenarios.

The empirical results of the study were presented in Chapter V. One of the purposes of this research was to estimate the economic effects of trade liberalization from data at a disaggregated level. The numerous sub-sectors within the chemical industry in combination with the two alternative scenarios, as well as their comparison in order to evaluate the Supplemental Agreement on Chemicals, created a multitude of results for the several effects considered in the study.

This study found that in the short-run the impact of free trade superseding the tariff rates of the second scenario, i. e., post-Kennedy Round tariffs with the continued existence of ASP, would be an increase in imports of $222.768 million and in exports of $615.424

million. The average price of U. S. chemical imports would fall by 4.9 percent; whereas the average price of U. S. chemical exports would rise by 7.6 percent. The expansion of international trade would create 978 jobs (net) annually for two years following free trade. The resultant transitional labor dislocation would cost society an estimated $4.365 million if the labor markets were large and mobile. Assuming a 5 percent discount rate, the net gain in social welfare for the United States would be $1416.703 million.

The comparison of the effects of the first scenario to those of the second scenario revealed that approval by Congress of the Supplemental Agreement on Chemicals would have reduced the average foreign tariff on chemicals from 9.2 percent to 7.2 percent in response to a U. S. reduction from an 8.1 percent average ad valorem tariff equivalent to a 7.6 percent average. The differences between the estimated effects in the short-run on trade volume indicate that the ratification of the ASP package would have increased imports by $10.198 million and exports by $153.077 million. The differences between the directly estimated net social welfare effects indicated a gain of $406.942 million, which included the social cost of labor dislocation.

In addition, the component parts of the net social welfare effects were calculated. Assuming large, integrated labor markets and a 5 percent discount rate, this study found that implementation of the Supplemental Agreement on Chemicals would have resulted in a net gain in producers' surplus of $3943.280 million, a net loss in consumers' surplus of $3511.631 million, a revenue loss for the government of $31.333 million, and a loss due to labor dislocation of $3.331 million. The sum of these component effects is a net social welfare gain due to the implementation of the ASP package equal to $396.985 million.

Disregarding the expansion of U. S. exports which would have resulted from the ASP package, the producers' and consumers' surpluses for the import market alone revealed a loss in producers' surplus of $374.204 million and a gain in consumers' surplus of $403.095 million.

Chapter V, which presented the empirical results, is concluded by a comparison of the trade effects obtained from disaggregated data to those obtained by apportionment among the three-digit groups of the effects estimated from aggregate data. The comparison revealed that for the industry the aggregate estimates exceed the sum of the disaggregated estimates. Furthermore, the comparison demonstrated that apportionment of the aggregate estimates does distort the variation revealed by the estimates obtained from disaggregated data.

## Conclusions

The findings of this study indicate that aggregate data, as used in previous studies, do distort the results obtainable from disaggregated data. The results also indicate that any relatively balanced, multilateral reduction of tariff duties levied on chemicals would create a net gain for the United States in terms of both the balance of trade and social welfare.

Furthermore, the empirical results of this study indicate that the United States would have benefited from Congressional approval of the Supplemental Agreement on Chemicals which had been negotiated during the Kennedy Round of GATT. The improvement in the United States' trade balance is an increase in net exports of $142.879 million. In terms of net social welfare, the benefits to the United States were calculated to be $406.942 million.

Industry opposition to the ASP package was strong, despite the fact that the producers' surplus component of social welfare would have been increased substantially by the Supplemental Agreement. Thus, it appears that the chemical industry, and perhaps therefore Congress, focused only on the concessions granted by the U. S. in the agreement and neglected the receipt of foreign concessions. With a myopic viewpoint limited to the market loss due to import expansion, the industry may have seen the loss of producers' surplus in the import markets and disregarded the potentially greater gain in producers' surplus which would result from export expansion.

Thus, Congress, acting presumably in the national interest and the chemical industry, acting in its own self-interest, erred in opposing the Supplemental Agreement. In both cases, it may have been an inadvertent result of incomplete analysis or of exaggerated importance given to the import markets.

It is surprising that the vigorous U. S. chemical industry seemingly had so little faith in its own ability to respond to the significant enlargement of potential export markets. As a result, other possible reasons for industry opposition come to mind. First, perhaps the nontariff effects of ASP as a barrier are especially strong and offer a high level of effective protection. Such strength is enhanced by the industry structure. For although the chemical industry is large, diverse and technologically competitive, it is composed of a variety of subindustries; the common characteristic of these subgroups is an oligopolistic market structure accompanied by relatively stable prices. Domestic price control increases the protection granted under the ASP system of valuation.

In addition, the oligopolistic structure of the sub-sectors may

conceal the existence of monopolies for particular chemical products. For these monopolists, the tariff aspect of the ASP system may serve as a barrier to entry with which to maintain the monopoly position. Or perhaps, the priorities of oligopolists place profit-maximization second to market-share maintenance.

With regard to additional research of a similar nature, the problems with data encountered in this study give rise to the usual appeal for improved and more highly disaggregated data. Most particularly, the appeal is for data collected in terms of a common classification system. The transition by the United States and Canada from their own unique systems to those used by the rest-of-the-world, including the United Nations, would be a major step in that direction. This study is affected indirectly, too, by the lack of reliable, comprehensive price data, which hinders the estimation of price elasticities on a disaggregated level. The paucity of such elasticity estimates limited the effectiveness of this analysis.

Further work similar to this study should be pursued, especially at a relatively disaggregated level of data. A significant advance would be the development of a more sophisticated model, particularly one that would integrate the treatment of the import and export markets. Studies with purposes similar to this one are needed with regard to non-tariff barriers if future trade negotiations are to succeed in the trade liberalization goal of GATT. The primary obstacle to such analysis is the lack of information with which to quantify such barriers.

## A SELECTED BIBLIOGRAPHY


Backman, Jules. The Economics of the Chemical Industry. Washington, DC: Manufacturing Chemists Association, February, 1970.

Bain, Joe S. International Differences in Industrial Structure. New Haven: Yale University Press, 1966.

Balassa, Bela. "Tariff Protection in Industrial Countries: An Evaluation." Readings in International Economics. Homewood, IL: Richard D. Irwin, Inc., 1968, pp. 579-604.

_____. Trade Liberalization Among Industrial Countries. New York: McGraw-Hill Book Company, 1967.

Balassa, Bela in collaboration with M. E. Krenin, R. J. Wonnacott, F. Hartog, S. J. Wells, S. B. Linder, K. Kojima, D. Dosser, and W. B. Kelly. Studies in Trade Liberalization. Baltimore, MD: The Johns Hopkins Press, 1967.

Balassa, Bela and Mordechai E. Krenin. "Trade Liberalization under the 'Kennedy Round': The Static Effects." Review of Economics and Statistics, Vol. XLIX (May, 1967), pp. 125-137.

Baldwin, Robert E. and John H. Mutti. "Policy Problems in the Adjustment Process (U.S.)." (Unpublished paper presented at World Bank Seminar: Industrialization and Trade Policies in the 1970's).

Ball, R. J. and K. Marwah. "The U. S. Demand for Imports, 1948-1958." Review of Economics and Statistics, Vol. XLIV (November, 1962), pp. 395-401.

Basevi, Giorgio. "The Restrictive Effect of the U. S. Tariff and Its Welfare Value." American Economic Review, Vol. LVIII (September, 1968), pp. 840-852.

Burn, Duncan and Barbara Epstein. Realities of Free Trade: Two Industry Studies. Toronto: University of Toronto Press, 1972.

Caves, Richard E. and Ronald W. Jones. World Trade and Payments: An Introduction. Boston: Little, Brown and Company, 1973.

Cheh, John H. "U. S. Concessions in the Kennedy Round & S-R Labor Adjustment Costs." Journal of International Economics, Vol. 4 (November, 1974), pp. 323-340.

Cheng, Hang Sheng. "Statistical Estimates of Elasticities and Propensities in International Trade." International Monetary Fund Staff Papers, Vol. 7 (April, 1959 - April, 1960), pp. 107-158.

The Contracting Parties to the General Agreement on Tariffs and Trade. Basic Documentation for Tariff Study: Summary Table No. 1 -- Tariff and Trade Summaries by BTN Headings. Geneva, July, 1970.

_____. Legal Instruments Embodying the Results of the 1964-67 Trade Conference. Geneva, June 30, 1967.

Curtis, Thomas B. and John Robert Vastine, Jr. The Kennedy Round and the Future of American Trade. New York: Prager Special Studies, 1971.

DeVries, Barend A. "Price Elasticities of Demand for Individual Commodities Imported into the United States." International Monetary Fund Staff Papers, Vol. I (April, 1951), pp. 397-419.

Edgmand, Michael R. and Tracy W. Murray. "Full Employment, Trade Expansion, and Adjustment Assistance." Southern Economic Journal, Vol. XXXVI (April, 1970), pp. 404-424.

Eposito, Louis and Frances Esposito. "Foreign Competition and Domestic Industry Profitability." Review of Economics and Statistics, Vol. 53 (November, 1971), pp. 343-353.

Evans, John W. The Kennedy Round in American Trade Policy. Cambridge, MA: Harvard University Press, 1971.

Glismann, Hans and Axel Neu. "Towards New Agreements on International Trade Liberalization - Methods and Examples of Measuring Non-tariff Trade Barriers." Weltwirtsch Aftliches Archiv, Vol. 107 (1971), pp. 235-271.

Grubel, H. G. and H. G. Johnson. "Nominal Tariff Rates and United States Valuation Practices: Two Case Studies." Review of Economics and Statistics, Vol. XLIX (May, 1967), pp. 138-142.

Houthakker, H. S. and Stephen P. Magee. "Income and Price Elasticities in World Trade." Review of Economics and Statistics, Vol. 51 (May, 1969), pp. 111-125.

Hufbauer, G. C. "American Selling Price Valuation and Benzenoid Chemical Tariffs." Review of Economics and Statistics, Vol. L (November, 1968), pp. 509-510.

_____. "Hypotheses and Tests of Trade Patterns." The Technology Factor in International Trade, Ec. Raymond Vernon. New York: National Bureau of Economic Research, 1970.

Johnson, Harry G. "The Cost of Protection and the Scientific Tariff." Journal of Political Economy, Vol. 68 (August, 1960), pp. 327-345.

Jondrow, James and Eugene Devine, Louis Jacobson, Arnold Katz, David O'Neill. Removing Restrictions on Imports of Steel. Arlington, VA: Public Research Institute, May, 1975.

Kahn, A. E. "The Chemical Industry." The Structure of American Industry: Some Case Studies. Ed. Walter Adams, 3rd Edition. New York: The Macmillan Company, 1961.

Krause, Lawrence B. "U. S. Imports 1947-1958." Econometrica, Vol. 30 (April, 1962), pp. 221-238.

_____. "United States Imports and the Tariff." American Economic Review, Vol. 49 (May, 1959), pp. 542-551.

Kreinin, Mordechai E. "Disaggregated Import Demand Functions--Further Results." Southern Economic Journal, Vol. 40 (July, 1973), pp. 19-25.

_____. "Effect of Tariff Changes on the Price and Volume of Imports." American Economic Review, Vol. LI (June, 1961), pp. 310-324.

_____. "Price Elasticities in International Trade." Review of Economics and Statistics, Vol. 49 (November, 1967), pp. 510-516.

Leamer, Edward E. and Robert M. Stern. Quantitative International Economics. Boston: Allyn and Bacon, Inc., 1970.

MacPhee, Craig R. Restrictions on International Trade in Steel. Lexington, MA: Lexington Books (D.C. Heath and Company, 1974.

Meltzer, Yale L. Chemical Guide to GATT, the Kennedy Round and International Trade, 1968. Park Ridge, NJ: Noyes Development Corporation, 1968.

Orcutt, G. H. "Measurement of Price Elasticities in International Trade." Review of Economics and Statistics, Vol. XXXII (May, 1950), pp. 117-132.

Organization for Economic Cooperation and Development. The Chemical Industry, 1967-1968. (No date, place, or publisher in book).

_____. Statistics of Foreign Trade, Series C Trade by Commodities--Market Summaries. Vol. 1 (January-December, 1972). Paris, France, 1972.

Price, James E. and James B. Thornblade. "U. S. Import Demand Functions Disaggregated by Country and Commodity." Southern Economic Journal, Vol. 39 (July, 1974), pp. 46-57.

Richardson, J. David. "The Response of Imports and Domestic Demand to Price, Tariff and Exchange Rate Changes: A Structural Estimation Study for Selected U. S. Manufactures." (Unpublished paper prepared under the auspices of the U.S. Department of State, Bureau of Economic Affairs, Contract SCC-1005-08817-70), March, 1972.

Stern, Robert M. "Price Elasticities in International Trade: A Compilation and Annotated Bibliography of Recent Research." (Unpublished paper) Ann Arbor, Michigan: University of Michigan, March 15, 1975.

Stone, Joe. "The Static Effects of Trade Liberalization: An Estimate for Large Traders." (Unpublished paper) East Lansing, Michigan: Michigan State University, Department of Economics, 1976.

United Nations, Department of Economic and Social Affairs. "Classification of Commodities by Industrial Origin." Statistical Papers, Series M, No. 43, Rev. 1, New York, 1971.

_____. The Growth of World Industry, Volume I, 1973 Edition, Commodity Production Data, 1964-1973. New York, 1975.

_____. The Growth of World Industry, Volume II, 1973 Edition. New York, 1975.

_____. "Standard International Trade Classification, Revised." Statistical Papers. Series M, No. 34, New York, 1961.

United States, Atomic Energy Commission. 1972 Financial Report. Washington, DC, 1972.

United States, Bureau of the Census. Annual Survey of Manufactures: 1970-1971. Washington, DC: U.S. Government Printing Office, 1973.

_____. U. S. General Imports, Schedule A Commodity by Country, Report FT 135, December, 1974, Washington, DC: U. S. Government Printing Office, 1972.

_____. U. S. Imports for Consumption and General Imports, Report FT 246, 1971 Annual, Washington, DC: U. S. Government Printing Office, 1972.

_____. U. S. Foreign Trade Statistics Classifications and Cross Classifications, 1970, Washington, DC: U. S. Government Printing Office, February, 1971.

_____. 1967 Census of Manufactures -- Alphabetic Index of Manufactured Products. Washington, DC: U. S. Government Printing Office, 1970.

_____. 1972 Census of Manufactures -- Numerical List of Manufactured Products, New (1972) SIC Basis. Washington, DC: U. S. Government Printing Office, 1975.

_____. 1972 Census of Manufactures -- Subject Series General Summary. Washington, DC: U. S. Government Printing Office, November, 1975.

United States, Bureau of Domestic Commerce. Chemicals: Quarterly Industry Reports, Vol. 1 (November, 1954). Washington, DC: U. S. Government Printing Office.

United States, Bureau of Labor Statistics. Employment and Earnings, Vol. 19, No. 7, January, 1973.

United States Code: Congressional and Administrative News. 93rd Congress--Second Session, 1974. Vol. 2. St. Paul, MN: West Publishing Company, 1975.

United States Department of State. "General Agreement on Tariffs and Trade: Protocol to GATT Embodying Results of the 1960-61 Tariff Conference (Done at Geneva, July 16, 1962) and Agreements Rectifying Part of the U. S. Schedule to the Protocol." Treaties and Other International Agreements, Vol. 13, Part 3, 1962. Washington, DC: U. S. Government Printing Office, 1963, pp. 2885-3813.

United States House of Representatives. Committee on Ways and Means. Hearings on Foreign Trade and Tariff Proposals. Washington, DC: U. S. Government Printing Office, 1968.

United States International Trade Commission. Annual Report 1975. Washington, DC: U. S. Government Printing Office, 1976.

_____. Operation of the Trade Agreements Program. 26th Report, 1974 (USITC Publication 765). Washington, DC: 1976.

United States Tariff Commission. Annual Report of the United States Tariff Commission. Washington, DC: U. S. Government Printing Office, Years 1970-1974.

_____. Customs Valuation, T.C. Publication 180, Washington, DC, July, 1966.

_____. Customs Valuation, T.C. Publication 501. Washington, DC, July, 1972.

_____. Operation of the Trade Agreements Program. 15th Report, July, 1962-June, 1963, T.C. Publication 147. Washington, DC: U. S. Government Printing Office, 1965.

_____. "Major Industrial Product Sectors: Tariffs and Other Trade Barriers," Part III of Trade Barriers, T.C. Publication 665. Washington, DC: U. S. Government Printing Office, April, 1974.

_____. Products Subject to Duty on the American Selling Price Bases of Valuation: Conversion of Rates of Duty on Such Products to Rates Based on Values Determined by Conventional Valuation Methods, T.C. Publication 181. Washington, DC, July, 1966.

Wemelsfelder, J. "The Short Term Effect of the Lowering of Import Duties in Germany." Economic Journal, Vol. 70 (March, 1960), pp. 94-104.

Yeager, Leland B. International Monetary Relations. New York: Harper & Row Publishers, 1966.

# APPENDIXES

# APPENDIX A

## THE CONCESSIONS OF BOTH KENNEDY ROUND PACKAGES

## The Kennedy Round Concessions

The major concessions in the Kennedy Round were the following:

1. The United States undertook to make only 20% cuts on most low-duty chemicals.

2. It excepted from any reduction certain other chemicals.

3. It agreed to reduce by 50% over five equal stages the duties on all other chemicals.

4. It retained the ASP system of valuation for benzenoid chemicals.

These concessions averaged out to a 43% cut on $325 million of our imports in the base year, 1964.

The European Community agreed in the Kennedy Round to:

1. Less than 50% reductions, ranging between 10% and 40%, on some chemicals, and no reductions on three chemicals.

2. 30% reductions on chemicals with duties of 25% or higher.

3. 35% reductions on chemicals for which Switzerland is its principal supplier.

4. 20% reductions on most other items.

These concessions averaged out to a 20% cut on $465 million of imports from the United States in the base year.

The United Kingdom agreed in the Kennedy Round to:

1. Partial or no reductions on a limited number of chemicals, including certain of its domestic revenue duties.

2. No reductions on most plastics, products which now generally have 10% or lower rates.

3. 30% reductions on chemicals with duties of 25% or higher.

4. 20% reductions on all other chemicals.

These concessions averaged out to a 25% reduction on $110 million of imports from the United States in the base year.

Switzerland and Japan agreed to make their entire reductions in the Kennedy Round. Together with the United Kingdom and the EEC, the average cut of these countries on imports in the base year will be about 26% on $890 million of imports from the United States. The remaining countries

did not participate in the separate ASP negotiation and their entire reductions will take place as specified in the Kennedy Round agreement.

## The ASP Concessions

Under the separate ASP agreement, the United States agreed conditionally to:

1. Convert duties based on ASP to normal bases of valuation.

2. Reduce by a further 30% the low duty items cut by only 20% in the Kennedy Round.

3. Further reduce certain chemical duties to rates which on the basis of 1964 trade would average 20% but are not limited to that level.

4. Establish duties of more than 25% for sulfa drugs and 30% for dyes and pigments.

The average U. S. reduction would be five percent, or a total of 48% in both agreements combined.

The European Community undertook in the ASP agreement to:

1. Reduce by a further 30% on all items, except those for which only partial or no reductions were made in the Kennedy Round. The average reduction would be 26% or a combined total of 46% in both agreements.

2. Modify its road tax system to eliminate discrimination against American automobiles.

The United Kingdom undertook in the ASP agreement to:

1. Reduce duties on plastics, where necessary, to the level of European Community duties on plastics, and bind all duties on plastics.

2. Reduce by a further 30% on all items cut by 20% in the Kennedy Round.

3. Further reduce by varying percentages duties of 25% or higher to bring them to a level of 12.5%.

4. The average reduction would be 22%, for a combined reduction of 47% in both agreements. They would also reduce the preferential tariff margin on tobacco imports.

Switzerland agreed to modify its regulations on canned fruit imports when the ASP agreement becomes effective. Its average tariff cut would be 49%, while that of Japan would be 44%. In short, all major participants agreed to make about the same average overall percentage reduction in their chemical tariffs.

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SOURCE: Quoted from the testimony of William M. Roth in United States House of Representatives. Committee on Ways and Means. Hearings on Foreign Trade and Tariff Proposals. Washington, DC: U. S. Government Printing Office, 1968.

# APPENDIX B

## DERIVATIONS OF THE EQUATIONS

Equation 3.1

The fall in the import price is a fraction, s, of the absolute height, T, of the barriers:

$$P' = (1 + t)P$$

$$dP' = -sT \qquad \text{and} \qquad dP = (1 - s)T = (1 - s)tP$$

$$\frac{dP'}{P'} = \frac{dP'}{P + T} = \frac{-sT}{P + T} = \frac{-st}{(1 + T)} = \qquad \text{where} \qquad t = \frac{T}{P}$$

$$(\frac{dP'}{P + T})(\frac{M}{dM}) = (\frac{-st}{1 + t})(\frac{M}{dM})(\frac{dP}{P})(\frac{P}{dP})$$

$$\frac{1}{\eta_M} = (\frac{-st}{1 + t})(\frac{1}{\varepsilon_M})(\frac{P}{dP}) = (\frac{-st}{1 + t})(\frac{1}{\varepsilon_M})(\frac{1}{(1 - s)t})$$

$$(1 + t)\varepsilon_M(1 - s)t = -st\eta_M$$

$$\varepsilon_M t(1 + t - s - st) = -st\eta_M$$

$$\varepsilon_M t + \varepsilon_M t^2 - \varepsilon_M st - \varepsilon_M st^2 = -st\eta_M$$

$$\varepsilon_M t + \varepsilon_M t^2 = -st\eta_M + \varepsilon_M st + \varepsilon_M st^2$$

$$\varepsilon_M t + \varepsilon_M t^2 = (\frac{dP'}{P + T})(1 + t)\eta_M - \varepsilon_M(\frac{dP'}{P + T})(1 + t) - \varepsilon_M t(\frac{dP'}{P + T})(1 + t)$$

$$(\frac{dP'}{P + T})(1 + t) = \frac{\varepsilon_M t + \varepsilon_M t^2}{\eta_M - \varepsilon_M - \varepsilon_M t} = \frac{\varepsilon_M t(1 + t)}{\eta_M - \varepsilon_M - \varepsilon_M t}$$

$$\frac{dP'}{P + T} = \frac{\varepsilon_M t}{\eta_M - \varepsilon_M - \varepsilon_M t}$$

Equation 3.2

$$\frac{dP}{P} = (1 - s)t$$

$$(\frac{dP}{P})(\frac{M}{dM}) = (1 - s)t(\frac{M}{dM})(\frac{dP'}{P + T})(\frac{P + T}{dP'})$$

$$\frac{1}{\varepsilon_M} = (1 - s)t\left(\frac{1}{\eta_M}\right)\left(\frac{P + T}{dP'}\right)$$

$$\frac{1}{\varepsilon_M} = (1 - s)t\left(\frac{1}{\eta_M}\right)\left(\frac{1 + t}{-st}\right)$$

$$-\eta_M st = (1 - s)t(1 + t)\varepsilon_M$$

$$-t\eta_M + t\eta_M - \eta_M st = (1 - s)t\varepsilon_M + (1 - s)t^2\varepsilon_M$$

$$-t\eta_M + t\eta_M(1 - s) = (1 - s)t\varepsilon_M + (1 - s)t^2\varepsilon_M$$

$$-t\eta_M = (1 - s)t[\varepsilon_M + t\varepsilon_M - \eta_M]$$

$$-t\eta_M = \frac{dP}{P}[\varepsilon_M + t\varepsilon_M - \eta_M]$$

$$\frac{dP}{P} = \frac{t\eta_M}{\eta_M - \varepsilon_M - t\varepsilon_M}$$

Equation 3.3

$$dM = dM$$

$$dM = \left(\frac{MdM}{M}\right)\left(\frac{P + T}{dP'}\right)\left(\frac{dP'}{P + T}\right)$$

$$dM = M\eta_M\left(\frac{dP'}{P + T}\right)$$

Substituting Equation 3.1:

$$\frac{dM}{M} = \frac{\eta_M t\varepsilon_M}{\eta_M - \varepsilon_M - \varepsilon_M t}$$

Equation 3.4

The increase in the duty-free value of imports can be seen in Figure 5, where the original duty-free value of imports, $V_M$, equals (P x M) as shown by area 1. The new duty-free value of imports equals [$P_o$ x (M + dM)], i.e., areas 1 + 2 + 3 + 4. Hence, the change in the value of imports, $dV_M$, equals areas 2 (= MdP), 3 (= PdM), and 4 (= dMdP).

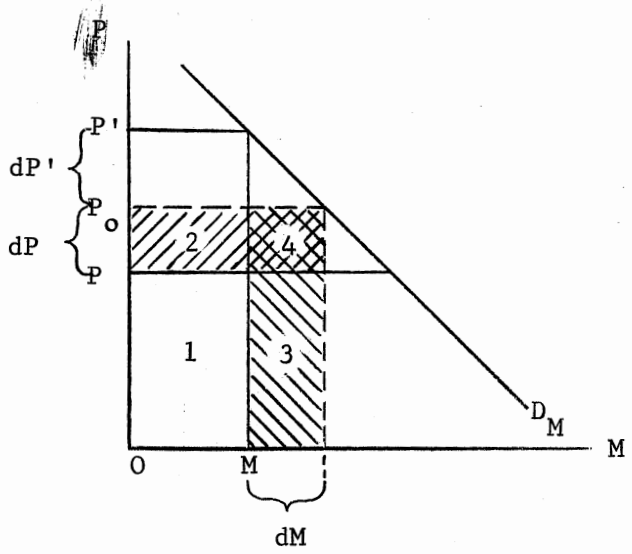



Figure 5. Import Demand

$$dV_M = M(dP) + P(dM) + (dM)(dP)$$

$$dV_M = M(dP)\left(\frac{P}{P}\right) + P(dM)\left(\frac{M}{M}\right) + (dM)(dP)\left(\frac{M}{M}\right)\left(\frac{P}{P}\right)$$

$$dV_M = (MP)\left(\frac{dP}{P}\right) + (MP)\left(\frac{dM}{M}\right) + (MP)\left(\frac{dM}{M}\right)\left(\frac{dP}{P}\right)$$

$$dV_M = V_M\left[\frac{dP}{P} + \frac{dM}{M} + \left(\frac{dM}{M}\right)\left(\frac{dP}{P}\right)\right]$$

This equation can be written in terms of elasticities by substituting Equations 3.2 and 3.3 into 3.4 which yields:

$$dV_M = V_M\left[\frac{t\eta_M}{\eta_M - \varepsilon_M - \varepsilon_M t} + \frac{\eta_M t\varepsilon_M}{\eta_M - \varepsilon_M - \varepsilon_M t} + \frac{t^2\eta_M{}^2\varepsilon_M}{\eta_M - \varepsilon_M - \varepsilon_M t}\right]$$

$$dV_M = V_M t\eta_M\left[1 + \varepsilon_M + \frac{t\eta_M\varepsilon_M}{\eta_M - \varepsilon_M - \varepsilon_M t}\right](\eta_M - \varepsilon_M - \varepsilon_M t)^{-1}$$

Equation 3.5

$$dW_M = \frac{1}{2}\underset{(<0)\ (<0)}{|dP'||dS|} + \frac{1}{2}\underset{(<0)\ (>0)}{|dP'||dD|} - \underset{(>0)\ (>0)}{|M||dP|}$$

$$dW_M = \frac{1}{2}(-dP')(-dS) + \frac{1}{2}(-dP')(dD) - (M)(dP)$$

$$dW_M = -\frac{1}{2}(dP')(-dS + dD) - M(dP)$$

$$dW_M = -\frac{1}{2}(dP')(dM) - M(dP)$$

$$dW_M = -\frac{1}{2}(dP')(\frac{P + T}{P + T})dM - M(dP)$$

By definition:

$$\eta_M = (\frac{dM}{M})(\frac{P + T}{dP'})$$

i.e.,

$$dM = \eta_M M(\frac{dP'}{P + T})$$

Thus, substituting:

$$dW_M = -\frac{1}{2}(\frac{dP'}{P + T})(P + T)\eta_M M(\frac{dP'}{P + T}) - M(dP)$$

$$dW_M = -\frac{1}{2}(\frac{dP'}{P + T})^2(P + tP)M\eta_M - M(dP)$$

$$dW_M = -\frac{1}{2}(\frac{dP'}{P + T})^2(1 + t)PM\eta_M - MP(\frac{dP}{P})$$

$$dW_M = -\frac{1}{2}(\frac{dP'}{P + T})^2 V_M(1 + t)\eta_M - V_M(\frac{dP}{P})$$

Equation 3.5.a

$$dW_{M,p} = \text{Area C}$$

$$dW_{M,p} = \frac{1}{2}(Q_S + Q_S')|dP'|$$

$$dW_{M,p} = \frac{1}{2}(Q_S + Q_S')(-dP)$$

$$dW_{M,p} = \frac{1}{2}(Q_S + Q_S + dQ_S)(-dP')$$

$$dW_{M,p} = -\frac{1}{2}(2Q_S + dQ_S)dP'$$

$$dW_{M,p} = -\frac{1}{2}(2V_S + dV_S)(\frac{dP'}{P + T})$$

$$dW_{M,p} = -\frac{1}{2}(\frac{dP'}{P + T})(2V_S) - \frac{1}{2}(\frac{dP'}{P + T})(dV_S)$$

By definition: $\varepsilon_D = (\frac{dV_S}{V_S})(\frac{P + T}{dP'})$

i.e., $dV_S = \varepsilon_D V_S(\frac{dP'}{P + T})$

Thus, substituting:

$$dW_{M,p} = -\frac{1}{2}(\frac{dP'}{P + T})(2V_S) - \frac{1}{2}(\frac{dP'}{P + T})[\varepsilon_D V_S(\frac{dP'}{P + T})]$$

$$dW_{M,p} = -(\frac{dP'}{P + T})(V_S)[1 + \frac{1}{2}(\frac{dP'}{P + T})\varepsilon_D]$$

Since the product may also be exported, the proper supply figure for use in the import market is not the nation's gross supply but is the output consumed within that country. Thus, $V_S$ should be replaced with $(V_S - V_X)$:

$$dW_{M,p} = -\frac{dP'}{P + T}(V_S - V_X)[1 + \frac{1}{2}(\frac{dP'}{P + T})\varepsilon_D]$$

Equation 3.5.b

$$dW_{M,c} = \text{Areas } C + D + F + H = \frac{1}{2}(Q_D + Q_D')|dP'|$$

$$dW_{M,c} = \frac{1}{2}(Q_D + Q_D + dQ_D)(-dP')$$

$$dW_{M,c} = -\frac{1}{2}(2Q_D)dP' - \frac{1}{2}(dQ_D)dP'$$

$$dW_{M,c} = -\frac{1}{2}(2V_D)(\frac{dP'}{P + T}) - \frac{1}{2}(dV_D)(\frac{dP'}{P + T})$$

By definition: $\eta_D = (\frac{dV_D}{V_D})(\frac{P + T}{dP'})$

i.e., $dV_D = \eta_D V_D (\frac{dP'}{P + T})$

Thus, substituting:

$$dW_{M,c} = -V_D(\frac{dP'}{P + T}) - \frac{1}{2}(\frac{dP'}{P + T})\eta_D V_D(\frac{dP'}{P + T}) = -(\frac{dP'}{P+T})V_D[1 + \frac{1}{2}(\frac{dP'}{P+T})\eta_D]$$

Equation 3.5.c

$$dW_{M,t} = \text{Areas } F + G = |dP'|(M) + (dP)(M)$$

$$dW_{M,t} = (-dP')(M) + (dP)(M)$$

$$dW_{M,t} = (\frac{-dP'}{P + T})(M)(P + T) + (\frac{dP}{P})(M)(P)$$

$$dW_{M,t} = (\frac{-dP'}{P + T})(M)(P + tP) + (\frac{dP}{P})(M)(P)$$

$$dW_{M,t} = (\frac{-dP'}{P + T})(V_M + tV_M) + (\frac{dP}{P})(V_M)$$

$$dW_{M,t} = (\frac{-dP'}{P + T})(V_M)(1 + t) + (\frac{dP}{P})(V_M)$$

$$dW_{M,t} = V_M[\frac{dP}{P} - (\frac{dP'}{P + T})(1 + t)]$$

Equation 3.6

$dP = (1 - f)T$ where $0 \leq f \leq 1$ and therefore $dP' = -fT$

and $\frac{dP'}{P + T} = (-f)(\frac{t}{1 + t})$; thus, $\frac{dP}{P} = (1 - f)t$

$$(\frac{dP}{P})(\frac{X}{dX}) = (1 - f)(t)(\frac{X}{dX})(\frac{dP'}{P + T})(\frac{P + T}{dP'})$$

$$\frac{1}{\varepsilon_X} = (1 - f)(t)(\frac{1}{\eta_X})(\frac{P + T}{dP'})$$

$$\frac{1}{\varepsilon_X} = (1 - f)(t)(\frac{1}{\eta_X})(\frac{1 + t}{-ft})$$

$$-\eta_X ft = (1 - f)[t(1 + t)]\varepsilon_X$$

$$-t\eta_X + t\eta_X - \eta_X ft = (1 - f)t\varepsilon_X + (1 - f)t^2\varepsilon_X$$

$$-t\eta_X + (1 - f)t\eta_X = (1 - f)t\varepsilon_X + (1 - f)t^2\varepsilon_X$$

$$-t\eta_X = (1 - f)t\varepsilon_X + (1 - f)t^2\varepsilon_X - (1 - f)t\eta_X$$

$$-t\eta_X = (1 - f)(t)[\varepsilon_X + t\varepsilon_X - \eta_X]$$

$$-t\eta_X = \frac{dP}{P}[\varepsilon_X + t\varepsilon_X - \eta_X]$$

$$\frac{dP}{P} = \frac{t\eta_X}{\eta_X - \varepsilon_X - t\varepsilon_X}$$

Equation 3.7

$$dX = dX$$

$$dX = \left(\frac{X}{X}\right)(dX)\left(\frac{P}{dP}\right)\left(\frac{dP}{P}\right)$$

$$dX = X\varepsilon_X\left(\frac{dP}{P}\right)$$

Substituting in Equation 3.6 yields:

$$\frac{dX}{X} = \varepsilon_X\left(\frac{t\eta_X}{\eta_X - \varepsilon_X - t\varepsilon_X}\right)$$

Equation 3.8

$$dV_X = V_X[\frac{dP}{P} + \frac{dX}{X} + (\frac{dP}{P})(\frac{dX}{X})]$$

The derivation is directly analagous to that of Equation 3.4.

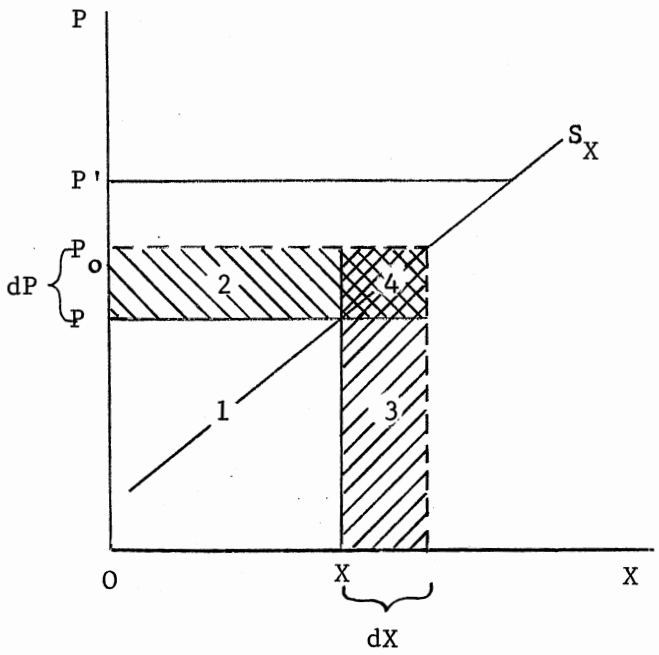



Figure 6. Export Supply

Equation 3.9

$$dW_X = \frac{1}{2}(dP)\overset{(<0)}{|dD|} + \frac{1}{2}(dP)\overset{(>0)}{|dS|} + X(dP)$$

$$dW_X = \frac{1}{2}(dP)(dS - dD) + X(dP)$$

$$dW_X = \frac{1}{2}(dP)(dX) + X(dP)$$

$$dW_X = \frac{1}{2}(\frac{dP}{P})(P)(dX) + X(dP)$$

By definition: $\varepsilon_X = (\frac{dX}{X})(\frac{P}{dP})$

i.e. $dX = \frac{\varepsilon_X(X)(dP)}{P}$

Substituting into the above:

$$dW_X = \frac{1}{2}(\frac{dP}{P})(P)[\frac{\varepsilon_X X(dP)}{P}] + X(dP)$$

$$dW_X = \frac{1}{2}(\frac{dP}{P})^2(\varepsilon_X)(PX) + (XP)(\frac{dP}{P})$$

$$dW_X = \frac{1}{2}(\frac{dP}{P})^2(\varepsilon_X)(V_X) + (\frac{dP}{P})(V_X)$$

Equation 3.9.a

$$dW_{X,c} = \text{Areas } E + F = \frac{1}{2}(Q_D + Q_D')(dP)$$

$$dW_{X,c} = \frac{1}{2}(Q_D + Q_D + dQ_D)(dP)$$

$$dW_{X,c} = \frac{1}{2}(2V_D)(\frac{dP}{P}) + \frac{1}{2}(dV_D)(\frac{dP}{P})$$

By definition: $\eta_D = (\frac{dV_D}{V_D})(\frac{P}{dP})$

i.e., $dV_D = \eta_D(\frac{dP}{P})(V_D) < 0$

Thus, $dW_{X,c} = V_D(\frac{dP}{P}) + \frac{1}{2}(\frac{dP}{P})(\eta_D)(\frac{dP}{P})(V_D)$

$$dW_{X,c} = (\frac{dP}{P})(V_D)[1 + \frac{1}{2}(\frac{dP}{P})\eta_D]$$

Since the product may also be imported, the proper demand figure for use in the export market is not the gross demand but is the demand for domestic production. Thus, $V_D$ should be replaced with $(V_D - V_M)$:

$$dW_{X,c} = (\frac{dP}{P})(V_D - V_M)[1 + \frac{1}{2}(\frac{dP}{P})(\eta_D)]$$

Equation 3.9.b

$$dW_{X,p} = \text{Areas } E + F + G + H + I = \frac{1}{2}(Q_S + Q_S')(dP)$$

$$dW_{X,p} = \frac{1}{2}(Q_S + Q_S + dQ_S)(dP)$$

$$dW_{X,p} = \frac{1}{2}(2Q_S)(dP) + \frac{1}{2}(dQ_S)(dP)$$

$$dW_{X,p} = V_S(\frac{dP}{P}) + \frac{1}{2}(dV_S)(\frac{dP}{P})$$

By definition: $\varepsilon_D = (\frac{dV_S}{V_S})(\frac{P}{dP})$

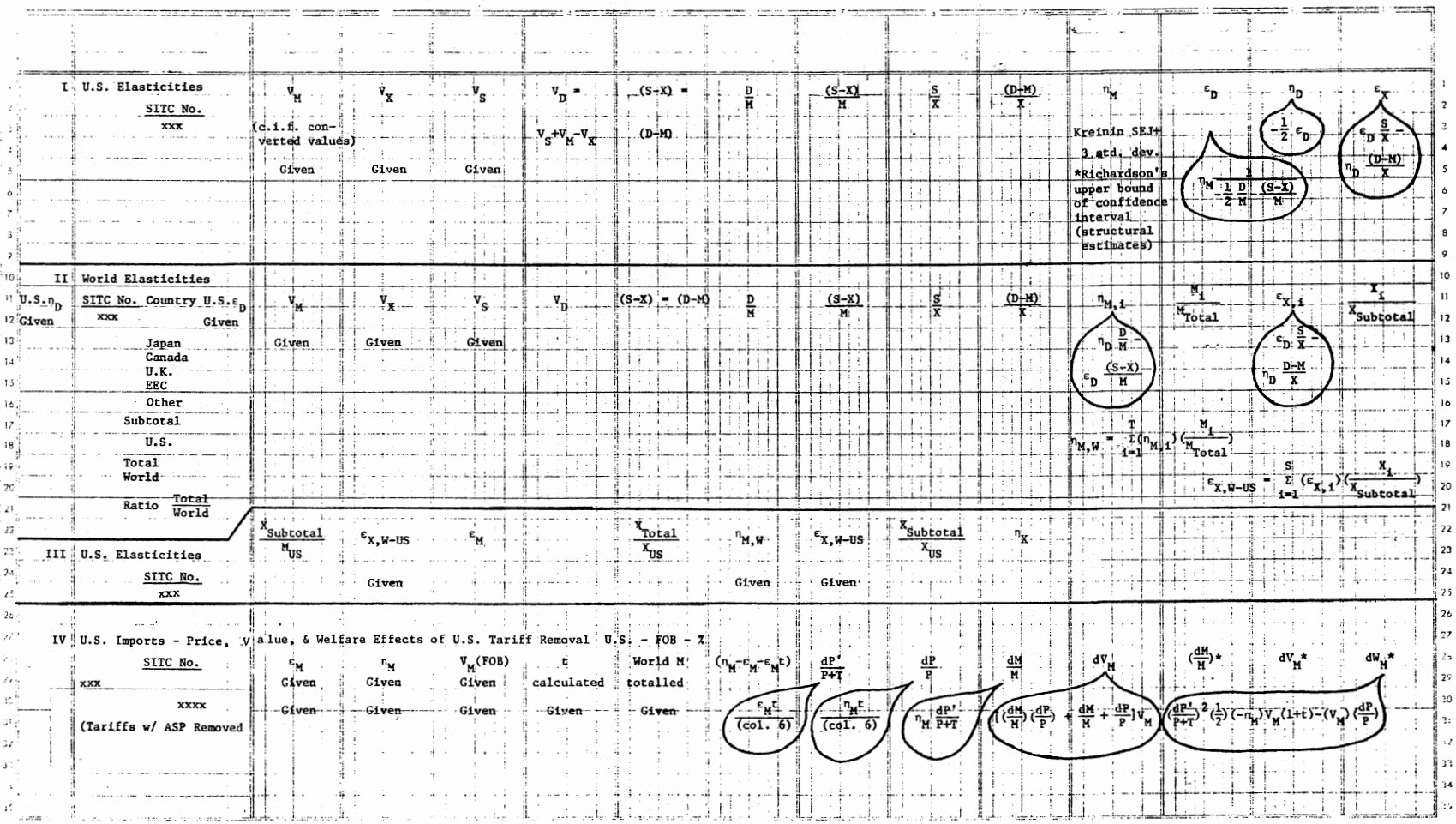
i.e., $dV_S = \varepsilon_D(V_S)(\frac{dP}{P})$

Thus, $dW_{X,p} = V_S(\frac{dP}{P}) + \frac{1}{2}(\frac{dP}{P})(\varepsilon_D)(V_S)(\frac{dP}{P})$

$$dW_{X,p} = (\frac{dP}{P})(V_S)[1 + \frac{1}{2}(\frac{dP}{P})(\varepsilon_D)]$$

# APPENDIX C

## SAMPLE WORKSHEETS


I U.S. Elasticities
SITC No.
xxx
$V_M$ (c.i.f. converted values)
$V_X$
$V_S$
$V_D = V_S + V_M - V_X$
(S-X) = (D-M)
$\frac{D}{M}$
$\frac{(S-X)}{M}$
$\frac{S}{X}$
$\frac{(D+M)}{X}$
$\eta_M$
Given
Given
Given
Kreinin SEJ+ 3 std. dev.
*Richardson's upper bound of confidence interval (structural estimates)
$\epsilon_D$
$\eta_D$
$\epsilon_X$
$-\frac{1}{2}\epsilon_D$
$\eta_M - \frac{1}{2}\frac{D}{M}\frac{(S-X)}{M}$
$\epsilon_D\frac{S}{X} - \eta_D\frac{(D-M)}{X}$
II World Elasticities
U.S. $\eta_D$ Given
SITC No.
xxx
Country
U.S. $\epsilon_D$ Given
Japan
Canada
U.K.
EEC
Other
Subtotal
U.S.
Total World
Ratio Total / World
$V_M$ Given
$V_X$ Given
$V_S$ Given
$V_D$
(S-X) = (D-M)
$\frac{D}{M}$
$\frac{(S-X)}{M}$
$\frac{S}{X}$
$\frac{(D+M)}{X}$
$\eta_{M,i}$
$\eta_D\frac{D}{M} - \epsilon_D\frac{(S-X)}{M}$
$\frac{M_i}{M_{Total}}$
$\epsilon_{X,i}$
$\epsilon_D\frac{S}{X} - \eta_D\frac{D-M}{X}$
$\frac{X_i}{X_{Subtotal}}$
$\eta_{M,W} = \sum_{i=1}^{T}(\eta_{M,i})(\frac{M_i}{M_{Total}})$
$\epsilon_{X,W-US} = \sum_{i=1}^{S}(\epsilon_{X,i})(\frac{X_i}{X_{Subtotal}})$
$\frac{X_{Subtotal}}{M_{US}}$
$\epsilon_{X,W-US}$
$\epsilon_M$
$\frac{X_{Total}}{X_{US}}$
$\eta_{M,W}$
$\epsilon_{X,W-US}$
$\frac{X_{Subtotal}}{X_{US}}$
$\eta_X$
III U.S. Elasticities
SITC No.
xxx
Given
Given
Given
IV U.S. Imports - Price, Value, & Welfare Effects of U.S. Tariff Removal U.S. - FOB - %
SITC No.
xxx
xxxx
(Tariffs w/ ASP Removed
$\epsilon_M$ Given
$\eta_M$ Given
$V_M$(FOB) Given
t calculated
World M totalled
Given
$(\eta_M - \epsilon_M - \epsilon_M t)$
$\frac{\epsilon_M t}{(col. 6)}$
$\frac{dP'}{P+T}$
$\frac{\eta_M t}{(col. 6)}$
$\frac{dP}{P}$
$\eta_M\frac{dP'}{P+T}$
$\frac{dM}{M}$
$dV_M$
$(\frac{dM}{M})(\frac{dP}{P}) + \frac{dM}{M} + \frac{dP}{P}]V_M$
$(\frac{dM}{M})^*$
$dV_M^*$
$dW_M^*$
$(\frac{dP'}{P+T})^2(\frac{1}{2})(-\eta_M)V_M(1+t) - (V_M)(\frac{dP}{P})$

V Foreign Tariffs: Wghtd Avg'g & CIF-FOB Conversion

(Tariffs w/ASP Removed - GATT Study)

| Country | SITC xxxx | $t_{cif}$ | $V_{D,SITC\ 5}$ (weight) | $t^*$ | $\frac{cif - fas}{fas}$ | $t_{fob}$** |
|---|---|---|---|---|---|---|
| EEC | | | | | | |
| Canada | | | | | | |
| Japan | | | | | | |
| UK | | | | | | |
| ROW | | | | | | |
| Austria | | | | | | |
| Denmark | | | | | | |
| Finland | | | | | | |
| Norway | | | | | | |
| Sweden | | | | | | |
| Switz | | | | | | |
| SUBTOTAL | | | | | | |

VI U.S. Price, Export & Welfare Effects of Foreign Tariff Removal

(Tariffs w/ASP Removed - GATT Study)

| SITC No. xxxx | $\epsilon_X$ | $\eta_X$ | $V_{X,fob}$ | $t^{**}$ | World M | $(\eta_X - \epsilon_X - \epsilon_X t)$ | $\frac{dP}{P}$ | $\frac{dX}{X}$ | $dV_X$ | $(\frac{dX}{X})^*$ | $dV_X^*$ | $dW_X^*$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | $t\eta_X$ / col. 6 | $\epsilon_X \frac{dP}{P}$ | $[(\frac{dP}{P})(\frac{dX}{X}) + \frac{dX}{X} + \frac{dP}{P}]V_X$ | | | |

VII Foreign Tariffs: Wght'd Avg'g & CIF - FOB Conversion

(Tariffs w/o ASP Removed - GATT Legal Instruments)

(Same as Worksheet V)

VIII U.S. Price, Export & Welfare Effects of Foreign Tariff Removal

(Tariffs w/ASP In Effect (Legal Instruments))

(Same as Worksheet VI)

IX U.S. Imports - Price, Value & Welfare Effects of U.S. Tariff Removal

(Tariffs w/ASP in Effect)

| SITC No. xxxx | $\epsilon_M$ | $\eta_M$ | $V_M$ | Ratio | $t$ | $(\eta_M - \epsilon_M - \epsilon_M t)$ | $\frac{dP'}{P+T}$ | $\frac{dP}{P}$ | $\frac{dM}{M}$ | $dV_M$ | $(\frac{dM}{M})^*$ | $dV_M^*$ | $dW_M^*$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | (t of Wksheet IV)(Ratio $\frac{ASP}{Supplemental}$) | | | | | | | | |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| X | U.S. Long Run Elasticities | | | | | | | | | | | | | | | |
| | SITC xxx | SR $\epsilon_D$ | SR $\eta_D$ | LR$\epsilon_D$* | LR$\eta_D$* | | | | LR $\eta_M$* | | | | | LR $\epsilon_X$* | | |
| XIA | Labor Displacement – Import Market (ASP Removed) | | | | | | | | | | | | | | | |
| | SITC xxx | $V_S - V_X$ | $\epsilon_D$* | $\frac{dP}{P+T}$ (Wksheet IV) | $\frac{L}{V_S - V_X}$ | Total $\Delta L_M$ (Thous. Jobs) | Total Annual $\Delta L_M$ (# of Jobs) | Avg Total Annual Lbr Cost Per Employee | | VARIANT I: Avg Duration (Min.) | VARIANT I: Annual $TLL_M$ (thous $) | | | VARIANT II: Avg Duration (Max.) | VARIANT II: Annual $TLL_M$ (thous $) | |
| XIB | Labor Displacement – Export Market (ASP Removed) | | | | | | | | | | | | | | | |
| | SITC xxx | $V_S$ | $\epsilon_D$* | $\frac{dP}{P}$ (Wksheet VI) | $\frac{L}{V_S}$ | Total $\Delta L_X$ (Thous. Jobs) | Total Annual $L_X$ (# of Jobs) | Avg Total Annual Lbr Cost Per Employee | | VARIANT I: Avg Duration (Min.) | VARIANT I: Annual $TLL_X$ (thous $) | | | VARIANT II: Avg Duration (Max.) | VARIANT II: Annual $TLL_X$ (thous $) | |
| XIC | Labor Displacement – Netted Markets (ASP Removed) | | | | | | | | | | | | | | | |
| | SITC xxx | (>0) (<0) $\Delta L_X + \Delta L_M$ | | Annual $\Delta L_N'$ | Avg Total Lbr Cost Per Employee | | If $\Delta L'$>0, like Export Mkt. I: Avg Duration (X-Min.) | If $\Delta L'$>0, like Export Mkt. I: Annual $TLL_N$ (thous $) | If $\Delta L'$>0, like Export Mkt. II: Avg Duration (X-Max.) | If $\Delta L'$>0, like Export Mkt. II: Annual $TLL_N$ (thous $) | If $\Delta L'$<0, like Import Mkt.: Avg Duration (M-Min.) | If $\Delta L'$<0, like Import Mkt.: Annual $TLL_N$ (thous $) | | If $\Delta L'$<0, like Import Mkt. II: Avg Duration (M-Max.) | If $\Delta L'$<0, like Import Mkt. II: Annual $TLL_N$ (thous $) | |
| | | (Thous. Jobs) | | ($\frac{\text{col. 1}}{.002}$) | Per Employee | | | | | | | | | | | |
| XII | Labor Displacement – (ASP Still in Effect) A, B, C – Same as Worksheets XIA, B, C | | | | | | | | | | | | | | | |
| XIII | Social Welfare Effects (ASP Removed) | | | | | | | | | | | | | | | |
| | SITC xxx | S-R $dW_M$ (million $) | L-R $dW_M$* (million $) | | SR $dW_X$ (million $) | LR $dW_X$* (million $) | | S-R $dW_{Net}$ (million $) | LR $dW_{Net}$* (million $) | Annual $TLL_{Net,Var\ I}$ (Worksheet XI – C) | | Annual $TLL_{Net,Var\ II}$ | | SR $dW_{Net}$ – $TLL_{N,I}$ | SR $dW_{Net}$ – $TLL_{N,II}$ | |
| XIV | Social Welfare Effects (ASP Still in Effect) Same as Worksheet XIII | | | | | | | | | | | | | | | |
| XV and XVI | Present Values of ΔNet Social Welfare (XV – ASP Removed and XVI – ASP Still in Effect) (million $) | | | | | | | | | | | | | | | |
| | SITC xxx | VARIANT I: SR $dW_{Net}$ – $TLL_L$ | VARIANT I: LR $dW_{Net}$* | | VARIANT I: d=5% | VARIANT I: d=10% | | S-R $dW_{Net}$ – $TLL_L$ | LR $dW_{Net}$ | VARIANT II | | VARIANT II: d=5% | | VARIANT II: d=10% | | |

VITA

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