OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.

DISCLAIMER

FAIR USE POLICY

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

15049

Distr.
LIMITED
UNIDO/IS.573
25 October 1985
ENGLISH

UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

TARIFF AND NON-TARIFF MEASURES IN THE WORLD TRADE OF PETROCHEMICAL PRODUCTS

(prepared by the UNCTAD secretariat for UNIDO)

Sectoral Working Paper Series

No. 37*/

Karen McCusker

Sectoral Studies Branch
Division for Industrial Studies

*/ This paper is preliminary and not for quotation pending the current review of the data in UNCTAD's data base. The review is scheduled to be completed early next year.

V.85-32561

SECTORAL WORKING PAPERS

In the course of the work on major sectoral studies carried out by the UNIDO Division for Industrial Studies, several working papers are produced by the secretariat and by outside experts. Selected papers that are believed to be of interest to a wider audience are presented in the Sectoral Working Papers series. These papers are more exploratory and tentative than the sectoral studies. They are therefore subject to revision and modification before being incorporated into the sectoral studies.

This paper was prepared by the UNCTAD secretariat as a contribution to the UNIDO study entitled "The petrochemical industry in developing countries - prospects and strategies", UNIDO/IS.572, Sectoral Studies Series No. 20, Vol. I, October 1985.

Foreword

This paper has been prepared by the UNCTAD secretariat for UNIDO's Division for Industrial Studies, Sectoral Studies Branch, in connection with its ongoing activities in the area of the petrochemical industry, a sector in which developing countries are expected to play an increasingly important role in the world's production and trade.

The report reviews recent changes in world trade, discusses tariff and non-tariff obstacles to trade and includes an analysis of the poten ial effects of tariff removal on the market of petrochemical products from developing countries.

The UNCTAD secretariat prepared this paper with the assistance of Ms. Karen McCusker. UNIDO expresses its appreciation for this valued inter-agency co-operation.

Material from this report has been used in the elaboration of chapter 6 of the UNIDO study entitled "The petrochemical industry in developing countries - prospects and strategies", UNIDO/IS.572, Sectoral Studies Series No. 20, Vol. I, October 1985 which is one of the main background documents for the Third Consultation on the Petrochemical Industries, held in Vienna, 2-6 December 1985.

Contents

Tables

I. INTRODUCTION

1. The petrochemical sector, with important backward and forward linkages in an industrialized economy, is concentrated in the developed countries. Highly capital-intensive and requiring large scales of production, the industry is characterized by vertical integration and concentration of market power. While the industry expanded rapidly during the Fifties and Sixties, excess capacity developed during the 1970s and growth in demand in the developed countries has slowed to a 3 to 4 per cent annual rate. On the other hand, the growth in demand for petrochemicals accompanying industrialisation is causing developing countries to start or increase local production of these products.

2. Meanwhile, it is evident that the global dynamics of the petrochemical industry are in a flux. In the North, the industry is scaling-down and undergoing a process of restructuring with an identifiable trend away from bulk chemicals and towards specialty items. As oil prices have risen the proportion of raw material cost in petrochemical production has increased accordingly. Supply considerations are determining the location of production and the oil producers are capitalizing on their resource advantages. In the near future, Canada, with price controls on natural gas, is expected to double its petrochemical output to 6 per cent of world production, with virtually all intended for export sales.

3. Substantial investment in petrochemical plants has recently taken place in developing countries. OPEC's ethylene (the most important petrochemical building block) capacity hs been projected to increase to 4 million tons by the mid-1980s, representing some 40 per cent of developing countries potential production, and 6 per cent of the industrialized world's capacity.[1] By 1990, Saudi Arabia's petrochemical plants could be supplying 10 per cent of Europe's base chemical needs.[2]

4. Closer contact between producers in developed and developing countries is desirable if product development, investment plans and policies are to be realistically formulated.[3] With the maturing of the industry, technological know-how is less of a constraint, and joint ventures, "buy-back" agreements, and equity participation are forms of international co-operation. Developing countries, whose petrochemical consumption is increasing more rapidly than world demand, are in a position to embark on joint projects, such as exchanging surplus engineering skills for access to raw materials or pursuing co-ordinated market development. Given that local markets are generally too small to justify efficient scales of production, and, for oil producers, in particular, the desire to increase the value added in their hydrocarbon exports, access to export markets is critical.

5. In order to provide some insight into problems confronting exporters of petrochemical products, this study reviews patterns of trade flows in the industry, investigates both tariff and non-tariff barriers to trade by product group, and estimates the potential trade expansion effects of liberalization.

---

[1] UNIDO, *World Industry in 1980* Vienna, 1981.

[2] UNIDO, *Opportunities for Co-operation Amongst Developing Countries of the Petrochemicals Industry"*, UNIDO / 15.376, Vienna, March 1983, p.14.

[3] UNIDO, *Industry in a Changing World*, Vienna, 1983, p.322.

II. INTERNATIONAL TRADE IN PETROCHEMICALS

6. As of 1981, total exports of petrochemicals (see annex table A-1 for product coverage) amounted to U.S.$66 billion, accounting for 3.4 per cent of world exports and 5.3 per cent of industrial exports (excluding food and fuels). For developed market economies, petrochemical products represented 6.3 percent of industrial exports; for developing countries, petrochemicals represented 1.4 per cent of industrial exports. By comparison, world trade in mineral fuels (defined as Division 3 of the Standard International Trade Classification) - the raw material for the petrochemicals industry - amounted to U.S.$475 billion, of which the developing countries exported $330 billion (according to the UNCTAD Handbook of International Trade Statistics, 1983). This latter statistic is noteworthy as it intimates the enormous potential for the petrochemical industry in oil-exporting developing countries.

7. Trade in petrochemicals is overwhelmingly dominated by the developed market economies (see table 1). Between 1970 and 1981, their share in world exports declined only marginally from 96.5 to 94.1 per cent. However, exports from the developing countries increased in the same period from 1.3 to 3.2 per cent of global trade. Developing countries account for a much larger share of world imports of petrochemicals, 22.4 per cent in 1981, up from 20.1 per cent in 1970. For the entire 1970-1981 period, developing country exports of petrochemicals grew by 15.5 per cent annually in constant prices while imports grew by 8.6 per cent. Growth was especially rapid in developing countries between 1975 and 1981, when exports grew by 20.5 per cent, annually compounded, more than double the 7.8 per cent export growth rate of developed market economies; imports by developing countries grew more slowly in the same period, by 9.1 per cent. While the export-to-import ratio for developing countries has improved, from 6.8 per cent in 1970 to 13.4 per cent in 1981, developing countries had a trade deficit in petrochemicals of $12 billion in 1981.

Table 1

Trade in petrochemicals for the period 1970-1981
($ US million at current prices)

Origin \ Destination	Year	Developed market-economy countries	Developing countries	Socialist countries
Developed market-economy countries	1970	7 095	1 897	667
	1975	18 417	5 664	2 016
	1980	47 825	14 099	4 630
	1981	44 885	13 559	4 259
Developing countries	1970	58	62	15
	1975	196	228	24
	1980	722	833	64
	1981	969	1 028	105
Socialist countries of Eastern Europe and Asia	1970	160	53	n.a.
	1975	479	166	n.a.
	1980	1 381	321	n.a.
	1981	1 483	315	n.a.

Source: United Nations Commodity Trade Statistics, Series D.

Note: The trade matrix is based on reported exports, except in the case of socialist countries, for which data has been derived from reported imports of other regions.

8. With regard to the direction of trade, the largest share, nearly half, of developing country exports has consistently been to other developing countries, while developing countries have also become a slightly more important market, just over one-fifth, for petrochemical exports from developed market economies (see table 2).

Table 2

Trade flows in petrochemicals by region
1970 and 1981

(percentage share)

Origin \ Destination	Developed market-economy countries	Developing countries	Socialist countries of Eastern Europe	World
Developed market-economy countries				
1970	73.5	19.6	6.9	100.0
1981	71.6	21.6	6.8	100.0
Developing countries				
1970	43.0	45.9	11.1	100.0
1981	46.1	48.9	5.0	100.0

Source : See table 1.

9. The product composition or commodity structure of petrochemical exports differs considerably between the various exporting regions (see table 3). *Organic petrochemicals* and *plastics and synthetic resins* represent the two largest product groups in exports from both developed market economies and developing countries. However, *organic petrochemicals*, whose share in petrochemical exports of developing countries has remained relatively constant, around 60 per cent since 1970, are of greater importance to this region. The leading exporters are Brazil, with nearly 40 per cent of developing country exports, followed by the Republic of Korea, Argentina, Singapore and Yugoslavia. Exports of *plastics and synthetic resins*, accounting for over a quarter of developing country petrochemical exports, have increased substantially to all three world regions. In this group the major exporters are Brazil, Republic of Korea and Yugoslavia, together accounting for nearly three-quarters of developing country exports in 1981.

Table 3

Commodity structure of selected trade flows in petrochemicals

(percentages based on current prices)

PRODUCT GROUP	Developed market-economy country exports to :				Developing country exports to:					
	Other developed market-economy countries		Developing countries		Developed market-economy countries		Other developing countries		Socialist countries	
	1970	1981	1970	1981	1970	1981	1970	1981	1970	1980
Organic petrochemicals	45.3	52.4	51.9	47.8	85.2	84.0	43.8	40.4	18.0	31.2
Synthetic rubbers	6.6	4.6	4.1	4.0	2.7	1.1	6.6	2.7	0.0	0.03
Synthetic fibres	6.8	3.7	8.6	6.6	5.8	2.2	7.9	9.6	0.4	23.4
Plastics and synthetic resins	37.2	36.5	30.8	37.4	6.1	12.2	27.2	37.7	3.7	11.2
Carbon black	0.9	0.6	0.8	0.7	0.0	0.01	4.5	1.7	0.9	0.0
Surfactants	3.4	2.8	4.2	3.8	0.2	0.4	10.6	8.3	78.0	34.5
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source : See table 1.

III. RESTRICTIONS TO TRADE IN THE PETROCHEMICAL INDUSTRY

10. In order that industrialization plans of developing countries may achieve their economic objectives, one of the more important investment criteria is an evaluation of the international trading environment in the particular industry or sector. Hence, an examination of the existing trade barriers in the petrochemicals industry may aid planners in their production and export strategies.

A. TARIFFS

11. A tariff is a tax placed on a product as it enters the country, calculated either as a monetary amount in relation to the volume of goods entered, or as a percentage of the value of the goods as assessed at the point of entry. Comparing levels of tariff protection in various countries is complicated by a lack of detailed computerized tariff-line data on tariffs and trade,[4] although such information is readily available for most developed market economies (DMECs). For developing and socialist countries, only a simple (unweighted) average can be easily computed. A survey of tariffs on petrochemicals in developing countries shows that they average between 20 and 40 per cent, with tariffs on some products in some countries as high as 140 per cent.[5]

12. For the DMECs for which detailed information is available, weighted average tariff rates have also been calculated. That is, a tariff average for each tariff line is calculated using actual trade weights together with the import duty; subsequently the average rate for each tariff line is aggregated to the product group level using weights based on the tariff line's importance in the total imports of a product group. Such an average is widely considered to give an unduly low reflexion of the tariff situation since imports are inversely related to tariff levels.

13. Average (weighted) tariff rates on petrochemicals of nine developed market economies and the EEC (10) are highest against the developing countries, although not for all product groups (see table 4). Thus, the trade-weighted tariff against developing countries' exports of all petrochemicals is 6 per cent, compared to 5 per cent for developed market economy exports. This can in part be ascribed to the preponderance of *organic petrochemicals* in the exports of developing countries, the high tariff rate in Japan[6] which accounts for a large part (nearly one-third) of these imports from developing countries, and the resultant higher weighted average tariff rate of 6.5 per cent on developing countries' imports versus 4.1 per cent for imports of developed market-economy countries. On the other hand, *plastics and synthetic resins* face much lower trade-weighted tariffs coming from developing country exporters than from other regions.

---

[4] The tariff rates used are post-Tokyo Round bound rates or applied rates if there is no binding. For consistent computations it is necessary to use 1976 trade weights.

[5] Tariff information for most DMECs is available to UNCTAD from GATT. Developing country tariff data for developing countries derives from UNCTAD's (UNDP-supported) *Trade Information System (TIS)*. However, trade data at the tariff-line level for developing countries is not presently held in UNCTAD.

[6] It should be noted that Japan has made a series of unilateral reductions in tariffs, to levels lower than the post-Tokyo Round rates, in a wide range of industries. These reductions are not yet registered in the tariff tapes available to UNCTAD. Accordingly, the rates for Japan may be over-estimated in some cases.

Table 4

Weighted average post-Tokyo Round tariff rates facing the imports of PETROCHEMICALS in major developed market-economy countries

(percentages)

PRODUCT GROUP	IMPORTS FROM:		
	Developed market-economy countries	Developing countries	Socialist countries of Eastern Europe & Asia
Organic petrochemicals	4.1	6.5	4.8
Synthetic rubbers	0.5	0.0	0.2
Synthetic fibres	4.3	4.8	5.5
Plastics and synthetic resins	6.0	2.2	6.4
Carbon black	0.6	0.0	0.6
Surfactants	5.4	2.4	7.1
TOTAL	5.0	6.0	4.7

Source : GATT trade and tariff tapes.

14. Imports of *synthetic rubbers* and *carbon black* from developing countries are duty-free in all selected importing markets *Synthetic fibres* are duty-free except in Japan, the United States and Switzerland. Exports of *plastics and synthetic resins* from developing countries encounter particularly high weighted-average tariff rates in Australia (20.9 per cent) and Canada (10.0 per cent). *Surfactants* from developing countries face higher import charges in the markets of Sweden and Austria than do similar imports from other regions. Tariff rates on *organic petrochemicals*, the largest group of petrochemical exports from developing countries, range from zero per cent in the Scandinavian countries to 18.5 percent in Japan (see Annex Table A-2).

15. Except in the markets of Canada and Japan, developing country exporters of petrochemicals face lower tariffs, due to the Generalized System of Preferences (GSP), in the major developed market economies, compared to either developed market economies or the socialist countries. Tariffs on imports from GSP beneficiaries range from zero per cent in Norway and Sweden to 9.0 per cent in Canada and 16.6 per cent in Japan. The range for non-preference-receiving countries is from 0.1 per cent in Finland to 19.4 per cent in Japan (see table 5).

Table 5

An impact of the GSP reductions on the weighted average tariff rates facing imports of PETROCHEMICALS from developing countries

(percentages)

	Weighted average post-Tokyo Round tariff rate	
	Including GSP	Not including GSP
Australia	3.9	5.1
Austria	2.5	1.8
Canada	9.0	9.2
EEC	0.8	6.3
Finland	0.1	0.1
Japan	16.6	19.4
Norway	0.0	3.0
Sweden	0.0	5.1
Switzerland	0.2	0.9
United States	1.8	5.3
TOTAL	6.0	9.8

Source: See table 4.
Note: A higher rate including the GSP occurs if imports from developing countries mainly fall under those sub-items with higher duties.

B. NON-TARIFF MEASURES

16. While the role of tariffs as trade barriers has been declining due to a series of multilateral negotiations, the application of non-tariff measures and their restrictive effects has become more intensive in both absolute and relative terms. Governments find it easier to utilize such measures rather than tariffs which have been progressively liberalized especially in the DMECs and which are subject to more rigorous international commitments. The concept of non-tariff measures embraces all types of governmental non-tariff measures which have an actual or potential effect on trade flows. By introducing unequal treatment between domestic and foreign goods of the same or similar production, those measures which actually create distortions in trade flows in this way (e.g. by restricting volume or price of imported products) are known as non-tariff barriers or non-tariff distortions.

17. Non-tariff distortions create uncertainty and curtail transparency in the international trading system; in general they are considered more detrimental than tariffs for the international commmunity. From the viewpoint of international price stability, a tariff is preferable to a quantitative restraint, since, under a fixed import quota, demand is insensitive to changes in world prices. Under tariffs, domestic firms are still faced with the threat of foreign competition if their prices become excessive. However, where a quota is applied, this competitive stimulus is missing, since this sets a limit on the extent of potential entry of foreign firms.[7]

18. In assessing the trade-restrictive effects of non-tariff barriers or distortions, various measures can be employed. If the direct price effects can be determined, for example in the case of a minimum import price or variable levy, the ratio of the import charge to the final price of the product provides a fairly reliable estimate of the "ad valorem" equivalent of the non-tariff barrier. In cases

[7] See A. Yeats, *Trade Barriers facing Developing Countries*,, London, Macmillan Press, 1979.

where such "ad valorem" equivalents cannot be derived, other indicators must be used. These include a *frequency index* which shows the ratio, in percentage terms, of the four-digit CCCN product groups affected by the given measure to the total number of four-digit CCCN product groups in the category; however, no relationship appears to exist between the frequency of application and the "ad valorem" incidence of a non-tariff measure. Another indicator is the *trade coverage index* which gives the ratio of the value of trade affected by NTMs to the total value of trade in the product group. This index suffers from the fact that items which are subject to very restrictive trade measures are automatically accorded zero or very low weights in the overall index value leading to a lower estimate.

19. With regard to types or categories of non-tariff measures affecting trade in petrochemicals, quantitative restraints, such as prohibitions, authorizations and quotas, on imports of petrochemicals appear to be more prevalent than price controls.[8] It may be noted from table 6 that volume-restraining measures affect a larger share of imports from developing countries than from developed market-economy countries, but price controls are relatively more important with respect to imports from developed market-economy countries.

Table 6

Categories of non-tariff measures applied by major developed market-economy countries to PETROCHEMICAL imports

Category of non-tariff measure	Affected share of imports (%) coming from:		
	Developed market-economy countries	Developing countries	Socialist countries of Eastern Europe & Asia
All measures, of which:	9.0	12.2	13.2
Control of price levels	2.0	0.9	6.9
Control of volume level	7.0	11.3	6.3

Source : UNCTAD Data Base on Trade Measures (preliminary: subject to revision later in 1985).

20. The *frequency* and *trade coverage* indices of non-tariff measures applied to petrochemicals is highest in the case of imports from socialist countries and lowest for developed market economies. In terms of *trade coverage* non-tariff measures applied by major developed market-economy countries are higher against developing countries than imports from the rest of the world; such measures affect 12.2 per cent of imports from developing countries, versus only 9.0 per cent of imports from developed market economies (see tables 7.1 and 7.2). This is due to high trade coverage of NTMs in *organic petrochemicals*, affecting 13.4 per cent of imports from

---

[8] Information on non-tariff measures is taken from the UNCTAD Data Base on Trade Measures, which may be considered to consist of a system of interlinking data sets, both computerized and non-computerized, including information on trade, tariffs, product-specific NTMs and general trade measures. Tariff information is held on all developed market-economy countries and 21 developing countries. Trade information is currently held for the developed market-economy countries and steps are being taken to obtain national tariff-line trade information for developing countries. Information on non-tariff measures (NTMs) is currently held - in different stages of completeness - on 57 countries, but at present the computerized records contain information on product-specific measures in only 51 developed and developing countries.

developing countries and 12.7 per cent of imports from developed countries. Non-tariff measures in this product category cover a particularly large share of imports in Japan and Switzerland (see annex table A-3 (a)). Non-tariff barriers on *plastics and synthetic resins* impact a large share of imports into Italy and Switzerland (see annex table A-3 (c). Imports of *synthetic fibres* from developing countries, which experience relatively high tariff rates, are not affected by NTMs (see annex, table A-3(b)). Amongst the product groups of lower trade value, all of Switzerland's imports of *surfactants* and the United States' imports of *carbon black* from developing countries are affected by non-tariff measures.

Table 7.1

Frequency (F) and trade coverage (V) of non-tariff measures applied by major developed market-economy countries

(percentages)

PRODUCT GROUP	IMPORTS FROM:					
	Developed market-economy countries		Developing countries		Socialist countries Eastern Europe/Asia	
	(F)	(V)	(F)	(V)	(F)	(V)
Organic petrochemicals	3.7	12.7	5.8	13.4	9.4	7.0
Synthetic rubbers	0.2	3.0	0.0	0.0	0.0	0.0
Synthetic fibres	3.3	2.9	0.0	0.0	30.1	19.0
Plastics and synthetic resins	4.6	3.3	7.4	8.6	11.5	20.6
Carbon black	0.0	0.0	8.3	55.0	0.0	0.0
Surfactants	3.1	11.8	2.9	0.4	0.0	0.0
TOTAL	3.9	9.0	6.0	12.2	9.9	13.2

Source: UNCTAD Data Base on Trade Measures (1983 trade data) (preliminary: subject to revision later in 1985).

Table 7.2

Estimates of the frequency (F) and trade coverage (V) indices for non-tariff measures applied by selected developed market-economy countries to imports of PETROCHEMICAL products

IMPORTING MARKET	IMPORTS FROM:					
	Developed market-economy countries		Developing countries		Socialist countries	
	(F)	(V)	(F)	(V)	(F)	(V)
Austria	0.9	0.09	0.0	0.0	0.0	0.0
Belgium-Luxembourg	1.2	1.8	1.0	0.02	8.0	24.0
Denmark	0.3	0.04	6.3	7.3	6.7	11.3
France	3.1	5.7	5.8	6.7	8.9	12.4
Fed.Rep.of Germany	1.0	2.9	0.6	5.0	3.6	14.6
Italy	22.5	24.3	19.6	16.9	32.7	19.3
Japan	4.8	15.6	8.8	25.9	16.0	20.4
Netherlands	1.0	5.5	0.6	0.7	7.3	8.2
Norway	0.0	0.0	0.0	0.0	0.0	0.0
Sweden	0.4	0.6	0.0	0.0	0.0	0.0
Switzerland	21.5	34.6	33.3	52.6	31.1	31.7
United Kingdom	0.9	1.9	0.5	0.3	2.9	9.9
United States	0.6	3.6	1.3	1.2	1.0	0.02
TOTAL	3.9	9.0	6.0	12.2	9.9	13.2

Source: See table 7.1

IV. POTENTIAL TRADE EXPANSION EFFECTS FROM TRADE LIBERALIZATION

21. Due to a lack of detailed and comprehensive statistics on trade and obstacles to trade, only a partial and tentative evaluation of the effects of trade liberalization can be attempted. This assessment, using a partial equilibrium trade model, estimates the potential expansion of imports into major developed market economies resulting from the elimination of post-Tokyo Round MFN tariff rates.

22. Tariff removal is assumed to boost demand for imports by reducing the domestic price of the imported good and resulting in *trade creation*, the degree of which is determined by (i) each product's price elasticity of import demand, (ii) the percentage change in price induced by the removal of tariffs and ad valorem equivalents of NTBs and (iii) the base period import level. As, however, individual exporters are not faced with the same duties - in particular preference-receiving countries being subject to lower duties - the elimination of tariffs will result in changes in the relative domestic prices of imports from different sources and, hence, give rise to another effect, *trade diversion*, which worsens the competitive position of suppliers who previously enjoyed a tariff preference.

23. As can be seen from tables 8 and 9, total trade expansion in petrochemical products if tariffs and "ad valorem" equivalents of non-tariff barriers are removed would amount to U.S.$ 1.7 billion for the world and U.S.$385 million for developing, or preference-receiving, countries (in 1980 dollars). Combined imports of the EEC (10), the United States and Japan would increase by 8.1 per cent from developing countries and by 10.8 per cent from non-preference-receiving, or developed, countries. Since preferential treatment has also been eliminated, the developed countries would understandably benefit to a greater extent from trade liberalization. In addition, the trade expansion effect of the elimination of non-tariff barriers has been assumed to impact only the developed countries (see note (c) to table 8).

24. The percentage trade expansion is higher for imports from developed countries in the markets of the United States and the European Economic Community, although not in Japan where imports from developing countries would show a slightly larger percentage increase. (It should be kept in mind that for Japan no NTB equivalents have been computed which thus, presumably, underestimates the total value of simulated trade creation.)

25. *Organic petrochemicals* and *plastics and synthetic resins* account for over ninety per cent of the imports from preference-receiving countries into these three markets. Trade expansion in the former product group would amount, solely from the elimination of tariffs, to $221 million for developing countries. By market, this implies a 7.4 per cent increase (over 1980 import levels) in imports by Japan, a 7.1 per cent rise in imports by the EEC and a 4.4 per cent increase in the imports of the United States. Trade liberalization would similarly increase imports of *organic petrochemicals* from developed countries by 5.9 per cent in Japan, 10.6 per cent in the EEC and 7.7 per cent in the United States; in the latter market, including the effect from removal of NTBs boosts imports by an additional 0.9 per cent.

26. In the case of *plastics and synthetic resins*, tariff removal expands imports into the EEC by 12.4 per cent for developing countries and 16 per cent for developed countries. In Japan, imports would increase by 16.3 per cent and 13.7 per cent from developing and developed countries, respectively, while in the United States market, imports from developing countries would actually decline slightly ('negative' trade creation due to trade diversion), although from developed countries they would increase by 6.7 per cent.

Table 8

Estimates of trade effects from the removal of post-Tokyo Round trade barriers

(values in 1980 US dollars)

IMPORTING MARKET	Trade creation from removal of:			Trade diversion a_/		Net trade expansion	
	Tariffs		NTBs b_/				
	Developed countries	Developing countries	All trading partners c_/	Developed countries	Developing countries	Developed countries	Developing countries
European Economic Community d_/	582	351	171	+ 24	- 24	777	327
United States	290	11	51	+ 2	- 2	342	9
Japan	193	52	n.a.	+ 3	- 3	196	49
TOTAL	1 065	414	222	+ 29	- 29	1 315	385

Source: UNCTAD Data Base on Trade Measures

Notes: The results are computed using the UNCTAD Trade Policy Simulation Model (see Appendix I). 'Developed countries' indicates non-preference-receiving countries; 'developing countries' are equivalent to preference-receiving countries.

a/ Trade diversion: potential gains to non-preference-receiving countries and potential losses to preference-receiving countries. Refers only to elimination of tariff preferences under the GSP. Informtion on the differential incidences of NTBs in ad valorem terms on developed and developing countries is not available.

b/ Trade created by the removal of NTBs is under-estimated as it has not been possible to compute ad valorem equivalents for all products and for all countries.

c/ The estimates are also based on computing the average price disadvantages in the importing country against world supplies as a whole (although there would normally be variations in the price disadvantages against different sources). Accordingly, results are not shown for developed and developing countries. However, an inspection of the NTM coverage in the UNCTAD Data Base suggests that developed countries would be the main beneficiaries of NTB removal. Accordingly in the columns on net trade expansion, the whole gain from NTB removal has been attributed to the developed countries.

d/ Relates only to external trade of the EEC, and not trade among members of the EEC.

Table 9

Estimated trade expansion effects in petrochemicals

(1980 million US dollars)

IMPORTS FROM:	E E C		United States		Japan	
	1980 imports	percentage increase	1980 imports	percentage increase	1980 imports	percentage increase
DEVELOPED COUNTRIES						
Total petrochemicals	5 491	14.2	3 961	8.6	2 682	7.3
of which:						
Organic petrochemicals	3 247	10.6	2 839	8.6	1 971	5.9
Plastics, syn.resins	1 438	16.0	1 041	6.7	543	13.7
DEVELOPING COUNTRIES						
Total petrochemicals	3 822	8.6	365	2.5	556	8.8
of which:						
Organic petrochemicals	2 556	7.1	205	4.4	418	7.4
Plastics, syn.resins	1 136	12.4	157	0.0	100	16.0

Source and notes: see table 8

V. SUMMARY AND CONCLUSIONS

27. With increasing industrialization, the developing countries are expanding their share of world trade in petrochemicals. Between 1970 and 1981, their exports grew from 1.3 to 3.2 per cent of world petrochemical exports and their imports from 20.1 to 22.4 per cent of world imports. The most recent data available for 1983 shows that imports of petrochemicals by developed market economies from developing countries were nearly U.S.$ 2 billion; this represented 4 per cent of DMECs petrochemical imports, a substantial gain in terms of import penetration compared to a one per cent share in 1975.

28. Within the industry, the product groups *organic petrochemicals* and *plastics and synthetic resins* represent the largest share of world petrochemical exports: 50.5 and 36.5 per cent respectively for developed market economies and 60.4 and 26.3 per cent for developing countries (1981 data). Nearly half of the developing country exports are destined for other developing countries, while only one-fifth of the developed market economy exports are to developing countries.

29. Regarding restrictions to trade, average trade-weighted tariffs in the major developed market economy countries are 6.0 per cent on petrochemical imports from developing countries compared to 5.0 per cent on imports from other developed market economies. However, without the Generalized System of Preferences, average tariffs would be 9.8 per cent on imports from developing countries. Developing country tariffs are generally higher than those of the DMECs. As far as non-tariff measures are concerned, their real measurement is difficult and subject to uncertainty. What the *trade coverage* index shows is that, as with tariffs, petrochemical imports from developing countries are affected by NTMs to a greater extent than those from developed market economies. That is, 12.2 percent of imports from developing countries are covered by NTBs while 9 per cent of imports from developed market-economy countries are affected.

30. Using UNCTAD's Trade Policy Simulation Model (see Appendix), the trade expansion effects of a removal of trade barriers can be estimated. Based on 1980 import levels, petrochemical imports by the EEC, the United States and Japan would increase by 10.8 per cent from developed countries and 8.1 per cent from developing countries and create an additional US $ 1.7 billion in trade (this of course does not take into account the multiplier effects on trade). Since preferential treatment has been eliminated, developed countries benefit from trade liberalization more than do developing, or preference-receiving, countries. In sum, while the effects of trade liberalization are impressive, it should be kept in mind that they are merely tentative results, based on partial evidence, and may well be conservative estimates.

APPENDIX I

THE UNCTAD TRADE POLICY SIMULATION MODEL

A brief description

Introduction

31. The model used by UNCTAD to estimate various effects of commercial policy changes, including changes in tariff rates and the incidence of non-tariff distortion of international trade, may be described technically as an *ex ante* partial equilibrium model, measuring the first-round effects of the simulated policy changes.[9] The UNCTAD model is in the same class of model as that used by Cline *et al.* at The Brookings Institution to analyze the effects of the Tokyo Round and by Sapir and Baldwin to analyze the effects of the Tokyo Round on India.[10]

32. Prior information on elasticities, the *ad valorem* equivalent of non-tariff distortions, etc. has been taken from other studies.[11] In the present study the results are based on infinite elasticity of supply. Sensitivity tests showed that less elastic supplies would reduce export volume but increase prices to the extent that revenue was substantially maintained.

The notation

33. The basic model can be described in a series of equations and identities from which the formulation for the simulations is derived. First the notation is given:

M - imports
X - exports
P - price
Y - national income
Em - elasticity of import demand with respect to domestic price
TC - trade creation
TD - trade diversion
i - subscript denoting commodity
j - subscript denoting domestic/importing country data
k - subscript denoting foreign/exporting country data
(In certain expression the subscript K is used to denote data for an alternative foreign/exporting country)
d - prefix denoting change
Mn - imports from non-preference-receiving countries
V - output in the importing country
t - tariff rate or non-tariff distortion (in *ad valorem* terms)

---

[9] Partial equilibrium models are vulnerable to the criticism that they do not take account of the economy-wide effects of changes. However, currently operational general equilibrium models do not provide the kind of detail possible in partial equilibrium models. General equilibrium models are also vulnerable to criticisms regarding the extensive underlying assumptions.

[10] Cline, W.R., *Trade Negotiations in the Tokyo Round - A Quantitative Assessment* (The Brookings Institution, Washington, D.C., 1978). Sapir, A. and Baldwin, R.E., "India and the Tokyo Round", *World Development*, Vol.II, No. 7, 1983.

[11] See, especially, Stern, R.M. *et al.*, *Price Elasticities in International Trade*, (London: Macmillan, for the Trade Policy Research Centre 1975)

The basic model

34. The importing country j's import demand function for commodity i produced in country k may be expressed in quantity terms as:

(1) $$M_{ijk} = F(Y_j, P_{ij}, P_{ik})$$

35. The producer/exporting country k's export supply function for commodity i may be expressed in quantity terms as:

(2) $$X_{ijk} = F(P_{ikj})$$

36. Expressions (1) and (2) are related by the following identity:

(3) $$M_{ijk} = X_{ijk}$$

37. Assuming that in a free trade situation the domestic price of the commodity i in the importing market j will be equal to exporting country k's export price plus transport and insurance charges, it follows that this price will rise by an amount equivalent to the *ad valorem* incidence of any tariff or non-tariff distortion applied to the good. Thus:

(4) $$P_{ijk} = P_{ikj}(1+t_{ijk})$$

38. It is also clear that the export revenues earned by k are:

(5) $$R_{ikj} = X_{ikj} \cdot P_{ikj}$$

Trade creation

39. The *trade creation* effect is the increased demand in country j for commodity i from exporting country k resulting from the price decrease associated with the assumed full transmission of price changes when tariff or non-tariff distortions are reduced or eliminated.

40. Given the basic model consisting of expressions (1) to (5), it is possible to write the basic formula for trade creation. First, from expression (4) it is possible to derive the total differential of domestic price with respect to tariffs and foreign price:

(6) $$dP_{ijk} = P_{ikj} \cdot dt_{ijk} + (1+t_{ijk}) \cdot dP_{ikj}$$

41. Now, the standard expression for the elasticity of import demand with respect to the domestic price can be re-arranged as follows:

(7) $dM_{ijk}/M_{ijk} = Em.(dP_{ijk}/P_{ijk})$

42. Substituting from expression (4) and (6) into expression (7) gives:

(8) $dM_{ijk}/M_{ijk} = Em.(dt_{ijk}/(1+t_{ijk})+dP_{ijk}/P_{ikj})$

43. The standard expression for the elasticity of export supply with respect to the world price can be re-arranged as follows:

(9) $dP_{ikj}/P_{ikj} = (dX_{ikj}/X_{ikj})/Ex$

44. From expression (3) it follows that

(10) $dM_{ijk}/M_{ijk} = dX_{ikj}/X_{ikj}$

45. Substituting expression (10) into (9) and the result into (8) produces the expression that can be employed to compute the trade creation effect. From expression (3) this is equivalent to exporting country k's growth of exports of commodity i to country j. The expression for *trade creation* can be written:

(11) $TC_{ijk} = M_{ijk}.Em.(dt_{ijk}/(1+t_{ijk})/(1-(Em/Ex))$

46. It may be noted that if the elasticity of export supply with respect to the world price is infinite then the denomimator on the right hand side of expression (11) becomes unity and can be ignored.

Trade diversion

47. Following standard practice, the term *trade diversion* is used to account for the tendency of importers to substitute goods from one source to another in response to a change in the import price of supplies from one source but not from the alternative source. Thus, if prices fall in one overseas country there will be a tendency to purchase more goods from that country and less from countries whose exports are unchanged in price. Trade diversion can also occur not because of the change in the export price as such but because of introduction or elimination of preferential treatment for goods from one (or more sources) while treatment for goods from other sources remains unchanged. Again there could be simply a *relative* change in the treatment of the goods from different sources in the importing country by differential alterations in the treatment of different foreign suppliers.

48. If the elasticity of substitution between alternative suppliers is not known then it is still possible to compute the trade diversion effect using a formulation developed by Baldwin and Murray[12] However, for this approach it is necessary to be able to calculate the level of import penetration by non-preference-receiving countries, i.e. the level of imports from non-preference-receiving countries in appar-

[12] Baldwin, R.E. and Murray, T. "MFN tariff reductions and developing country trade benefits under the GSP", *The Economic Journal", 87, March 1977.*

ent domestic consumption (defined as domestic output of commodity i *plus* imports of commodity i *less* exports of commodity i).[13] The formulation for trade diversion can then be written:

$$(13) \qquad TD_{ijk} = TC_{ijk} \cdot (Mn_{ij}/V_{ij})$$

49. This formulation assumes "the substitutability between a developing country product and a similar product produced in non-beneficiary |i.e. non-preference-receiving| countries should be similar to the substitutability between a developing country product and a similar product produced in the donor |importing| country" (*Id.*).

The total trade effect

50. The total trade effect is obtained simply by summing together the trade creation and trade diversion effects. Results can be summed for the importer across product groups and/or across sources of supply. Results can be summed across groups of importers for single products or groups of products as well as for single sources of supply or for groups of suppliers. Results can also be summed for suppliers across product groups. Finally, results can be summed for groups of suppliers either for individual products or across product groups.

[13] In the present study market penetration ratios were taken from the World Bank Market Penetration Project, whose results were kindly made available to UNCTAD.

Annex - Table A - 1

PRODUCT COVERAGE

SITC (Rev)	CCCN	Product coverage
512	1510, 1511 2208 2901-2940 2943, 2945	Organic chemicals, e.g. ethylene, benzene, styrene, methane, et.al.
599.75	3814	Anti-knock preparations
Synthetic rubbers		
231.2	4002	Synthetic rubber and rubber substitutes
599.76	3815	Prepared rubber accelerators
Synthetic fibres		
266.2 (excl. 266.23)	5601A	Discontinuous synthetic fibres, not carded or combed; continuous filament tow for the manufacture of discontinuous synthetic fibres
266.3 (excl. 266.33)	5602A	Discontinuous regenerated fibres, not carded or combed; continuous filament tow for the manufacture of discontinuous regenerated fibres
Plastics and synthetic resins		
581 (excl. 581.3, 581.91 and 581.92)	3901, 3902 3906	Products of condensation, polycondensation and polyaddition; products of polymerization and co-polymerization; other artificial plastic materials (e.g. polyethylene, polyvinylchloride, (PVC) etc.)
Carbon black		
513.27	2803	Carbon black, etc.
Surfactants		
554.2	3402	Surface-acting agents and washing preparations

Table A-2

Weighted average post-Tokyo Round tariff rates facing imports of petrochemicals from developing countries (1), developed market-economy countries (2) and the socialist countries of Eastern Europe and Asia (3)

	Australia			Austria			Canada			EEC			Finland		
Product group	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Organic petrochemicals	0.6	1.4	1.1	1.7	2.3	1.1	9.0	5.3	5.4	9.9	4.8	5.6	0.0	1.0	1.9
Synthetic rubbers	0.0	2.2	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.1	0.2	0.0	0.0.	0.0
Synthetic fibres	0.0	1.6	7.5	0.0	1.9	0.1	0.0	8.4	8.5	0.0	4.8	6.2	0.0	0.4	3.0
Plastics and synthetic resins	20.9	10.3	6.3	5.1	7.5	7.3	10.0	7.5	6.2	0.6	6.5	8.5	0.6	2.0	0.5
Carbon black	0.0	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0.	0.0
Surfactants	0.0	9.1	0.0	9.3	8.1	8.9	11.6	12.0	0.0	0.0	3.8	6.7	0.0	8.6	3.1
TOTAL	3.9	4.6	1.2	2.5	5.4	1.9	9.0	6.4	5.5	0.8	5.1	5.3	0.1	1.8	1.3

	Japan			Norway			Sweden			Switzerland			United States		
Product group	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Organic petrochemicals	12.5	6.4	4.5	0.0	4.8	4.2	0.0	3.6	4.2	0.2	0.4	0.5	1.8	6.6	7.8
Synthetic rubbers	0.0	0.4	0.0	0.0	2.9	0.3	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.5.	0.0
Synthetic fibres	10.0	10.0	0.0	0.0	2.4	3.2	0.0	1.5	3.2	1.1	2.9	3.5	5.3	5.7	4.9
Plastics and synthetic resins	0.0	6.2	1.4	0.0	14.7	10.6	0.0	9.4	9.5	0.9	1.2	0.4	0.0	5.6	0.1
Carbon black	0.0	5.8	5.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0.	0.0
Surfactants	0.0	6.9	0.0	0.0	21.4	20.0	7.0	6.1	6.5	1.0	2.3	2.3	3.6	5.0	4.5
TOTAL	16.6	6.2	4.2	0.0	11.9	3.5	0.0	6.9	4.5	0.2	0.8	0.5	1.8	6.0	6.0

Source: GATT trade and tariff tapes.

Table A-3 (a)

Estimates of the frequency (F) and trade coverage (V) indices for non-tariff measures applied by selected developed market-economy countries to imports of ORGANIC PETROCHEMICALS

IMPORTING MARKET	IMPORTS FROM:					
	Developed market-economy countries		Developing countries		Socialist countries	
	(F)	(V)	(F)	(V)	(F)	(V)
Austria	0.7	0.04	0.0	0.0	0.0	0.0
Belgium-Luxembourg	1.6	20.0	1.5	0.02	4.5	2.3
Denmark	0.5	0.04	9.4	7.8	4.9	1.0
France	4.1	7.9	9.2	7.6	8.8	9.3
Fed.Rep.of Germany	1.4	5.3	1.0	5.8	3.1	3.2
Italy	3.0	10.2	2.7	1.3	25.7	19.0
Japan	8.6	21.5	16.0	32.7	20.4	24.3
Netherlands	1.6	7.3	0.8	0.07	3.2	1.3
Norway	0.0	0.0	0.0	0.0	0.0	0.0
Sweden	0.0	0.0	0.0	0.0	0.0	0.0
Switzerland	28.9	54.7	38.6	53.2	37.5	46.7
United Kingdom	1.2	2.6	0.8	0.3	1.8	3.8
United States	0.6	4.0	0.3	1.1	0.6	0.02
TOTAL	3.7	12.7	5.8	13.4	9.4	7.0

Source : See table 7.

Table A-3 (b)

Estimates of the frequency (F) and trade coverage (V) indices for non-tariff measures applied by selected developed market-economy countries to imports of SYNTHETIC FIBRES

IMPORTING MARKET	IMPORTS FROM:					
	Developed market-economy countries		Developing countries		Socialist countries	
	(F)	(V)	(F)	(V)	(F)	(V)
Austria	0.0	0.0	0.0	0.0	[illegible]	0.0
Belgium-Luxembourg	9.1	12.7	0.0	0.0		100.0
Denmark	0.0	0.0	0.0	0.0	.0	0.0
France	7.4	4.2	0.0	0.0	.0	0.0
Fed.Rep.of Germany	5.2	0.6	0.0	0.0	0.0	0.0
Italy	7.1	8.1	0.0	0.0	91.7	32.8
Japan	0.0	0.0	0.0	0.0	0.0	0.0
Netherlands	3.8	0.08	0.0	0.0	77.8	39.6
Norway	0.0	0.0	0.0	0.0	0.0	0.0
Sweden	0.0	0.0	0.0	0.0	0.0	0.0
Switzerland	0.0	0.0	0.0	0.0	0.0	0.0
United Kingdom	5.3	6.6	0.0	0.0	0.0	0.0
United States	2.9	2.9	0.0	0.0	0.0	0.0
TOTAL	3.3	2.9	0.0	0.0	30.0	19.0

Source : See table 7.

Table A-3 (c)

Estimates of the frequency (F) and trade coverage (V) indices for non-tariff measures applied by selected developed market-economy countries to imports of PLASTICS AND SYNTHETIC RESINS

IMPORTING MARKET	IMPORTS FROM:					
	Developed market-economy countries		Developing countries		Socialist countries Eastern Europe/Asia	
	(F)	(V)	(F)	(V)	(F)	(V)
Austria	1.7	0.1	0.0	0.0	0.0	0.0
Belgium-Luxembourg	0.4	0.05	0.0	0.0	10.0	51.0
Denmark	0.2	0.08	0.0	0.0	13.0	32.6
France	1.6	2.0	1.4	0.2	11.8	32.1
Fed.Rep.of Germany	0.3	0.7	0.0	0.0	6.4	43.4
Italy	55.2	62.8	58.1	87.0	60.4	76.7
Japan	0.0	0.0	0.0	0.0	0.0	0.0
Netherlands	0.2	1.9	0.0	0.0	15.2	32.3
Norway	0.0	0.0	0.0	0.0	0.0	0.0
Sweden	0.5	1.1	0.0	0.0	0.0	0.0
Switzerland	3.0	9.8	8.7	33.2	5.6	1.7
United Kingdom	0.1	0.7	0.0	0.0	8.0	45.1
United States	1.3	2.1	2.5	0.4	4.2	0.02
TOTAL	8.6	3.3	7.4	8.6	11.5	20.6

Source : See table 1.

For the guidance of our publications programme in order to assist in our publication activities, we would appreciate your completing the questionnaire below and returning it to UNIDO, Division for Industrial Studies, D-2119, P.O. Box 300, A-1400 Vienna, Austria

---

Q U E S T I O N N A I R E

Tariff and non-tariff measures in the world trade of petrochemical products

		(please check appropriate box) yes	no
(1)	Were the data contained in the study useful?	☐	☐
(2)	Was the analysis sound?	☐	☐
(3)	Was the information provided new?	☐	☐
(4)	Did you agree with the conclusion?	☐	☐
(5)	Did you find the recommendations sound?	☐	☐
(6)	Were the format and style easy to read?	☐	☐
(7)	Do you wish to be put on our documents mailing list?	☐	☐
		If yes, please specify subjects of interest	
(8)	Do you wish to receive the latest list of documents prepared by the Division for Industrial Studies?	☐	☐

(9) Any other comments?

Name:
(in capitals) .....

Institution:
(please give full address) .....

Date: .....