

**THE UNCTAD TRADE POLICY
SIMULATION MODEL**

**A note on the methodology,
data and uses**

Sam Laird and Alexander Yeats

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PREFACE

This note has been prepared in response to numerous requests from individual member States of UNCTAD, from other international organizations and from academic institutions for detailed information on the methodology and the data used in the UNCTAD Trade Policy Simulation Model (TPSM).

The model has been used principally in connection with UNCTAD's work on protectionism and structural adjustment as well as in evaluating various proposals for a Global System of Trade Preferences (GSTP) among developing countries. The results have been published mainly in the *Trade and Development Report*, various documents for UNCTAD's Trade and Development Board and technical working notes on the GSTP. For technical reasons, it was not possible to give a full description of the model and data sources in such documents which are of a policy nature and restricted in size.

The model has also been used to provide information on the direct trade effects of various possible trade liberalization scenarios to member States of UNCTAD and other international organizations, notably UNIDO and the World Bank. In this connection, it is felt that the model will be of major practical importance in helping developing countries to assess quantitatively the implications of proposals for trade liberalization in any future multilateral trade negotiations (MTN), or to assist in evaluating the likely effects of changes in developed countries' generalized system of preference (GSP) schemes. In addition, the UNCTAD secretariat has employed the model in quantifying the potential for alleviating developing country debt burdens through trade liberalization initiatives.

The work on the model is ongoing, both with respect to the updating of the data and to the model itself. The present note, therefore, is representative only of the current situation (April 1986). Future readers are invited to consult the authors concerning revisions.

Comments on data and methodology are welcomed, particularly suggestions for improvement. The authors would also appreciate hearing from researchers who are conducting studies into the restrictiveness of non-tariff barriers.

¹ The authors are Economic Affairs Officers, in UNCTAD, Geneva. The views expressed in this paper are those of the authors and do not necessarily reflect the views of the United Nations, or its staff.

INTRODUCTION

1. 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. (See Annex I for a full technical description). The UNCTAD model is in the same class as that used by Cline *et al.* at The Brookings Institution to analyze the effects of the Tokyo Round, by the International Monetary Fund to quantify the effects of trade liberalization initiatives on developing country export earnings, and by Sapir and Baldwin to analyze the effects of the Tokyo Round on India.²

2. The most important calculations in the simulations relate to the direct trade effects. Two distinct effects are calculated:

- (1) **The trade creation** (or loss) effect resulting from the changed level of domestic demand for imports from a particular trading partner caused by the changed price of the imported good after the tariff change or relative to the price of the domestically produced substitute (it is assumed that the price change would fully reflect the tariff change, i.e. that the benefits of the tariff change would be passed on to consumers); and
- (2) **The trade diversion** effect - the substitution of goods coming from one set of foreign suppliers for goods from another set of foreign suppliers. This results from the changes in the relative import prices (after payment of duties) of goods from the different sets of foreign suppliers as a consequence of changes in the differential in the rates which they face. This can occur through changes in the MFN rate, the preference rate, if any, or both. If a preference rate for one set of countries is introduced or reduced while the other set of countries continues to face

² Gine, W.R., *Trade Negotiations in the Tokyo Round - A Quantitative Assessment* (The Brookings Institution, Washington, D.C., 1978); International Monetary Fund, *Effects of Increased Market Access on Selected Developing Country Export Earnings: An Illustrative Exercise*. (DM/84/54), Washington, D.C., 24 August, 1984). Sapir, A. and Baldwin, R.E., "India and the Tokyo Round", *World Development*, Vol.II, No.7, 1983. For a non-technical discussion of the use of such models for evaluating the effects of various trade liberalization proposals, see Robert Stern, 'Evaluating Alternative Formulae for Reducing Industrial Tariffs', *Journal of World Trade Law*, 10 (Jan: Feb. 1976), pp.50-64.

the MFN rate, then there is positive trade diversion in favour of the preference-receiving countries and negative trade diversion for the other set of countries.

3. The trade creation and trade diversion effects are summed to provide the net effect in each market for each partner country, whether or not preference-receiving. An important assumption needs to be mentioned: that any other limitations on the growth of imports (e.g. non-tariff barriers or limits on GSP treatment) would be lifted to the extent necessary to permit the projected tariff-induced trade expansion to take place. If these limitations were maintained, then the trade volume would not rise to the extent predicted, and quota rents, for example, would increase.

4. The model can also be used directly to compute the price, revenue and welfare effects from trade liberalization. Together with data from UNIDO's Data Base on Industrial Statistics, it has also been used to estimate the direct trade effects of liberalization on output and employment. There is scope for further development in this respect.

5. Partial equilibrium models are vulnerable to the criticism that they do not take account of the economy-wide effects of changes, although they can be extended to approximate the results of inter-industry effects and the maintenance of equilibrium in the balance of trade. Theoretically, general equilibrium models are more satisfactory, since they also take account of second-round effects, such as inter-industry effects and exchange rate effects.³ They, therefore, provide valuable insights into the inter-action of a large number of economic variables. However, they are also vulnerable to criticisms regarding the extensive underlying assumptions, and the results obtained using such models are very sensitive to changes in these assumptions. There are a number of problems associated with working versions of this modelling approach, not the least of which is the loss of detail which arises because it is necessary to work in large aggregates to make such models computable at reasonable cost.

6. Although the partial equilibrium approach has a number of drawbacks, as a modelling approach it has the advantage of working at a very fine level of detail. For example, in most studies

³ One of the more comprehensive models of this type is the *Michigan Model of World Production and Trade*, a description of which can be found in Deardorff, A.V., and Stern, R.M. *The Michigan Model of World Production and Trade: Theory and Applications*, M.I.T. Press, Cambridge, Mass., 1986. For an example of the use of this model to examine the impact of complete elimination of the post-Tokyo Round tariffs, see Deardorff, A.V. and Stern, R.M.. 'The economic effects of the complete elimination of post-Tokyo Round tariffs', in *Trade Policy in the 1980s* Cline, W.R.(ed.), Institute for International Economics. Washington D.C. 1983.

carried out at UNCTAD, tariff line information is used. This is extremely detailed, depending on the detail of the tariff classification and the number of trading partners. As an illustration, the United States data for one year contain in the order of 150,000 observations. Working at this level of detail permits considerable precision in identifying key products and trading partners affected by particular trade policy scenarios. Methodologically, it has the advantage of avoiding the aggregation bias that is common to general equilibrium models.

7. Since the UNCTAD model uses prior information on elasticities from other studies (i.e. it is a simulation model not an estimating model), it is relatively easy to examine new policy options on an *ex ante* basis.

II. THE BASIC DATA AND PARAMETERS

A. Tariffs

8. The basic tariff data used in the model comes from one of two sources. In the case of the majority of the developed market-economy countries (DMECs), tariff information is drawn from GATT computer tapes which are not available to all users. In the case of developing countries, tariff information is coded in UNCTAD's Trade Information System (TIS - a UNDP-supported project). DMEC tariff information has been used principally in studies on the effects of trade liberalization, mainly for the Trade and Development Board but also in the analysis of GSP schemes. Tariff information on developing countries has been used in the context of simulations of the effects of the Generalized System of Trade Preferences among developing countries.

9. The GATT tapes contain a highly complex and extensive set of information on tariff rates. The main (but not the whole) set of information covers: the detailed national tariff number (the number of digits varies from country to country, but in any case matches the detail of the corresponding GATT trade data); the pre-MTN base rate tariffs (i.e. those in force in 1978); other tariff rates (such as applied rates, temporary rates and various preferential rates) when they exist (i.e. GSP, EEC ACP preferences, etc.); the post-Tokyo Round MFN rate; and various codes covering the nature of the legal binding of the tariff, if any.

10. In the UNCTAD model, the MFN tariff rates used as the base or initial rates for the simulations of liberalization in the DMECs are the post-Tokyo Round statutory bound rates or, in the absence of a binding, the applied rates, but simulations have also been carried out using the applied rates for the most recent year for which data are available (mainly 1983). In cases where preferences exist (e.g. under the GSP or through other preferential arrangements such as EFTA or the Lome Convention) the appropriate preferential rate is used as the base rate. This base rate is that which is relevant to the year for which the trade data are drawn. In the model, the base tariff

rate is applied at the tariff-line level against individual partner countries (sometimes against groups facing common rates, e.g. preference-receiving countries under the GSP).

11. In addition to the basic tariff information, UNCTAD also takes account of ceilings or quotas in the operation of the GSP. It would be desirable to include in the modelling exercises information about the extent to which imports from each trading partner enter at preferential rates or MFN rates under each tariff item. Unfortunately, this information is not available at UNCTAD for more than a few GSP donor countries, mainly because importers regard this information as confidential. Such detailed information has been made available on computer tape by the United States, and was loaded by UNCTAD from printed material from Australia. There have been problems in introducing such information for other countries for which it is not confidential, and the data will be introduced progressively. At present, for preference-granting countries other than the United States and Australia, the average utilization factor is used (taken from country reports provided under the GSP).

12. In the case of developing country tariff rates, the TIS has concentrated mainly on recording the MFN rate, and it has sometimes been necessary to convert specific rates to *ad valorem* terms. For some groups of developing countries, such as ASEAN, preferences that are allocated to other countries in the particular group are also recorded. Further information on developing country preference rates is being progressively added. Since tariff line trade data are not compiled for these countries, it is necessary to compute the arithmetic mean of the tariff up to the level of the 4-digit SITC item.⁴ At that level it is then possible to use the *United Nations Commodity Trade Statistics*, Series D, to trade weight to a higher level of aggregation.

⁴ Arithmetic means of tariffs for sectors are typically higher than averages using current trade weights. This is because of the depressing effect of tariff restrictions on imports. For a discussion of aggregation biases in the computation of tariff averages see Laird, S. and Yeats, A., 'Aggregation biases in the computation of tariff averages', Mimeo. UNCTAD, Geneva, 1986.

B. Non-tariff barriers (NTBs)

13. In order to use the model to estimate the trade liberalization effects of NTB elimination, a key requirement is comprehensive information on government-imposed trade restrictions in the major industrialized country markets. Since no central records exist from which *ad valorem* equivalents of the NTBs could be drawn, this data deficiency has been resolved by conducting a major search of the professional literature in order to compile as many estimates as possible for the nominal equivalents of non-tariff barriers.⁵ However, in order to hold this aspect of the exercise to manageable dimensions, the search was specifically focused on a list of "core" products that had previously been identified by UNCTAD as being of special export interest to the developing countries.⁶

14. In the effort to compile information on nominal equivalents for NTBs, considerable use was made of a recent International Monetary Fund study which partially tabulated such statistics, as well as a related survey conducted under the auspices of the Institute for International Economic Studies, in Stockholm.⁷ Table 1, which is drawn from the IMF study, indicates the types of studies from which we have compiled data on the *NTB ad valorem* equivalent for use in our simulations.

15. Although these investigations generally concentrated on manufactures, they also contained some data on commodity protection. For most of the agricultural products in the core group, a fairly extensive body of empirical information had been developed concerning the *ad valorem* incidence of existing non-tariff barriers. Here, the starting point for the data collection effort was two general analyses by the United Nations Food and Agricultural Organization, and the International Food Policy Research Institute (Washington), which examined the level and effects of agricultural protection in industrial countries.⁸ Supplemental data was drawn from product-specific or country-specific studies which are fully listed in Annex II.

⁵ The studies which have attempted to quantify the effects of these measures relate primarily to the European Economic Community, Japan and the United States. For this reason, the simulations of the trade effects of liberalizing these measures had to be confined to these three major markets.

⁶ See UNCTAD, *Problems of protectionism and structural adjustment (Part I)*, (TD B/IOJ9 (Part I)), Geneva, 28 January 1985.

⁷ See, International Monetary Fund, *Effects of Increased Market Access on Selected Developing Countries Export Earnings: an Illustrative Exercise*, (DM/84/54), Washington, D.C., 24 August 1984. The results of the Stockholm study have been published in Alexander Yeats, *Trade Barriers Facing Development Countries: Commercial Policy Measures and Shipping* London, McMillan, 1979. A further general source employed in the collection of data was Vernon Roningen and Alexander Yeats, "Non-tariff Distortion of International Trade: Some Preliminary Empirical Evidence", *Weltwirtschaftliches Archiv*, January 1977, pp. 613-624.

⁸ See UN Food and Agricultural Organization, *FAO Commodity Review and Outlook 1979-1980*. Rome, FAO, 1979,

Table I
Information collated by IMF on tariff equivalents of tariff and non-tariff barriers for seven commodities in four OECD markets

(percentages)

Sector	United States	European Communities	Japan	Canada
Meat	49(a),16(b) 6(c)	118(a),50(b) 104(d),37(c)	328(a),297(b) 219(c)	52(a)
Cereals	20(e),55(c) 0(b)	81(h),35(e) 73(b),51(d) 34(c)	175(b),70(e) 139(c)	
Sugar	27(0), 18(c)	31(d),46(b) 33(c)	44(b),53(c)	
Textiles	59(e), 9(g)	50(e)	18(c)	39(j)
Iron and steel	6(g), 5(i)	6(o)	3(i)	
Clothing	70(e), 9(g)	50(e)	23(e)	39(j)
Footwear	2(g), 9(i)	12(i)	16(i)	...
All sectors	33(e)	39(e)	62(e)	...

Source: IMF, (*op.cit.*), Table 1.

Notes: See following page.

16. With regard to the NTB equivalents compiled from these sources, several specific points should be noted. First, many of these estimates were derived in a manner that they reflect the "general" or average level of protection against all exporters and do not reflect any special differential adverse incidence which may exist on developing countries' exports.⁹ Thus, in sectors like textiles and clothing, where goods originating in developing countries are subject to clear discrimination under the *Multifibre Arrangement*, the estimated *ad valorem* equivalents of existing restrictions are downward biased. It is recognized that this problem produces a similar downward

pp.112-114, for basic data, and Alberto Valdes with the assistance of J. Hayssen, *Trade Liberalization in Agricultural Commodities and the Potential Foreign Exchange Benefits to Developing Countries*, Washington, D.C., International Food Policy Research Institute, 1979.

⁹ The sources employed in tabulating the *ad valorem* equivalents of NTBs utilized various methods for arriving at these estimates. It should be recognized that there is no one generally accepted procedure for quantifying non-tariff measures and that all procedures which have been employed may be subject to various sources of bias. For a comprehensive analysis relating to this point, see Robert Stern and Alan Deardorf, *Methods of Measurement of Non-tariff barriers*, UNCTAD/ST/MD/28, Geneva. 1985.

IMF SOURCES OF INFORMATION ON NON-TARIFF BARRIERS

Reference notes for table 1

- (a) FAO, "Protectionism in the Livestock Sector", Rome, 1980. Estimates refer to beef for 1977-79.
- (b) S.J.Anjaria, et al., "Developments in International Trade Policy", *IMF Occasional Paper No.16*, Washington, D.C., 1982. Meat estimates refer to beef for 1977-79. Cereal estimates refer to a simple average for rice, maize and wheat for the United States; maize and wheat for the European Communities, and rice, wheat, barley and soybeans for Japan, in 1979-80.
- (c) Japan Economic Institute, "Agricultural Protectionism", Tokyo, 1983. Estimates for meat refer to beef; for cereals, to grains for the United States and the European Communities, and to a simple average for rice, wheat and barley for Japan in 1978-80. Estimates for sugar also refer to 1978-80.
- (d) Commonwealth Secretariat, *Protectionism: Threat to International Order*, London, 1982. Estimates for meat refer to beef; and for cereals to a simple average for rice, maize and wheat in 1979-80. Estimates for sugar refer to the same time period.
- (e) A.J.Yeats, *Trade Barriers Facing Developing Countries*, New York, 1979. All estimates are for 1973. For cereals, estimates refer to grains and grain products; for textiles, clothing and manufactures, estimates are the sum of post-Kennedy Round tariffs and tariff equivalents for non-tariff barriers. Tariff equivalents for non-tariff barriers refer to apparel for both textiles and clothing.
- (f) Derived from U.S. Department of Agriculture, "Sugar and Sweetener: Outlook and Situation", Washington, D.C., 1981. Estimates refer to 1979-80. Transport costs were assumed at 6 per cent of the c.i.f. price.
- (g) P. Morici and L. L. Megna, *U.S. Economic Policies Affecting Industrial Trade*, Washington, D.C., 1983. The tariff equivalent for textiles reflects the impact of the Multifibre Arrangement; for iron and steel, it reflects the effects of several orderly market agreements with Japan, and quotas against other producers; for footwear, it reflects orderly market agreements with Taiwan and Korea between 1977-79.
- (h) U. Koester, "Policy Options for the Grain Economy of the European Community: Implications for Developing Countries", *IFPRI Research Report No.35*, Washington, D.C., 1982. Estimates refer to a simple average for wheat, barley and maize for 1979-80.
- (i) Pre-Tokyo Round tariffs calculated in A.V. Deardorff and R.M.Stern, "The Effects of the Tokyo Round on the Structure of Protection". Paper presented at the Conference on the *Structure and Evolution of Recent U.S.Trade Policy*, National Bureau of Economic Research, Cambridge, Mass., December 1982.
- (j) M. Wolf, "Managed Trade in Practice: Implications of the Textile Arrangements", in W.R.Cline (ed.), *Trade Policies in the 1980s*, Washington, D.C., 1983. The simple average of total protective rates for 16 products in 1979 was employed.

bias in estimating the magnitude of the developing countries' trade expansion associated with a removal of these restraints.¹⁰ Another (downward) bias occurs in respect of NTBs for which no

¹⁰ In principle, this bias could occur in respect of any measure applying to a sub-group of trading partners, e.g. restrictions on steel imports from other major developed market economies.

estimates of *ad valorem* equivalents could be found, e.g. "voluntary" export restraints. In such cases, it is not possible, when using the model, to simulate the magnitude of trade expansion associated with the barriers' removal. Finally, it should be noted that some *ad valorem* equivalents for non-tariff barriers applied in the agricultural sector are quite volatile due to a wide year-to-year variation in these products' prices on international markets.¹¹ In these cases, it has often been necessary to make a judgemental decision as to what constituted an average or "normal" level of protection, based on information relating to several years.

C. Imports

17. For the DMECs, the trade data used in the model are taken from the GATT trade tapes for the relevant year. This information is recorded at the tariff-line level, thus permitting the matching of tariff and trade information on most DMECs. Import data in this series are recorded at the point of clearing customs, even though they may have been imported considerably earlier and held in bond. In the case of the United States, Canada, Australia and New Zealand, imports are valued on a free-on-board (f.o.b) basis, while for all other developed countries a cost-insurance-freight (c.i.f) valuation is employed. As a result, *trade projections* made with the model vary between countries in terms of f.o.b. and c.i.f. value.

18. For developing countries the trade data are taken from the United Nations Commodity Trade Statistics, Series D, which uses the United Nations Standard International Trade Classification (SITC), both in Revision 1 and Revision 2, although predominantly in Revision 1 for developing countries. Imports data in this series are recorded at the time of arrival in the importing country, even though some time may pass before they clear customs. For the most part, these data are recorded at the four-digit level of the SITC. An additional point is that the developing country trade data are normally several years out of date (on average they now apply to the 1980-82 period) while more recent data (1984-85) are available for developed countries. This means that in

¹¹ As an example, *ad valorem* equivalents have been estimated by the UNCTAD secretariat for the European Economic Community's variable import levies by taking the ratio of these import charges to the international prices of the products to which they were applied. Due to variations in both prices and levies, this procedure generated estimated *ad valorem* equivalents for NTBs facing some major agricultural imports that differed by as much as 100 percentage points from year to year. See UNCTAD, *Protectionism and structural adjustment in agriculture* (TD/B/939), Geneva, 17 March 1983, p.72, for time series on nominal equivalents for the EEC variable levies over the period 1975 to 1981.

studies of the liberalization of trade among developing countries it was necessary to use data for earlier years for one or two countries. In order to obtain consistent data sets, it would have been necessary to use earlier data for all countries or to estimate trade data for later years for those countries for which the reported data were less recent.

D. Market penetration data

19. If the elasticity of substitution between alternative suppliers is not known, 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 share of imports from non-preference-receiving countries in apparent domestic consumption (defined as domestic output *plus* imports *less* exports).

20. The principal source of information lies in the data which were first produced in the World Bank Market Penetration Project. This work is now carried out at OECD under the title of "The OECD Compatible Trade and Production Data Base"¹³. Information is available on output, imports and exports for some 11 major DMEC markets under the International Standard Industrial Classification (ISIC).

¹² Baldwin, R.E. and Murray, T. 'MFN Tariff reductions and developing country trade benefits under the GSP', *The Economic Journal*. 87, March 1977. See the description of the UNCTAD model in Annex I for the explanation of this point.

¹³ For information, see Brodin, A., and Blades. D., "The OECD Compatible Trade and Production Data Base, 1970-1983", Department of Economics and Statistics Working Papers, No.31, OECD, Paris, March, 1986.

*E. Elasticities**(i) Elasticity of import demand*

21. Information on elasticities of import demand came from a literature search. Primary use was made of a compendium prepared by Robert Stern with this information supplemented by additional data taken from studies by the Brookings Institution and the Kiel Institute for World Economics.^{14 14}.

(ii) Elasticity of export supply

22. Information on elasticities of export supply has not yet been explicitly used in the model, since comprehensive information regarding the parameters is not readily available. The main simulations normally use an assumed value of infinity, and it is routine to carry out "sensitivity" tests based on simulations for different values, including assumptions of inelastic supply. Simulations with alternative values have shown that when supplies are assumed to be relatively inelastic, the volume changes are considerably less but there is also a positive effect on the prices received by exporters which tends to compensate for this. The result is that with certain combinations of supply and demand elasticities the revenue effect associated with reductions of tariffs or the elimination of NTBs is often close to that under infinite supply elasticities.

23. One important effect is not as yet taken into account for the cases where elasticities of supply are non-infinite. This is the simultaneous impact of liberalization of trade in a number of markets, as might happen following multilateral negotiations. Such liberalization together with non-infinite supply elasticities is likely to cause a much smaller expansion of trade volumes than are predicted by the present version of the model. However, the resulting price increases are also likely to be higher, thus operating as a counter to the smaller trade volumes in the computation of the revenue

¹⁴ See Robert Stern *et al.* *Price Elasticities in International Trade*. London, Macmillan, for the Trade Policy Research Centre, 1975; William Cline, *et al.* *Trade Negotiations in the Tokyo Round: A Quantitative Assessment*, Washington, D.C.. The Brookings Institution, 1978; and Rolf Langhammer, "Problems and Effects of a Developing Country's Tariff Concession Round on South-South Trade", *Kiel Working Paper, No.167*, Institute for World Economics, Kiel, February 1983.

effect. This problem does not arise under the assumption of perfectly elastic supply since there is no effect on world prices.

(iii) Elasticity of substitution

24. If explicit values are available for the elasticity of substitution between goods from different sources then it is not necessary to use an approach based on market penetration data (as mentioned above). However, it is in any case an option to assume values for the elasticity of substitution (and conduct simulations across a range of reasonable estimates). These elasticity values are used in the computation of the trade diversion effect, i.e. the extent to which trade is diverted from one foreign supplier to another in consequence of shifts in relative prices resulting from differential movement in tariff rates or the *ad valorem* incidence of NTBs.¹⁵

25. It is implicit in computations of trade diversion, as in this type of exercise, following Armington¹⁶, that the products coming from different foreign sources (e.g. from developing countries or from other industrialized countries) are imperfect substitutes.¹⁷ It is then possible to express the percentage change in the relative shares of the alternative suppliers in terms of the elasticity of substitution, the percentage change in relative prices and the original relative shares of imports from the alternative sources. Constant market shares of individual countries within each group of foreign suppliers equally affected by the trade policy change are assumed.

F. Concordances

26. The various data series used in the model are classified under different systems (e.g. SITC, ISIC or national tariff classifications - of which most but not all are based on the Customs Co-operation Council Nomenclature (CCCN) at the 4-digit level). Since these systems do not concord

¹⁵ For a discussion of empirical estimates of the elasticity of substitution, see Cline, (*op.cit.*). In The Brookings Institution Model a value of 2.5 was used. It is probable that the elasticity is lower for highly differentiated products, and vice versa. The higher the value of this elasticity, the higher the trade diversion effects i.e. the benefits from the present arrangements would be higher than estimated, as would be the losses arising from the implementation of the new arrangements.

¹⁶ Armington, P., "A theory of demand for products distinguished by place of production", *IMF Staff Papers*, Vol.16.1969, pp.159-178.

¹⁷ See also Learner, E. and Stern R.M., *Quantitative International Economic*, Boston, Alien and Bacon Inc., 1972, Chapter II, on the concept of the elasticity of substitution in international trade.

on a one-to-one basis there are sometimes errors in cross-classifying data, particularly at the detailed level. The concordances of the national tariff classifications of the United States (TSUSA) and of Canada - which are not CCCN-based - pose particular problems, not the least because of reclassification of items from one year to the next. Because of imperfections in the concordances, especially for certain specific products, it can happen that, if one wishes to examine a particular industry as defined at, say, the 4-digit SITC level, the relevant tariff numbers would include more or less products than those that are strictly within the SITC item product description. At higher levels of aggregation these problems are much less important.

II. USES OF THE MODEL

27. Two of the main uses of the model have been in connection with UNCTAD's work on protectionism and structural adjustment and also in providing technical backstopping to work on the GSTP. Examples of the output of the model for these two different types of exercise are given in Annex III, Tables A1 to A5. Tables A1 and A2 are taken from previously published UNCTAD documents and indicate the projected increase in developing country exports to the DMECs that would accompany a liberalization of selected tariffs and NTBs. Similar results could be easily generated for different product groups or for different liberalization proposals such as the general tariff cutting formulae employed in the Tokyo Round multilateral trade negotiations. Table A3 shows the results of one particular policy option for the GSTP (i.e. implementation of 20 percent linear tariff preferences for intra-trade), while Annex Table A4 examines the likely impact of preferences on the level and structure of South-South commodity trade. Similar projections could be made for any other procedure for creating preferences for intra-developing country trade (even those involving differential exchange rates or transport cost preferences). The remaining Table A5 relates to a study that was conducted by UNCTAD on trade-debt issues and shows how a trade liberalization in DMECs would influence the most heavily indebted countries and their major export products.

28. Another example of the use of the model is to identify in fine detail how specific products will be affected by different trade policy approaches. This is something for which the model is particularly suited, since the larger general equilibrium models do not work at this level of detail. An example of this use of the model is the identification of key products in particular markets where the developing countries would benefit from trade liberalization. Obviously, this type of application could greatly assist developing countries in formulating trade liberalization proposals for any future multilateral negotiations.

29. Another example of the use of the model is to evaluate the direct trade effects of existing preferences under the Generalised System of Preferences (GSP) for developing countries. The model can also be used to evaluate the effects of changes in the schemes and can even be used to

simulate the likely effects of alternative options which might be considered. Related applications could greatly assist developing countries in the design and implementation of the GSTP.

30. The model has also been used to provide information to developed and developing countries in evaluating trade policies, on request. Among the intended uses of this material has been the planning of new export ventures or the preparation for balance-of-payment consultations within GATT. The model has also been employed to assist developing countries in evaluating the potential contribution that trade liberalization initiatives could make towards alleviating these nations' international debt burdens.

III. FUTURE WORK ON THE MODEL

31. The following points cover the main areas for future refinement of the model as well as the data and parameters used.

Elasticities: It is intended to conduct further research to extend the files on elasticities of import demand, export supply and substitution between different sources of supply for different products and for different countries. As a long-term goal it may be desirable to make original estimates from econometric analysis.

NTBs: New work is needed to update and extend the files on the *ad valorem* equivalents of non-tariff barriers for different products in different countries, including countries other than the EEC, Japan and the United States. This would primarily be on the basis of research into the economic literature for estimates made by other organizations and academic researchers. However, alternative approaches are being examined, including the possibility of estimates derived from the UNCTAD Data Base on Trade Measures.¹⁸

Employment: It is intended to extend the analysis of the economic impact of trade liberalization to other products and countries, including exporting countries. The analysis of indirect employment effects can be expanded through the use of input-output tables for the importing, liberalizing countries and/or the exporting countries, so that the effects on related industries can be calculated. At present, the analysis of the employment effects is limited to the direct effects resulting from an expansion of imports as a consequence of the importer's own liberalization, whereas the expansion in exports results only from the liberalization by other countries.

¹⁸ For information on the Data Base on Trade Measures, see 'Introductory note on methodology employed and the problem of definitions', prepared by the UNCTAD secretariat (TD/B/AC.42,2), 4 September 1985.

Other effects: It is possible to extend the model by equilibrating changes in imports and exports to simulate exchange rate adjustments to restore balance of trade equilibrium, as has been done by Cline (*op.cit.*) However, this would still not simulate the restoration of global equilibrium, which is particularly important when a number of countries are undertaking simultaneous liberalization efforts as, for example, in the context of multilateral negotiations under the GATT or in the context of GSTP. To meet these objectives it is intended to expand the usefulness of the modeling work in co-operation with other efforts in UNCTAD, in other international organizations and in academic institutions. This would permit the finely detailed information on tariffs and NTBs stored by UNCTAD to be used in compiling first-round effects of trade liberalization (reducing aggregation bias common to larger models), while using the general equilibrium models to analyse second-round effects on a global basis.

VI. Co-operation with other organizations and governments

32. UNCTAD has received a number of requests for simulations of specific policy changes along the lines of the present paper as well as simulations for changes in specific countries. For example, first-round results from the model for an MFN liberalization of tariffs and NTBs in the EEC, Japan and the United States have been used by the World Bank in a general equilibrium model to study a variety of second-round effects for the purposes of the *World Development Report 1986*.

33. The model is also used to assist UNIDO consultants in the preparation of sectoral studies on the effects of trade distortions which are used in UNIDO's system of consultations. For example, earlier versions of the model were used to assist UNIDO with respect to sectoral studies in the following sectors: building materials; wood and wood products; oilseeds, vegetable oils and related products; and petrochemicals. The current version of the model has been used to provide information for a UNIDO sectoral study on pharmaceuticals (not yet published). The UNIDO studies are as follows:

- "Tariff and non-tariff measures in the world trade of wood and wood products", Sectoral Studies Branch, Division for Industrial Studies, UNIDO (UNIDO/IS.396).
- "Tariff and non-tariff measures in the world trade of oilseeds wood, vegetable oils and related products", Sectoral Studies Branch, Division for Industrial Studies, UNIDO (UNIDO/IS.396).
- "Tariff and non-tariff measures in the world trade of building materials", Sectoral Studies Branch, Division for Industrial Studies, UNIDO (UNIDO/IS.524).
- "Tariff and non-tariff measures in the world trade of petrochemicals", Sectoral Studies Branch, Division for Industrial Studies, UNIDO (UNIDO/IS.573) - currently being revised for publication.

34. Preliminary discussions have also been held with the representatives of the International Development Research Centre (Canada) concerning the use of the model for assessing the likely impact of new customs unions among developing countries. Representatives of national governments have been assisted by the secretariat on their request concerning use of the model in connection with balance-of-payment consultations in GATT and the IMF.

ANNEX

Technical Description of the UNCTAD Trade Policy Simulation Model

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:

NOTATION

M	- imports	M _n	- imports from non-preference-receiving countries
X	- exports	V	- output in the importing country
P	- price	R	- revenue
W	- welfare	t	- tariff rate or non-tariff distortion in <i>ad valorem</i> terms
Y	- national income		

E_m - elasticity of import demand with respect to domestic price

E_x - elasticity of export supply with respect to export price

E_s - elasticity of substitution with respect to relative prices of the
- same product from different sources of supply

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 expressions the subscript K is used to denote data for an
- alternative foreign/exporting country)

d - prefix denoting change

Examples:

P_{ijk} - Price of commodity *i* in country *j* from country *k* (i.e. domestic price in *j*)

P_{ikj} - Price of commodity *i* from country *k* to country *j* (i.e. export/world price *j*)

M_{ijk} - Imports of *i* by *j* from *k*

X_{ikj} - Exports of *i* by *k* to *j*

The basic model

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

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

The producer/exporting country *k*'s export supply function for commodity *i* may be expressed as:

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

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

$$(3) \quad M_{ijk} = X_{ikj}$$

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:

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

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

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

Trade creation

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.

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

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

Now, the standard expression for the elasticity of import demand with respect to the domestic price can be rearranged as follows:

$$(7) \quad dM_{ijk} / M_{ijk} = Em \cdot (dP_{ijk} / P_{ijk})$$

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

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

The standard expression for the elasticity of export supply with respect to the world price can be rearranged as follows:

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

From expression (3) it follows that:

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

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:

$$(11) \quad TC_{ijk} = M_{ijk} \cdot Em \cdot dt_{ijk} / ((1 + t_{ijk}) \cdot (1 \cdot (Em/Ex)))$$

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

Trade diversion

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.

(i) *Without explicit values for the elasticity of substitution*

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.¹⁹ 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 apparent domestic consumption (defined as domestic output of commodity i plus imports of commodity i less exports of commodity i). The formulation for trade diversion can then be written:

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

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.*).

¹⁹ Baldwin, R.E. and Murray, T. “MFN tariff reductions and developing country trade benefits under the GSP”. *The Economic Journal* 87, March 1977.

(ii) **With explicit values for the elasticity of substitution**

If explicit values are available for the elasticity of substitution between goods from different sources then it is not necessary to use the approach outlined above. Alternatively, if there are no market penetration data available then there may be no option but to assume values for the elasticity of substitution (and conduct simulations across a range of reasonable estimates).

It is possible to define the elasticity of substitution as the percentage change in relative shares associated with a one percent change in the relative prices of the same product from alternative sources. That is:

$$(14) \quad E_s = \frac{d(\Sigma M_{ijk} / \Sigma M_{ijK}) / (\Sigma M_{ijk} / \Sigma M_{ijK})}{d(P_{ijk} / P_{ijK}) / (P_{ijk} / P_{ijK})}$$

where k denotes imports from one (group) of foreign supplier(s),
 K denotes imports from another (group) of foreign supplier(s),
 and the summation is only across the country group k or K but not across product groups (i) nor across imports (j).

From this expression it is then possible to express the percentage change in the relative shares of the alternative suppliers in terms of the elasticity of substitution, the percentage change in relative prices and the original relative shares of imports from the alternative sources. By extensive expansion, substitution and rearrangement, it is possible to obtain the following expression for the change in imports from one country – or trade diversion (TD) gain or loss, as the case may be – as a result of the change in duty paid prices relative to the prices from other sources resulting from a commercial policy change:

$$(15) \quad TD_{ijk} = \frac{M_{ijk}}{\Sigma M_{ijk}} \cdot \frac{\Sigma M_{ijk} \cdot \Sigma M_{ijK} \cdot E_s \cdot \frac{d(P_{ijk} / P_{ijK})}{P_{ijk} / P_{ijK}}}{\Sigma M_{ijk} + \Sigma M_{ijK} + \Sigma M_{ijk} \cdot E_s \cdot \frac{d(P_{ijk} / P_{ijK})}{P_{ijk} / P_{ijK}}}$$

The term in expression (15) for the relative price movement is specified in terms of the movements of the tariffs or the *ad valorem* incidence of non-tariff distortions for the two foreign sources. Expression (15) is the equivalent of the final expression for trade diversion given by Cline (*op. cit.*). As in Cline, similar expressions can be derived to obtain separate results for the different groups of foreign/exporting countries. Alternatively, the results can be summed for one group, and this sum can be distributed among members of the alternative group of foreign suppliers in accordance with their prior share in the imports from that group.

The total trade effect

The total trade effect is obtained simply by summing together the trade creation and trade diversion effects. Results can be summed for the imported 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.

The price effect

If the export supply elasticity is infinite then there is no ***price effect*** on exports. Otherwise the price effect can be obtained by substituting expression (10) into (9), giving:

$$(16) \quad dP_{ikj} / P_{ikj} = (dt_{ijk} / (1 + t_{ijk})).(Em/(Em-Ex))$$

The revenue effect

Expression (16) has direct application in estimating the ***revenue effect*** for the exporting country. If the export supply elasticity is infinite, there is no price effect – as noted above – and consequently revenue increases in proportion to the increase in exports. Otherwise the percentage increase in revenue is equal to the percentage increase in exports ***plus*** the percentage increase in prices. This can be shown by taking from expression (5) above the total differential of revenue with respect to export price and the volume of exports:

$$(17) \quad dR_{ikj} = P_{ikj} \cdot dX_{ikj} + X_{ikj} \cdot dP_{ikj}$$

Dividing the left-hand side (LHS) of (17) with the LHS of expression (5) and the right-hand side (RHS) of (17) with the RHS of (5) gives:

$$(18) \quad dR_{ikj} / R_{ikj} = (P_{ikj} \cdot dX_{ikj} + X_{ikj} \cdot dP_{ikj}) / (P_{ikj} \cdot X_{ikj})$$

Reducing and substituting from expression (10) gives:

$$(19) \quad dR_{ikj} / R_{ikj} = (dM_{ikj} / M_{ijk}) + (dP_{ikj} / P_{ikj})$$

Alternatively, this can be written:

$$(20) \quad dR_{ikj} / R_{ikj} = (dt_{ijk} / (1 + t_{ijk})).Em.((1 + Ex)/(Ex-Em))$$

The welfare effect

The ***welfare effect*** arises from the benefits consumers in the importing country derive from the lower domestic prices after the removal or reduction of tariffs or the ***ad valorem*** incidence of non-tariff distortions. As noted by Cline (*op.cit.*), “for the pre-existing level of imports, any price reduction to the consumer merely represents a transfer away from the government of tariff revenue formerly collected on the import and therefore no net gain to the country as a whole. But for the increase in imports, there is a net welfare gain equal to the domestic consumers’ valuation of the extra imports minus the cost of extra imports at supply price (excluding tariffs)”. Thus, the net welfare gain is normally estimated as the increase in import value times the average between the ***ad***

valorem incidence of the trade barriers before and after their elimination. This welfare gain can also be thought of as the increase in consumer surplus. It can be written:

$$(21) \quad W_{ijk} = 0.5(dt_{ijk}, dM_{ijk})$$

In the case where the elasticity of export supply is less than infinity the supply price is higher than previously. The new domestic price of imports does not decline to the full extent of the tariff change and import expansion is less than in the case of infinitely elastic export supply. Welfare can still be computed using expression (21) but needs to be interpreted as a combination of consumer surplus and producer surplus.

ANNEX II

Primary Sources for Estimates of the Tariff Equivalents of NTBs

- William Cline, et.al., *Trade Negotiations in the Tokyo Round: A Quantitative Assessment*, Washington, D.C., Brookings Institution, 1978.
- Commonwealth Secretariat, *Protectionism - Threat to International Order: The Impact on Developing Countries*, London, 1982.
- Carl Hamilton, "Voluntary Export Restraints on Asia: Tariff Equivalents, Rents and Trade Barrier Information", *Seminar Paper No.276*, Stockholm, Institute for International Economic Studies, April, 1984.
- International Monetary Fund, *Effects of Increased Market Access on Selected Developing Countries' Export Earnings: An Illustrative Exercise*, (DM/84/54), Washington.D.C, 24 August 1984.
- P. Morici and L. Megna, *US Economic Policies Affecting Industrial Trade*, Washington, D.C., National Planning Association, 1983.
- V. Roningen and A. Yeats, "Non-tariff Distortions of International Trade: Some Preliminary Empirical Evidence", *Weltwirtschaftliches Archiv*, Band 112, Heft 3, 1976, pp.613-623.
- G. Sampson and A. Yeats, "An Evaluation of the Common Agricultural Policy as a Barrier Facing Agricultural Exports to the European Economic Community", *American Journal of Agricultural Economics*, No.59, February 1977, pp.99-106.
- E. Saxon and Kym Anderson, *Japanese Agricultural Protection in Historical Perspective*, Canberra, Research School of Pacific Studies - Australian National University, July 1982.
- United Nations Food and Agricultural Organization, "New Protectionism and Attempts at Liberalization in Agricultural Trade", Chapter III, in *Commodity Review and Outlook: 1979-80*, Rome, 1980, pp. 109-121.
- United Nations Food and Agricultural Organization, *Protectionism in the Oilseeds, Oils and Oilmeals Sector*, (CCP: of 81/2) Rome, January, 1981.
- United Nations Food and Agricultural Organization, *Agricultural Protectionism and Stabilization Policies: A Framework of Measurement in the Context of Agricultural Adjustment*, (C.75/LIM/2) Rome, October 1975.
- United Nations Food and Agricultural Organization, *Protectionism in the Livestock Sector*, (CCP 80/4), Rome, October 1980.
- UNCTAD, *Protectionism and structural adjustment in Agriculture*, (TD/B/939), Geneva, 17 March 1983.
- United States Federal Trade Commission, *Effects of Restrictions on United States Imports: Five Case Studies and theory*. Staff Report of the Bureau of Economics to the Federal Trade Commission, Washington, D.C., June 1980.

ANNEX III

ILLUSTRATIONS OF SIMULATIONS MADE WITH THE UNCTAD MODEL

Explanatory note

Table A1 illustrates the results of a simulation covering the effects on developing countries of the elimination of both tariff and non-tariff barriers. Tariff elimination was simulated for 20 DMECs for which tariff information is held, while tariff and NTB elimination is simulated for the EEC, Japan and the United States. The separate effects of preferential and MFN liberalization were simulated. The results are shown for all 3-digit ISIC industries. The simulations were based on 1983 import data from the GATT trade tapes and assume infinite supply capabilities. These simulations used the version of the model with an explicit elasticity of substitution among foreign suppliers, which was assumed to equal 2 in all industries. These results were reported in "Problems of protectionism and structural adjustment - Introduction and Part I: Restrictions on trade and structural adjustment", report by the UNCTAD secretariat (TD/B/10SI(Part I), Chapter III).

Table A2 presents more detailed results from the same simulations that were carried out for Table A1. The information for the effects on developing countries of MFN liberalization of tariffs and NTBs by the EEC at the 4-digit CCCN level was ranked in order of magnitude of the value of the gains in \$ US. The table lists the top fifty items in order of the size of projected trade gains. Accordingly, this table represents the list of items on which developing countries would gain most from liberalization by the EEC and which would therefore be expected to rank highest in any "request list" for negotiations. Similar lists were computed for Japan and the United States, and are shown in "Problems of protectionism and structural adjustment - Introduction and Part I : restrictions on trade and structural adjustment", report by the UNCTAD secretariat (TD/B/1081(Part I), Annex II).

Annex Table A3 shows the results from a simulation of the influence of preferences for intra-trade on the exports, imports and trade balances of selected major developing countries or country groups. The simulation assumed that preferences were generated through 10, 20 and 50 per cent linear tariff cuts and that supply in developing countries was infinitely elastic. For more details, including the projected effects of different preferential tariff margins, see UNCTAD, *Considerations relating to the negotiating elements and likely economic effects of a global system of trade preferences (GSTP) among developing countries*, (UNCTAD/ECDC/179) (Geneva: 9 July 1985).

Annex Table A4 summarizes the results of simulations of the effects of full tariff preferences (100 per cent preferential margins) on the commodity intra-trade of developing countries. The table shows the projected change in the value of this exchange under three different assumptions concerning supply conditions (perfectly elastic supply, unitary' elastic supply and a case when export prices rise by one-third of the corresponding change in volumes) and also indicates the resulting changes in developing countries' trade shares. See Samuel Laird and Alexander Yeats, 'Empirical Evidence Concerning the Magnitude and Effects of Developing Country Tariff Escalation', mimeo. UNCTAD Geneva, 1-4 April 1986.

Annex A5 is drawn from a simulation study that examined the use of trade liberalization initiatives for alleviating the debt burdens of the most heavily indebted developing

countries. The table shows the projected expansion of these nations' exports resulting from a full preferential liberalization of tariffs and NTBs applied to their "core" products in the EEC, Japan and the United States. In these projections supply is assumed to be perfectly elastic, but sensitivity tests are run on this parameter in the full study. For details, see Samuel Laird and Alexander Yeats, "On the Potential Contribution of Trade Policy Initiatives for Alleviating the International Debt Crisis", mimeo. UNCTAD, Geneva, 2 November 1985.

TABLE I: Gains to developing countries of trade liberalization through (a) reduction to zero of tariffs in 20 developed market economy countries, and (b) reduction to zero of tariffs and certain non-tariff barriers (NTBs) in the EEC, Japan and United States (\$ million)

ISIC	Industry	20 DMECs			EEC, Japan and United States only				
		Imports 1983	Tariff lib. gains		Imports 1983	Incl. imports under liberalization			
			(a) MFN	(b) Pref.		(a) MFN		(b) Pref.	
						Tariffs	Tariffs + NTBs	Tariffs	Tariffs + NTBs
111	Agric. + livestock	12609	251	480	11291	230	329	432	592
113	Hunting, trapping, etc.	12	0	0	2	0	0	0	0
121	Forestry	1940	0	0	1833	0	0	0	0
122	Logging	2109	0	0	2099	0	0	0	0
130	Fishing	3107	165	228	2982	164	1013	226	1465
210	Coal mining	49	1	2	14	1	1	2	2
220	Crude petroleum	100817	1157	1675	94894	1542	1542	1639	1639
230	Mining	6195	0	0	5356	0	0	0	0
290	Stone quarrying, etc.	3468	33	44	2956	32	32	42	42
311	Food products	20236	900	1272	18538	835	4087	1177	5122
312	Food products nes	399	16	26	266	16	40	24	58
313	Beverages	544	47	304	478	44	48	286	298
314	Tobacco	293	32	38	285	30	30	35	35
321	Textiles	7921	1190	2007	6502	826	3194	1191	5162
322	Wearing apparel	9779	4728	5076	9146	4506	11785	4688	12461
323	Leather & products	1322	228	304	1123	167	261	208	303
324	Footwear	219	30	35	206	25	123	29	137
331	Wood products	2521	116	201	2296	102	102	166	166
341	Paper & products	701	10	42	589	7	12	34	43
342	Printing, publishing	319	2	12	261	2	3	10	13
351	Industrial chemicals	3401	82	274	2928	67	79	235	251
352	Other chemical prods.	1350	11	51	1102	13	33	47	161
353	Petroleum refineries	21440	648	1078	17741	645	645	1071	1071
354	Petroleum, coal prods.	30770	157	158	31069	156	156	157	157
355	Rubber products	2267	1359	1495	1977	1209	2207	1234	2234
356	Plastic products, nec	542	148	229	440	85	85	143	183
361	Pottery, china, etc.	169	74	105	149	70	70	92	92
362	Glass + products	218	10	36	191	9	16	29	51
369	Non-metal prods. nec	327	11	36	333	9	9	28	30
371	Iron + steel	2905	181	247	2440	168	702	212	1043
372	Non-ferrous metals	7361	45	190	7850	46	229	187	436
380	Fab. metal products	946	0	0	157	0	8	0	8
381	Metal products	1486	154	355	1264	79	296	199	529
382	Machinery nec	2939	205	434	2978	196	200	394	407
383	Electrical machinery	8462	871	1514	8017	781	1337	1305	2076
384	Transport equipment	2727	177	382	2003	146	274	283	450
385	Professional goods	3086	194	425	2492	100	100	272	272
390	Other industries	2946	398	545	2566	364	438	468	563
410	Energy	4	0	0	2	0	0	0	0
610	Wholesale trade	6	0	0	6	0	0	0	0
620	Retail trade	176	0	0	156	0	0	0	0
832	Var. business services	21	0	2	19	0	0	1	1
941	Movies, etc.	10	0	1	9	0	0	0	0
959	Photographic studios	89	0	2	84	0	0	1	1
1-9	ALL TRADE	268204	14043	19303	247091	12671	29485	16549	37557

Source: Table 8 of UNCTAD document TD/B/1081 (Part I) of 23 January, 1985

Note: The 20 DMECs are Australia, Austria, Canada, EEC (10 countries), Finland, Japan, New Zealand, Norway, Sweden, Switzerland and the United States.

Table A4

Projected Changes in the Structure of Developing Countries' Intra-Trade in Primary and Processed Commodities Under Preferential Tariffs

Processing chain	1981 Value of <u>intra-trade (\$ million)</u>		Share of processed products	Projected change in developing country intra-trade <u>In processed commodities under tariff preferences a/</u> <u>(\$ million)</u>					
	Primary stage	Processed products		<u>Value</u>		<u>Processed products' share</u>			
				$e_s = \infty$	$e_s = 3.0$	$e_s = 1.0$	$e_s = \infty$	$e_s = 3.0$	$e_s = 1.0$
All Commodities	51,644.8	13,874.9	21.2	2,529.5	1,894.4	1,365.0	2.4	1.8	1.3
All commodities (excl. petroleum)	6,871.0	6,182.7	47.4	1,491.4	1,132.1	845.7	3.9	3.0	2.1
of which:									
Meat	547.7	49.8	8.0	12.6	9.8	8.1	1.8	1.5	1.2
Fish	260.4	125.6	32.5	36.0	29.4	23.6	4.1	3.1	2.4
Fruit	857.9	157.3	15.5	23.9	19.2	15.2	1.1	0.8	0.5
Vegetables	555.6	73.7	11.7	9.8	9.6	9.3	0.6	0.6	0.6
Vegetables oils <u>b/</u>	70.0	147.5	67.8	9.3	6.9	4.8	0.1	-0.1	-0.3
Coffee, cocoa and sugar	1,798.9	121.5	6.3	38.2	30.9	24.5	1.4	1.1	0.9
Leather	54.8	123.7	69.2	43.8	30.2	22.1	8.1	4.3	3.3
Rubber	1,295.3	262.3	16.9	151.8	91.0	63.4	7.1	4.3	3.0
Wood and paper	69.6	2,107.0	96.8	258.7	217.3	157.9	-0.5	-0.5	-0.5
Wool	25.5	26.7	51.1	25.9	21.1	17.1	12.7	10.6	8.7
Cotton	486.7	348.2	41.7	258.9	186.8	132.4	13.0	9.9	7.3
Iron	314.4	1,235.2	79.7	300.1	233.9	186.2	3.1	2.4	2.0
Copper	183.2	697.7	79.2	157.3	115.2	79.4	2.8	2.0	1.3
Bauxite	35.4	306.0	89.6	87.9	71.6	57.6	2.1	1.8	1.5
Lead	11.0	51.2	82.3	6.8	5.2	3.9	1.5	1.1	0.8
Zinc	26.4	85.7	76.4	15.2	12.2	9.8	2.4	1.9	1.6
Tin	56.9	128.5	69.3	28.7	20.5	13.6	4.0	2.9	1.9
Phosphates	221.3	135.1	37.9	26.5	21.3	16.8	2.7	1.9	1.4
Petroleum	44,773.8	7,692.2	14.7	1,038.1	762.3	519.3	1.3	0.9	0.6

Note: The projected trade changes shown in this table are based on the assumption that any non-tariff barriers applied to these products are also liberalized to an extent that the full effects of the tariff preferences can be realized. Trade diversion estimates, which are incorporated in the total figures, are based on an assumed elasticity of substitution of 1.5 between preference receiving and other products. See Cline (1978) for a discussion covering this latter point. Table 1 shows the SITC product groups that are included in the "All Commodities" projections as well as in the individual commodity processing chains.

a/ Processed commodities are defined as all items other than the stage one goods listed in Table 1 of this study.

b/ Including groundnuts, copra, palm kernel oil and oilseeds.

Table A5**Analysis of the influence of a Debt-Related Trade Liberalization on the Export of All and Selected Developing Countries**

1983 Estim. Debt (\$mill)	1980 Value of Imports (\$mill)			Annual Export Increase from a Preferential Trade Liberalization						Present Value of Increased Exports due to Preferential Liberalization (\$ mill)		
				EEC		Japan		United States				
	EEC	JAPAN	USA	Tariffs NTBs	Tariffs & NTBs	Tariffs Tariffs & NTBs	Tariffs & NTBs	Tariffs & NTBs	Tariffs & NTBs	Tariffs & NTBs		
Developing Countries												
All Developing Countries	812,900	167,652.1	76,777.1	67,203.4	7,150.8	19,013.2	2,880.0	3,881.2	4,492.6	11,869.1	290,468	695,270
Selected Latin American Countries												
Argentina	30,000	1,906.4	240.7	719.4	96.8	419.0	12.0	36.0	10.8	108.8	2,394	11,276
Brazil	81,918	5,693.8	1,426.8	3,401.7	284.0	1,377.9	39.6	70.8	293.8	626.3	12,350	41,500
Colombia	12,288	1,528.8	167.6	1,476.8	124.7	203.6	6.4	8.4	27.1	97.5	3,164	6,190
Chile	12,394	1,435.0	411.1	514.4	20.6	87.2	9.4	20.8	3.7	20.9	674	2,578
Ecuador	6,923	256.3	255.0	927.1	24.1	28.8	38.0	41.1	2.4	6.2	1,290	1,522
Mexico	75,697	1,613.0	505.8	10,992.0	74.9	198.7	14.5	40.1	421.0	955.0	10,208	23,876
Peru	10,950	1,427.9	475.2	707.1	12.6	18.7	11.2	15.2	8.0	10.6	636	890
Venezuela	24,522	2,904.2	684.4	5,171.3	119.9	304.2	31.8	32.7	65.6	84.0	4,346	8,418
Other Selected Developing Countries												
Algeria	19,824	5,376.9	448.3	6,548.6	80.3	102.8	11.6	11.6	29.6	29.6	2,430	2,880
Egypt	26,494	2,577.0	122.3	441.0	70.9	209.2	1.2	1.3	4.7	16.9	1,536	4,520
Republic of Korea	35,414	1,906.7	1,967.9	3,509.1	390.4	916.1	208.7	359.4	787.5	2,148.0	27,732	68,470
Moroco	11,850	1,253.4	37.7	20.8	118.4	332.2	2.6	13.5	1.7	4.8	2,454	7,010
Pakistan	12,639	1,237.7	197.8	99.3	99.6	320.0	5.7	28.5	10.5	68.9	2,316	8,348
Philippines	18,374	1,830.9	771.3	1,648.5	90.4	806.3	79.7	136.5	188.6	462.9	7,174	28,114
Turkey	18,836	1,619.6	36.2	189.3	138.9	508.5	4.2	4.2	6.1	15.4	2,984	10,562
Yugoslavia	12,090	7,823.9	27.9	423.9	701.3	1,484.0	7.6	7.6	33.4	86.4	14,846	31,560

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