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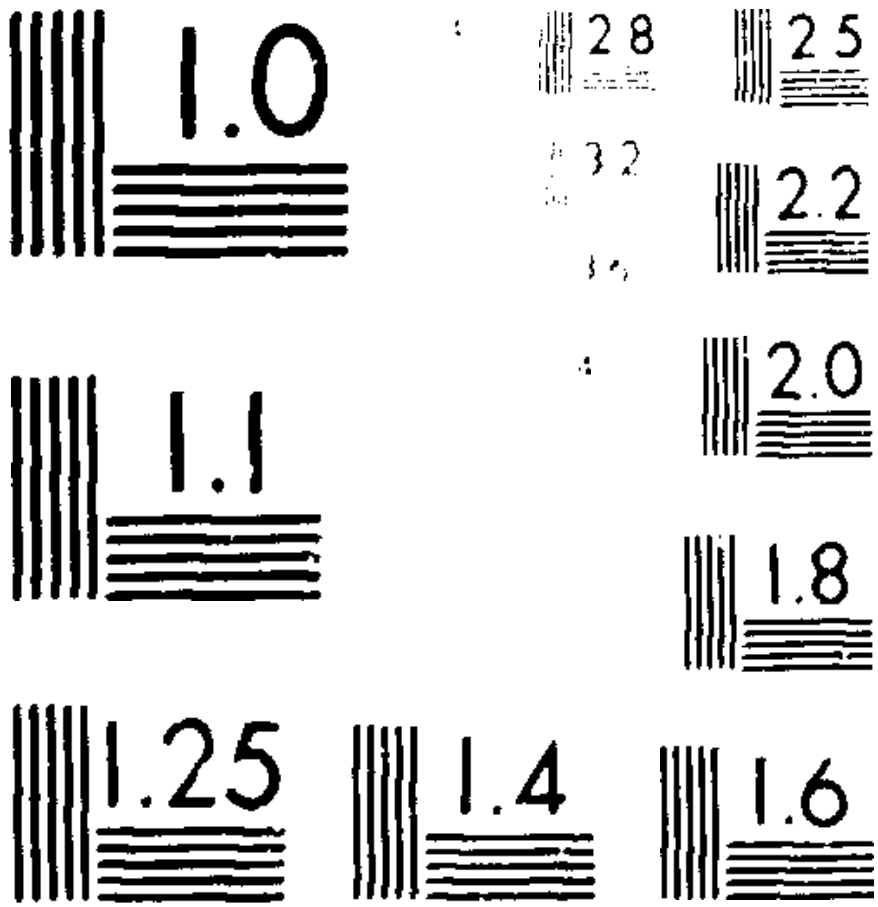
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The Developing Countries' Prospects for Trade in Manufactures in the 1980s; Export Performance and Import Requirements. Methodological Considerations

Prepared by the

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CONTENTS

INTRODUCTION

Chapter II of a forthcoming UNIDO publication[1/] contains an empirical investigation of the developing countries' recent export performance together with a prospective analysis of probable trends in world trade in manufactures in the 1980s. The present paper provides the methodological background for those results. Whereas the major concepts and methods used in the above mentioned analysis will be described in the sections below, the presentation and discussion of the main results are confined to the Survey for which the present paper serves as a technical annex.

The two parts of the analysis are reflected in corresponding two parts of this technical note. The first section deals with some problems of quantifying certain theoretical concepts of international trade, such as the measurement of (revealed) comparative advantage and the quantitative assessment of determinants of observed trade patterns. In the second section a simple econometric model is developed which serves the purpose of a scenario analysis of future patterns of world trade in manufactures. Problems of specification, estimation and scenario construction are discussed and the approaches to solve them are outlined in some detail. Short descriptions of the data used for the empirical analyses conclude each of the two sections.

I. METHODOLOGICAL REMARKS ON AN ANALYSIS OF THE DEVELOPING COUNTRIES' EXPORT PERFORMANCE

In section A of Chapter II of the above mentioned UNIDO publication[2/] an attempt was made to identify some typical characteristics of the developing countries' recent performance in exports of manufactures. A number of hypotheses suggested by the theories of international trade were tested on the basis of detailed information about trade in manufactures in the mid-1960s and mid-1970s. Thereby certain between-country-group differences and changes in the measure of export performance over time were explained without the application of a formal model. The results obtained were of interest by themselves, but also pointed to possibilities of refining the analytical tools for further analyses.

A. MEASUREMENT CONCEPTS

In order to realize an operational approach, a number of concepts had to be introduced to allow for a quantitative assessment of certain characteristics of the trade in manufactures. Again, the problem was to find suitable measures of trade performance that could be used for an empirical analysis of trade patterns. The search for applicable means of quantification and testing focused on three aspects of particular importance in the present context:

(i) export performance as an indicator of "revealed" comparative advantage;

(ii) diversification of trade flows as a dynamic aspect of trade patterns;

(iii) intra-industry trade as a consequence of increased specialization within industries.

Tentative means of quantifying the three aspects of trade performance will be considered below and the most promising concepts selected for further use in the analysis.

Export performance and revealed comparative advantage

One central concept in the discussion of trade patterns and their characteristic features is that of comparative advantage. A fundamental difficulty in finding an empirically relevant measure for comparative advantage lies in the fact that "comparative advantage is usually specified with respect to pre-trade relative prices, whereas empirical

researchers in international economics confront trade data generated by trade flows in post-trade equilibria".[3] This dilemma led economists to introduce the notion of "revealed comparative advantage" on the basis of the assumption that the "commodity pattern of trade reflects relative costs as well as differences in non-price factors"[4]. Among the suggestions for an empirical measure of revealed comparative advantage (RCA) the following three were considered in the present exercise:

(1a) $$XM_{ij} = \frac{X_{ij}}{M_{ij}}$$ (export-import ratio)

(1b) $$EP_{ij} = \frac{X_{ij}}{X_{im}} \Big/ \frac{X_{.j}}{X_{.m}}$$ (relative export share)

(1c) $$D_{ij} = \frac{X_{ij} - M_{ij}}{X_{ij} + M_{ij}} \Big/ \frac{X_{im} - M_{im}}{X_{im} + M_{im}} - 1$$ (Donges-Riedel-measure of revealed comparative advantage)[5]

where the following notational conventions were used:

i = country;

j = commodity (group);

m = total manufacturing;

. = summation over the respective subscript (superscript);

M = imports;

X = exports.

The measure finally chosen for use in the empirical analysis of export performance was (1b) which was called <u>export performance ratio</u> (EP-ratio) and designated by the symbol EP_{ij}. This ratio was supposed to serve the purpose of roughly indicating patterns of actual comparative advantage better than the other two measures. The basis for this

judgement was the conjecture that the import data included in (1a) and (1c) would strongly reflect various trade restrictions employed by different countries and thereby distort the proxy measures of patterns of comparative advantage.

While import data were excluded from the measurement concept for export performance, they were introduced into the weighting scheme applied in order to derive EP-ratios for groups of countries as follows:

$$(2) \qquad EP_{gj} = \sum_{i=1}^{G} \frac{(X + M)_{ij}}{\sum_{i=1}^{G} (X + M)_{ij}} \cdot EP_{ij}$$

where g refers to a country group and G stands for the number of countries in that group. By using total trade values (exports plus imports) as weights, the size of each included economy was taken into account.

In addition to comparisons of export performance in manufactures between typical groups of countries, intertemporal changes of the structure of exports received special attention. Support for a dynamic view of revealed comparative advantage (RCA)[6/] was found in the observed export performance patterns. In connection with the hypotheses concerning the dynamics of comparative advantage, a special indicator was introduced, an RCA-index, that was thought to represent both the static and the dynamic aspect of revealed comparative advantage:

$$(3) \qquad RCA_{ij} = 1/2 \left(EP^{1}_{ij} + EP^{1}_{ij} \frac{EP^{1}_{ij}}{EP^{0}_{ij}}\right) \cdot 100$$

where 0 and 1 indicate the initial and the terminal year(s) of the period considered. The measure RCA_{ij}, which has been defined elsewhere[7], is interpreted as a projected EP-value in index number form, where the assumption was made that past trends in export performance will continue in the future at a declining pace compared to the reference period[8]. Since the RCA-index was not intended to serve predictive purposes, but was rather used as a means for ex-post comparisons of export patterns, its utilization in the present context seemed to be justified.

Export diversification and intra-industry trade

In order to assess the diversification of a country's exports among the various industries[9] two measures have been applied:

(4a) $$C_i = \left(\sum_{j=1}^{n} \left(X_{ij} / X_{i.} \right)^2 \right)^{1/2}$$ (concentration index)

(4b) $$CV_i = \frac{(S^2 (EP))^{1/2}}{\overline{EP}} \cdot 100$$ (coefficient of variation of the EP - ratio)

where $\overline{EP}$ and S^2 (EP) are the sample mean and sample variance of the EP-ratios of a country, taken over all n industries. The concentration index C is bounded from below by $(n)^{-1/2}$ and from above by 1. While the former value indicates complete diversification, i.e. every industry attains the same export share, the maximum value 1 represents complete concentration of manufactured exports in one single industry. The

coefficient of variation of EP-indices is also interpreted as a measure of export diversification (or conversely: export concentration) and represents a slightly different concept. Instead of using a uniform distribution among industries as the reference point as in the case of C, the coefficient of variation treats export diversification relative to the pattern of world demand for exports of manufactures[10/]. This view is implied by the relative-share form of the EP-ratio which takes the various industries' shares in world exports of manufactures as a norm for measuring a country's export performance[11/]. Accordingly, the EP-ratio's dispersion around the "normal value" of unity would have reflected in a strict sense a country's diversification in line with the structure of world exports of manufactures. The present standard-deviation indicator CV was finally chosen, however, as the more popular measure for the dispersion of export performance ratios.

With regard to intra-industry trade flows the simplest quantitative concept was introduced by using the unadjusted Grubel-Lloyd index of intra-industry trade[12/].

$$IIT_{ij} = \frac{(X_{ij} + M_{ij}) - |X_{ij} - M_{ij}|}{X_{ij} + M_{ij}} \cdot 100 \qquad (5)$$

Aggregate values of the IIT-index were obtained as weighted averages across countries and/or industries, where total trade (exports plus imports) values were used as weights.

B. THEORETICAL BACKGROUND OF THE EXPORT PERFORMANCE ANALYSIS

The analysis of developing countries' export performance referred to at the beginning of the present section[13/] was conducted in the framework of two widely used theoretical accounts of international trade. Some of the implications of these trade theories served as a basis for explaining a number of typical features of the patterns of developing countries' exports of manufactured goods. Whereas no formal models representing these theories were applied, a number of theoretical expectations about export performance were tested in the light of observed trade patterns.

The factor proportions explanation of trade as it is represented in the Heckscher-Ohlin model links an economy's trade pattern with the relative endowment with capital and labour. Consequently, relative abundance of one of these two factors of production is expected to lead to an export structure which is biased towards products whose production is intensive in the use of that factor. An empirical test of this hypothesis raises first of all the question of classifying manufactured goods as capital-intensive or labour-intensive. Both the general validity of such a classification[14/] and quantifiable criteria on which it would be based, were discussed quite extensively in the literature without leading to an unanimously accepted view. Accordingly, for the present study two criteria were selected on the basis of their conceptual appeal and the availability of appropriate data. To indicate

capital-intensity of an industry, capital per man was considered an appropriate measure for the present exercise. One of the reasons for this choice was the availability of data for India[15/] for most of the industrial branches, a fact which seemed to be an advantage for an analysis of developing countries' export patterns. Industries for which capital-per-man data were not available were classified according to value added per employee[16/].

An extension of the Heckscher-Ohlin theory of foreign trade can be found in the product cycle model[17/]. This theoretical account of international trade proceeds from the premise that industrial products pass through a "cycle" of New, Growth and Mature phases. While the factor proportions explanation is accepted for trade in mature (old) products, comparative advantage in new products is thought to be determined by the relative abundance (or scarcity) of factors of production other than capital and labour. The formulation of the product cycle model usually found in the literature is in terms of two production factors - skilled and unskilled labour - suggesting that "relative abundance of skilled manpower rather than that of other inputs determines competitive advantage in new products"[18/]. This view implies that new products are characterized by a relatively high skill intensity in their production processes. Accordingly, in the present analysis industrial products were classified as mature or new in terms of their production processes' intensity in the use of skilled labour. The measure used was the labour skill ratio which is defined as the percentage of the labour force classed as skilled, i.e. the percentage of professional, technical and scientific personnel in an industry's labour force[19/].

The fact that today's trade theories represent a broad spectrum of tentative theoretical explanations of observed trade patterns[20/] lead to the consideration of an alternative interpretation of the product cycle. This new view of the product cycle model attempted to "incorporate into the determination of international trade patterns 'product development' as a form of competition"[21/]. It can be argued that the intensity of competition by product development would be a better indicator for the type of competition that the product cycle theory attempts to explain. As a consequence, in the present exercise industrial products were also classified as standardized or unstandardized on the basis of an industry's rate of product development measured by the rate of product turnover[22/].

These theoretical concepts and related empirical measures gave rise to two alternative classifications of industries which were considered as not belonging to the resource-based category[23/]:

(a) the mature - new distinction drawn on the basis of skill intensity,

(b) the standardized - unstandardized partition established in terms of product development.

Both the "mature" and the "standardized" classes were subdivided into a capital-intensive and a labour-intensive category according to the factor proportions account of international trade. Based on this classification scheme a number of aggregate measures of export performance were constructed, and their observed values compared with the expectations derived from the outlined theoretical concepts. Thereby the explanatory power of current trade theories was tested in an informal way on the background of trade patterns observed over the recent past.

C. DATA

The data base of the analysis of export performance was a set of computerized files of commodity trade statistics provided by the United Nations Statistical Office. These data files contain country information on commodity trade flows down to the five-digit SITC-level,[24/] where values of the respective trade flows are given in thousands of current US dollars.

Data used in the classification procedure which was described in the preceding section was extracted from a number of sources which are listed below in priority order;

(i)Resource dependence:
- a) H.B. Lary, op. cit., 1968
- b) S. Hirsch, loc. cit., 1974.

(ii)Skill intensity:
- a) H.B. Lary, op. cit., 1968.
- b) S. Hirsch, loc. cit., 1975.
- c) G.C. Hufbauer, op.cit., 1970.

(iii)Product development:
- a) J.M. Finger, loc. cit., 1975.

(iv)Factor intensity:
- a) A.H.M. Mahfuzur Rahman, op. cit., 1973.
- b) H.B. Lary, op. cit., 1968.
- c) S. Hirsch, loc. cit., 1975.
- d) G.C. Hufbauer, op. cit., 1970.

With the exception of source (iv.a) which provided data for India, all classification data used were US data from various time periods.

II. METHODOLOGY FOR ANALYZING THE DEVELOPING COUNTRIES' PROSPECTS FOR TRADE IN MANUFACTURES IN THE 1980s

Section B of Chapter II of the above-mentioned UNIDO publication[25/] presents an analysis of some trade implications of alternative futures of overall economic growth and of broad options of industrial and commercial policies. The concepts and methods used in those investigations are reviewed and discussed in the following pages. Some introductory remarks on the general characteristics of the approach will be followed by a thorough discussion of the attempts to specify quantitative relations which could be supposed to describe the considered phenomena sufficiently well. Questions of building an appropriate model and of estimating its parameters are treated, as well as the possibility of using this model for a scenario analysis of trade relationships. Finally, the data used for estimating the model parameters and for producing the alternative scenarios will be described.

A. SOME GENERAL REMARKS

The methodological framework presented in the following sections was not intended to provide a technical tool for forecasting or projection purposes. As will become clear from the detailed description of the approach given below, the derivation of quantitative predictions would have been far beyond its scope. What it could yield instead is an analysis of certain trade prospects, not in the form of projections of the future of world trade in manufactures, but rather by assessing the dimensions of a spectrum of possible future developments of that

particular trade aspect of the world economy by way of a scenario analysis. Moreover, the approach allowed only for a partial analysis of the structure of world trade, focusing on some implications for trade in manufactures that were derived from a number of assumptions about future economic growth and economic policies.

The issue selected for prospective analysis is the broad structure of trade in manufactures between the industrialized (North) and the developing countries (South). In this context interest centered around the following trade flows:

(i) imports of three broad categories of manufactures (chemicals, machinery and transport equipment, other manufactures) of both regions;

(ii) exports of manufactures from South to North;

(iii) total exports of manufactures by the South.

Special consideration was given to the ratio between trade flow (iii) and the South's imports of machinery and transport equipment as a measure of one particular aspect of the developing countries' collective self-reliance, namely the ability to pay for important capital goods imports with earnings from manufactured exports. In addition to the identification of relationships between overall economic growth and the growth of the above listed trade flows, an attempt was made to introduce certain broad economic policy aspects into the analysis. This raised a number of conceptual problems, which were related to the identification of demand and supply factors as determinants of the trade

flows. Taking both demand and supply issues into account in a simultaneous equation framework would have complicated the approach unduly. Thus a number of a priori decisions were made with regard to the policy-related objectives of the present study. Following common modelling practice, trade flows (i) were viewed from the demand side. For trade flow (ii) a demand-oriented analysis was required too, if possible effects of the North's general commercial policy attitude were to be considered. On the other hand, a supply-oriented view seemed to be adequate for flow (iii), in order to capture possible effects of the developing countries' industrial policies.

All the above considerations shaped the system of relations that eventually emerged. Another important constraint on the final form of the model was the severe limitation of data which led to an extremely high level of aggregation of the relationships.[26/] The resulting model allowed for an econometric analysis of highly aggregate trade relationships and the subsequent construction of various scenarios of world trade in manufactures in the 1980s.

B. MODEL SPECIFICATION AND ESTIMATION

For an analysis of the above selected trade flows a number of hypothetical functional relationships were formulated and tested statistically, with the objective of identifying both demand- and supply-oriented characteristics of the growth of international trade in manufactures. Of course, economic theory and relevant empirical findings provided the basis for the formulation of estimation equations. A number of modifications had to be applied, however, to several of the commonly used equational forms because of particular conceptional features and data limitations of the present exercise. Import functions were

formulated in demand form as usual, whereas for exports both demand and supply aspects were taken into account. Thus, the function for the South's exports of manufactures to the North was specified as an export demand function, according to the demand-oriented aspects of related commercial policies. On the other hand total exports of manufactures from the South were related to supply characteristics for the purpose of assessing the dimensions of the South's export potential. Finally, a simple industrial growth relationship was added to complete the model. The following pages give a summary of the theoretical arguments taken into account in the respective specification attempts together with a discussion of study specific conceptual and data problems and their implications for specification. Thereby, the main arguments for the choice of alternative equational forms for subsequent statistical testing should be provided.

Import demand

The typical structural equation of import demand[27/] can be written as

$$(1) \qquad M_{ij}^{d} = M_{ij}^{d}(D_{ij}, p_{ij}, p_{ij}^{M}, R_{ij}, \underline{Z}_{ij})$$

where

M = real value of imports,

D = domestic activity variable,

p = domestic price index,

p^{M} = import price (unit value) index,

R = US dollar exchange rate,

$\underline{Z}$ = vector of other variables affecting imports,

the superscript d refers to demand, i stands for the importing country and j denotes a commodity class. The choice of a domestic activity variable D depends on the commodity class j considered. In the case of

aggregate imports, national income is taken as the domestic activity affecting the import volume, whereas the ratio of import prices to domestic prices is normally introduced as an explanatory variable due to the assumed substitutability between imports and domestic goods. This leads to the simplest form of an aggregate import function

$$(2) \quad M_i^d = M_i^d (Y_i, p_i^M / p_i)$$

where Y stands for real GDP and for partial derivatives

$$\partial M_i^d / \partial Y_i > 0 , \quad \partial M_i^d / \partial (p_i^M / p_i) < 0 \quad \text{is expected.}$$

The most commonly used functional form of an import demand equation is the log-linear form[28]

$$(3) \quad \ln M_{it}^d = a_i + b_i \ln Y_{it} + c_i \ln (p_{it}^M / p_{it}) + u_{it}$$

where t denotes the year and u is an error term. This formulation suggests constant income and price elasticities of import demand. If equation (3) is estimated on the basis of real-life data, the equilibrium assumption of equality between the levels of import demand and the actual import levels is implied ($M^d = M$). To describe the disequilibrium case, a partial adjustment mechanism for imports is frequently introduced which relates the change in actual imports to the gap between current import demand and lagged actual imports. This leads to an alternative formulation of the aggregate import equation

$$(4) \quad \ln M_{it} = \gamma a_i + \gamma b_i \ln Y_{it} + \gamma c_i \ln (p_{it}^M / p_{it}) + (1-\gamma) \ln M_{it-1} + \gamma u_{it}$$

where $(0 \leq \gamma \leq 1)$ characterizes the adjustment of imports according to

$$(5) \quad \ln M_{it} - \ln M_{it-1} = \gamma [\ln M_{it}^d - \ln M_{it-1}]$$ [29]

Other possibilities of refining the import equation are the distinction

between cyclical and secular income elasticities[30/] and the inclusion of further explanatory variables in order to reduce the expected misspecification biases of elasticity estimates.[31/]

Bearing in mind the above considerations, constant elasticity relationships between imports on the one side and domestic activity and price levels on the other side were formulated, subject to a number of qualifications and modifications. Instead of total imports, three broad categories of manufactured imports[32/] were investigated. This suggested the use of import equations similar to (1), where a certain import category is related to the relevant domestic activity determining import demand. Although for each category specific import-domestic activity elasticities were estimated[33/], these elasticities were not used in the final projection exercise. The reason for this decision was that the respective import-domestic activity correspondences[34/] seemed to be useful for descriptive purposes, but were considered to be too tenuous to serve as a basis for projections.[35/] Therefore, the level of total domestic economic activity represented by GDP was related to import demand of each of the three categories. Accordingly, for each import category specific domestic activity elasticities were replaced by total income elasticities.[36/]

Concerning price elasticities the high level of aggregation which was dictated by the data situation caused additional problems. Since aggregate imports of a region also include intra-regional trade, a price variable - like the one in equation (3) - which accounts for substitution between imports and domestic production, cannot be transferred straight to an aggregate relation. In the present analysis of trade in manufactures a conceptual distinction between North and South was suggested by the structure of the considered trade relationships. Despite the vigorous expansion of intra-South trade in the recent past,

the 1977 value-share of imports from the North in the South's total imports of manufactures was still more than 88 per cent. Accordingly, in the present two-region framework the South was considered as largely satisfying its demand for manufactured goods by imports from the North.[37/] The use of regional import functions similar to those found in country models - where no "intra"-trade is present - seemed, therefore, to be justifiable in the case of the Southern region. An additional argument for the inclusion of price variables in the South's import equations can be seen in some empirical evidence for the developing countries' imports responding to price changes.[38/] The actual choice of a suitable price variable was influenced by restrictions on data availability too, leading to the use of relative international prices[39/] instead of the above-mentioned import price - domestic price ratios.

A different treatment had to be found, however, for the North's imports of manufactures, given the fact that these imports consisted mainly of intra-North trade with an intra-trade share of more than 91 per cent in 1977.[40/] Since the reasons for assuming price elasticity of imports outlined above are not valid in the case of intra-trade, no price variable was included among the explanatory variables of the North's import equations. As a consequence, the "explanation" of the North's imports of manufactures was confined to the concept of income elasticity of those imports.

As a result of the foregoing discussion, the following import equations were specified for testing subject to the above qualifications:

$$(6a) \quad \ln M^j_{rt} = a^j + b^j \ln Y_{rt} + c^j \ln p^j_t + u^j_t$$

$$(6b) \quad \ln M^j_{rt} = a'^j + b'^j \ln Y_{rt} + v^j_{rt}$$

where in addition to previously-explained notational conventions the following symbols are used:

r = region, where N = North, S = South

j = one of the three manufactured product categories defined by SITC 5, SITC 7, and SITC 6 + 8,

p^j = relative international price of product category j expressed as $p^j = P^j/P^m$, where P^j and P^m designate the unit value indices of all market economies' exports of product group j, and total manufactures, respectively,

u, v = error terms.

The choice of the log-linear functional form was supported by recent empirical findings on the appropriate functional form of a specified import equation[41/]. In view of the severe data limitations and the highly aggregate character of the present analysis, no attempts were made to introduce more refined versions of import equations.

Export demand

The general form of the aggregate export demand function found in the literature is

$$(7) \quad X_i^d = X_i^d(p_i^X, p_{ci}^X, Y_{Mi}, \underline{Z})$$

where X = real value of exports,

p^X = export price index,

Y = real income,

$\underline{Z}$ = vector of other variables affecting export demand,

the superscript d stands for demand, i refers to the exporting country, ci to the countries competing with i and Mi to the countries importing from i[42/]. The equational form used for estimation in a number of empirical studies[43/] is the following log-linear relation

$$(8) \quad \ln X_{i,t} = a_i + b_i \ln \left(p^X_{i,t} / p^X_{ci,t} \right) + c_i \ln Y_{Mi,t} + u_{i,t}$$

where often, for reasons of simplicity, both the competing exporters and the importing countries are taken to be the world in total. The coefficients b_i (c_i) are expected to carry a negative (positive) sign and can directly be interpreted as price (income) elasticity of the demand for exports from country i.

In the present analysis the export demand approach was chosen for analyzing the South's exports of manufactures to the North (in symbols: $X_{S \to N}$). Taking equation (8) as a starting point, three modifications of that widely used type of export demand equation were introduced. First, the price variables to be included in the relationship were selected in a way which provided a close correspondence between the trade flow analyzed and relevant price developments. Since exports of manufactures to the North were investigated, only unit value indices of that type of export flows were used. Moreover, the North had to be taken as the competing exporter in the Northern markets, where the competing export flow was intra-North trade in manufactures. Second, in an alternative version of (8), total income of the importing region (the North) as an explanatory variable was replaced by the level of total imports of manufactures by the North. Thus, the total-import elasticity

of the South's exports of manufactures to the North was substituted for the corresponding income elasticity. Under the plausible assumption of income-elastic Northern imports[44/] this modification of equation (8) indirectly took account of the income elasticity of export demand. On the other hand, the total-import elasticity was expected to provide a direct indicator of the South's recent success in penetrating Northern markets.[45/] Third, some additional independent variables (see equation (7)) were suggested for statistical testing. Those variables were intended to capture policy influences in the given trade flow, where emphasis was put on certain developments in the importing North which would be expected to affect the industrialized countries' commercial policies. In this context, the interrelated problems of structural adjustments and possible factor market disruption in the North play an important role.[46/] As a proxy indicator of the strucutural adjustment process in industrialized countries the share of manufacturing employment in total employment was chosen. The proxy was intended to depict the employment aspect of that process that is immediately relevant for trade policy. As a second option a general time trend was introduced in order to capture tendencies in commercial policies among other factors. Finally, the ratio of manufacturing value added of the South to that of the world in total was tentatively included on the basis of the assumption that this variable would reflect the Southern exporters' non-price competitiveness to a certain extent.[47/]

As a result, the following equations were formulated for testing the relationship between the South's exports of manufactures to the North and the above described (mostly demand-oriented) variables:

$$(9a)\quad \ln X_{S\to Nt} = a + b\ln\left(p_{S\to N}/p_{N\to N}\right)_t + c\ln Y_{Nt} + dZ_t + u_t$$

$$(9b)\quad \ln X_{S\to Nt} = a' + b'\ln\left(p_{S\to N}/p_{N\to N}\right)_t + c'\ln M_{Nt} + d'Z_t + v_t$$

where

$X_{S\to N}$ = real value of exports of manufactures from South to North,

$p_{r\to s}$ = unit value index of exports of manufactures from region r to region s,

M_N = real value of imports of manufactures by the North,

u, v = error terms and

Z = is one of the following three variables:

(i) $\ln\left(E_N^m/E_N\right)$ $\quad E^m$ = manufacturing employment,
E = total employment,

(ii) T = time $\quad (T_t = t)$;

(iii) $\ln\left(V_S/(V_N + V_S)\right)$.

The coefficients b and b' represent price elacticities, whereas the income (total-import) elasticity is given by c (c'). The convenience of obtaining elasticity estimates directly from the regressions and common practice lead to the log-linear formulation.

Export supply

For a country i the supply of manufactured exports can be written as the following function

$$(10) \qquad X_i^s = X_i^s (R_i, P_i^X, P_i^D, I_i, U_i, Z_i)$$

where

X = real value of manufactured exports,

R = exchange rate variable (e.g. real effective exchange rate),

P^X = export price index of manufactures,

P^D = domestic (wholesale) price index of manufactures,

I = index of industrial production,

U = capacity utilization rate,

$\underline{Z}$ = vector of other variables affecting export supply of manufactures,

the superscript s stands for supply and i refers to the exporting country[48/].

Relation (10) can serve as a basis for formulating a supply-oriented function for the aggregate exports of manufactures by the South. In the case of some explanatory variables in (10), however, inclusion in the South's aggregate relationship raises difficulties. Among those variables are the exchange rate and the price variables[49/]. In view of the fact that the "export supply potential depends above all on the capacity to produce"[50/], the index of industrial production (or a similar measure) was given preference in the selection process of

independent variables. The rate of capacity utilization was dropped because of difficulties expected for both the estimation and the interpretation of the corresponding parameter.[51/] Data limitations and problems of quantifiability precluded additional explanatory variables from the relation. Thus, for the present exercise the supply-oriented function of exports of manufactures from the South was reduced to a form which contained a measure of industrial production as the only explaining factor.[52/]

Following common practice, the log-linear functional form was chosen

$$(11) \quad \ln X_{St} = a + b \ln V_{St} + u_t$$

Growth of industry

Many empirical studies were devoted to the question of identifying the major determinants and sources of industrial growth. The analysis of patterns of structural change[53/] in particular added significantly to an understanding of the role of industrialization in the development process. In all these studies the interrelationship between the growth of industry and overall economic growth has been a central point of interest. A considerable number of explanatory factors for between-country differences in the stage of industrialization has been suggested and tested statistically, whereas the investigations of intertemporal changes of a country's share of industry in total production tended to centre around the MVA - GDP relationship.[54/] Accordingly, the present exercise - which is based on highly aggregate

time series data - focused on this latter relationship when trying to analyze the growth of industrial production of the South:

(12) $V_S = V_S(Y_S)$

Since linear regression techniques were to be used for parameter estimation, the choice of a functional form for (12) was restricted to the classes of linear and log-linear functions as usual.[55/] The two alternative equations formulated for statistical testing were

(13a) $V_{St} = a + b\, Y_{St} + u_t$

(13b) $\ln V_{St} = a' + b' \ln Y_{St} + c' (\ln Y_{St})^2 + v_t$

Equation (13a) implies a variable GDP - elasticity of the South's value added in manufacturing which is expected to decline with a rising share of MVA in GDP ($b < 0$)[56/]. The same elasticity behaviour is expected for equation (13b) in the form of a negative sign of the coefficient c'.

Selection of model equations

On the basis of the above equations a regression analysis was carried out to obtain the precise specification of the scenario analysis model and to estimate the model parameters. This econometric exercise was performed by use of time series data (annual observations on the selected variables for the years 1960 to 1977). The decision to follow a pure time series approach - which is reflected in some of the specification considerations - was taken in spite of the small number of available annual observations (18). One reason for this choice was the always present problem of data availability which would have imposed serious

restrictions on the selection of suitable cross-country time-series samples. Furthermore, pooling of cross-section and time-series data would have led to problems associated with the inference from cross-country patterns on time paths of variables.[57/] Thus, complications caused by the use of pooled data samples were avoided, whereas estimation problems typically arising in a time series framework had to be given due consideration.

Table 1 summarizes the results of OLS estimation of the candidate equations formulated in the preceding section. Those equations that were to constitute the desired model were selected according to both substantive criteria derived from economic theory and statistical criteria embodied in various tests. Whereas substantive judgement - which was mainly based on considerations of the economic plausibility of obtained results - was given the highest priority the statistical criteria were treated as secondary means for discriminating between alternative equational forms.[58/]

In the case of the import functions the full set of specified equations was estimated for imports of manufactures by the South. The regression results by and large confirmed the theoretical and empirical expectations of other studies. For both chemicals (SITC 5) and machinery and transport equipment (SITC 7) the inclusion of price variables reduced the residual sums of squares slightly. Furthermore, income and price elasticities carried the expected signs and their values were of a plausible order of magnitude.[59/] Since an overwhelming portion of the developing countries' imports of the above two product categories

Table 1. Results of the OLS - estimation of alternative equational forms [a/]

(annual observations 1960-1977)

A. Imports of manufactures

Equation	Dependent variable	Intercept (t - ratio)	Coefficients of independent variables (t - ratios)					$\bar{R}^2$ (SEE)	DW (d.f.)
			GDP		relative prices				
			$\ln Y_N$	$\ln Y_s$	$\ln p^5$	$\ln p^7$	$\ln p^{6+8}$		
(6a i)	$\ln M_S^5$	-7.74 (-28.68)		1.54 (36.52)	-0.32 (-2.22)			0.993 (0.042)	1.37 (15)
(6a ii)	$\ln M_S^7$	-7.83 (-10.99)		1.75 (16.23)		-1.81 (-2.26)		0.966 (0.090)	0.72 (15)
(6a iii)	$\ln M_S^{6+8}$	-4.67 (-8.68)		1.23 (15.12)			-0.27* (-0.28)	0.959 (0.079)	0.51 (15)
(6b i)	$\ln M_S^5$	-8.10 (-33.84)		1.60 (43.13)				0.991 (0.046)	0.77 (16)
(6b ii)	$\ln M_S^7$	-6.60 (-12.84)		1.57 (19.66)				0.958 (0.101)	0.62 (16)
(6b iii)	$\ln M_S^{6+8}$	-4.771 (-12.27)		1.24 (29.61)				0.961 (0.076)	0.45 (16)
(6b iv)	$\ln M_N^5$	-18.10 (-58.99)	2.62 (69.03)					0.996 (0.036)	1.67 (16)
(6b v)	$\ln M_N^7$	-14.72 (-45.58)	2.37 (59.74)					0.995 (0.038)	0.88 (16)
(6b vi)	$\ln M_N^{6+8}$	-11.84 (-39.03)	2.02 (53.90)					0.994 (0.036)	1.43 (16)

Table 1. Results of the OLS estimation of alternative equational forms (continued)

B. Exports of manufactures from South to North

Equation	Dependent variable	Intercept (t - ratio)	Coefficients of independent variables (t - ratios)						$\bar{R}^2$ (SEE)	DW (d.f.)
			Relative price	GDP	Import level	Other variables				
			$\ln (P_{S\to N}/P_{N\to N})$	$\ln Y_N$	$\ln M_N$	$\ln (E_N^M/E_N)$	T	$\ln [V_S/(V_N+V_S)]$		
(9a)	i)	$\ln X_{S\to N}$	-16.21 (-11.95)	-0.16* (-0.46)	2.33 (14.10)		-1.76 (-2.38)		0.986 (0.[illegible])	2.08 (14)
	ii)		- 8.98 (- 2.03)	-0.31* (-0.96)	0.80* (0.98)			0.07 (2.24)	[illegible] (0.068)	2.14 (14)
	iii)		- 8.57 (- 2.85)	0.11* (0.33)	1.72 (6.22)			1.27 (3.48)	0.989 (0.058)	2.54 (14)
	iv)		-18.68 (-18.56)	-0.73 (-2.55)	2.63 (20.95)				0.993 (0.077)	1.57 (15)
(9b)	i)	$X_{S\to N}$	- 2.80 (-10.52)	-0.14* (-0.63)	1.03 (21.56)	-2.17 (-4.59)			0.994 (0.045)	2.27 (14)
	ii)		- 4.26 (-14.34)	-0.50* (-2.00)	0.60 (2.62)			0.05 (2.65)	0.989 (0.058)	2.04 (14)
	iii)		1.09 (1.06)	0.00* (-0.01)	0.80 (8.93)			1.24 (4.76)	0.994 (0.044)	2.63 (14)
	iv)		- 3.73 (-14.34)	-0.84 (-3.25)	1.19 (23.64)				0.985 (0.068)	0.95 (15)

Table 1. Results of the OLS - estimation of alternative equational forms (continued)

C. Total exports of manufactures from the South

Equation	Dependent variable	Intercept (t-ratio)	Coefficient of independent variable (t-ratio) industrial production	$\bar{R}^2$ (SEE)	DW (d.f.)
			In V_S		
(11i)	ln X_S	-4.08 (-32.89)	1.49 (56.26)	0.995 (0.043)	1.85 (16)

D. Growth of the South's industry

Equation	Dependent variable	Intercept (t -ratio)	Coefficients of independent variables (t- ratios) GDP			$\bar{R}^2$ (SEE)	DW (d.f.)
			Y_S	ln Y_S	$(\ln Y_S)^2$		
(13a i)	V_S	-30.38 (-19.37)	0.22 (95.35)			0.998 (1.890)	0.38 (16)
(13b i)	ln V_S	- 2.36 (- 2.15)		0.90 (2.65)	0.03* (1.09)	0.999 (0.008)	1.51 (15)
ii)		- 3.55 (-83.85)		1.28 (193.93)		0.999 (0.008)	1.26 (16)

Table 1. Results of the OLS - estimation of alternative equational forms

(continued)

a/ The notation of the various equations is explained in the text.

Note: Regression coefficients which are not significant at the five per cent level carry an asterisk. The abbreviations used have the following meaning:

$\bar{R}^2$ multiple correlation coefficient adjusted for degrees of freedom,

SEE standard error of estimate,

DW Durbin-Watson d statistic,

d.f. degrees of freedom.

Source: UNIDO Secretariat estimates.

comes from outside the region,[60/] i.e., from developed countries, the equational form (6a) with a relative price variable as it is usually found in country analyses of external trade, could be expected to provide a satisfactory description in the present case too. This conceptual argument does not hold, however, for the developing countries' imports of other manufactures (SITC 6+8) which contain a considerable portion of intra-trade[61/]. Accordingly, the price variable did not contribute to the explanation of the dependent variable's variance as in the previous cases and its empirical t-value appeared to be very low.[62/] The omission of relative price as an explanatory variable did not change the residual sum of squares and the income elasticity estimate by any mentionable amount. Conceptual reasons[63/] similar to those mentioned in connection with the South's imports of other manufactures led to the specification and estimation of only one equational form for the North's imports of the three considered categories of manufactures.

The low values of the Durbin-Watson d-statistic for most of the import equations pointed to probable specification errors. In two cases[64/] considerably better d-values were obtained, when the squared income term was included among the explanatory variables too. Although a quadratic-logarithmic equation sometimes provided a fairly good description of historical time series, this equational form was not deemed appropriate for medium- to long-term projections, since no convincing economic argument could be found for assuming a steadily increasing (declining) income elasticity of imports of any of the three considered categories of manufactures.[65/] Furthermore, under the given data restrictions no possibility was seen to include additional explanatory variables. Finally, dynamic versions of the import equations

- as described by equation (4) - did not solve the problems probably arising from misspecification. Although d-values improved for all tested equations, the coefficient of the lagged dependent variable did not show the expected behaviour in most cases.[66/] This coefficient was insignificant at the five per cent level for all equations except for the dynamic version of (6aii), and in addition carried the wrong (negative) sign for the counterparts of equations (6ai), (6biv-vi). On the other hand, the inclusion of lagged imports as an additional explanatory variable in equation (6aii) lead to an unreasonably high estimated value of the long-run price elasticity.[67/] Thus, conventional constant-elasticity equations were accepted as import demand relationships, where the resultant estimates of constant elasticities had to be interpreted as estimates of average elasticities for the reference period 1960-1977.

As a partial result of the first round of OLS estimations, equations (6ai), (6aii), (6biii - vi) were specified as the import part of the desired model. From Table 1 it can be seen that the goodness of fit of the selected equations - measured by the adjusted multiple correlation coefficient - was more than satisfactory.

For the demand-oriented relationship between the South's exports of manufactures to the North and some of their possible determinants, eight variants were formulated. They combined a price variable and an income (or income-related) term with tentative other factors which were supposed to capture effects of structural changes and/or commercial policies of the importing region (E^m_N/E_N, T) as well as non-price competitiveness of the exporting region ($V_S/(V_N+V_S)$). While

equations (9a i-iv) yielded direct estimates of the income elasticity of the South-to-North exports of manufactures, equations (9b i-iv) used the concept of a total-import elasticity.[68/] Among the explanatory variables other than relative price and income (total imports of manufactures) of the importing region, none yielded the expected results. The North's share of manufacturing employment in total employment, e.g., failed to reflect restrictive trade policy implications of de-industrialization of the North. The most likely reason for this is the high level of aggregation of the considered relationships which does not allow to test the above hypothesis for those industries which are the concern of protective measures. The negative coefficients obtained for this variable in the aggregate relationships reflect rather a substitution effect between domestic production and imports of manufactures in which the South can compete. Furthermore, the inclusion of the manufacturing employment share among the independent variables rendered the coefficients of the relative price variable insignificant[69/] in both equation variants.

When a time trend T was included, the price elasticities became insignificant. Morecver, the positive time coefficient seemed to represent rather the overall growth of the considered export flow than a trend in commercial policy effects as originally intended.[70/] Although, equation (9bii) showed a very good fit and a value of the Durbin-Watson-d-statistic near 2, it was excluded from the final model for this conceptual reason. In general, explanatory factors suggested by economic theory - like income of the importing region and relative prices - were considered to be superior to the rather unspecific time trend. Finally, the non-price competitiveness variable's

$(V_S/(V_N+V_S))$ coefficients appeared with the expected sign,

but yielded very low t-values of the price elasticities too. Since the theoretical arguments for inclusion of the relative price variable seemed to be far stronger than those for introducing the above new variable, equations (9a iii) and (9b iii) were also ruled out. Despite a lower value of the Durbin-Watson-d-statistic for equation (9biv) than for (9aiv), the former equation was finally selected because of the fact that the North's total manufactured imports as an independent variable directly took account of the trade share aspect of the analyzed North-South relationship. An additional argument for this choice was the slightly lower residual variance of (9b iv) compared to (9a iv).[71/]

As a supply function for the exports of manufactures from the South, the simple equation (11i) performed satisfactorily. The coefficient of the lagged dependent variable in a dynamic version of (11i)[72/] was - in contradiction to the assumed partial adjustment process - less than zero and not significant.

Finally, for the MVA - GDP relationship the constant elasticity equation (13b ii) was chosen. Whereas the coefficient of the quadratic term included in equation (13b i) did not carry the expected negative sign, the linear equation (13a i) appeared to be equivalent to the log-linear equation (13b ii) in terms of goodness of fit. The extremely low value of the Durbin-Watson d-statistic for (13a i), seemed to point to a serious specification error, whereas this was not the case for equation (13b ii). As a consequence, the declining-elasticity equation (13a i) was dropped in favour of the constant-elasticity relationship (13b ii).

Values of the Durbin-Watson d-statistic shown in Table 1 indicated the presence of serial correlation for a number of equations. In these cases the application of OLS is likely to result in an underestimate of the sampling variances of the regression coefficients and the precise form of the t-test derived for the linear model is no longer valid. The results of a re-estimation of the above relationships, however, showed that most of the equations that yielded the best OLS results, performed satisfactorily also when adjustments were made for autocorrelation of the disturbances.[73/] As a result of the selection process described above, the model of aggregate world trade in manufactures shown in Table 2 was specified.

Parameter estimation

A first set of parameter estimates for the model presented in Table 2[74/] can be extracted from the results summarized in Table 1. However, there are a number of objections to a straight-forward application of the OLS technique to the model equations. The first argument for reviewing the estimation procedure stemmed from the simultaneous nature of the relations which might give rise to a simultaneous equation bias of the OLS estimates. These latter estimates would be optimal only if the treated model were recursive, i.e., in the present case if the covariance matrix of disturbances were diagonal. This assumption, however, did not seem to be realistic in the light of the expected contemporaneous correlation of disturbances within the two sets of import equations (N1 - N3) and (S2 - S4).[75/] Therefore, the application of 3SLS to the whole model was suggested as an estimation procedure which takes into account all the model equations and is

Table 2. A Model of World Trade in Manufactures

Equation	Region	Equational Form[a/]
N1	North	$M_N^5 = A_{N1} \cdot (Y_N)^{b_{N1}} \cdot U_{N1}$ [b/]
N2	North	$M_N^7 = A_{N2} \cdot (Y_N)^{b_{N2}} \cdot U_{N2}$
N3	North	$M_N^{6+8} = A_{N3} \cdot (Y_N)^{b_{N3}} \cdot U_{N3}$
N4	North	$M_N = M_N^5 + M_N^7 + M_N^{6+8}$
S1	South	$V_S = A_{S1} \cdot (Y_S)^{b_{S1}} \cdot U_{S1}$
S2	South	$M_S^5 = A_{S2} \cdot (Y_S)^{b_{S2}} \cdot (p^5)^{c_{S2}} \cdot U_{S2}$
S3	South	$M_S^7 = A_{S3} \cdot (Y_S)^{b_{S3}} \cdot (p^7)^{c_{S3}} \cdot U_{S3}$
S4	South	$M_S^{6+8} = A_{S4} \cdot (Y_S)^{b_{S4}} \cdot U_{S4}$
S5	South	$X_S = A_{S5} \cdot (Y_S)^{b_{S5}} \cdot U_{S5}$
S6	South	$X_{S \to N} = A_{S6} \cdot (M_N)^{b_{S6}} \cdot (p_{S \to N}/p_{N \to N})^{c_{S6}} \cdot U_{S6}$
S7	South	$X_{S \to S} = X_S - X_{S \to N}$

a/ The constant-elasticity relationships N1 - N4 and S1 - S6 were written in antilog form for the sake of compatibility with the identities N4 and S7. Parameter estimates were obtained, however, from the corresponding log-linear equations.

b/ The U's indicate multiplicative error terms.

asymptotically more efficient than 2SLS[76/] if the covariance matrix of disturbances is not diagonal.

Another problem with the application of OLS arose from the presence of positive autocorrelation of the disturbance term (mentioned above) as indicated by the low values of the Durbin-Watson d-statistic for most of the model equations. Since autocorrelation poses also a problem for the application of simultaneous-equation methods, an attempt to correct for serial correlation by an appropriate single-equation method seemed to be justifiable.[77/] Thus, alternative parameter estimates were computed by use of a method similar to the Cochrane-Orcutt technique, where - according to the values of the Durbin-Watson statistic obtained in connection with OLS estimation (Table 1) - first order autoregressive schemes were assumed for the error terms of the equations N2, S1 - S4 and S6.[78/]

The results of the two refined estimation procedures applied to the model are presented in Table 3.

It can be seen that the differences between corresponding regression coefficients estimated by the two refined methods were negligible.[79/] While the asymptotic properties of 3SLS - under the assumption of serially uncorrelated error terms of the model equations - are attractive, there is only scarce evidence on the small-sample properties of this and other simultaneous equation methods. Moreover, in the present context incomplete specification and related autocorrelation of disturbances seemed to pose the most serious problems. Therefore, in the final choice of parameter estimates, preference was given to that

Table 3. Parameter estimates of the log-linear forms of the model equations in Table 2
(annual observations 1960-1977)

A. Three-stage Least-squares (3SLS)

Equation [a]	Dependent variable	Intercept	Coefficients of independent variables (standard errors)							R^2 [b]
			Y_N	Y_S	V_S	M_N	p^5	p^7	pS→N/ pN→N	
N1	M_N^5	-18.035	2.613 (0.037)							
N2	M_N^7	-14.661	2.360 (0.040)							
N3	M_N^{6+8}	-11.791	2.017 (0.037)							
S1	V_S	-3.550		1.275 (0.006)						
S2	M_S^5	-7.820		1.557 (0.036)			-0.251 (0.093)			0.999
S3	M_S^7	-7.397		1.686 (0.072)				-1.326 (0.217)		
S4	M_S^{6+8}	-4.653		1.224 (0.057)						
S5	X_S	-4.034			1.484 (0.025)					
S6	$X_{S\to N}$	-3.623				1.17? (0.035)			-0.691 (0.076)	

Table 3. Parameter estimates of the log-linear forms of the model equations in Table 2 (continued)

B. Equations adjusted for serial correlation, if necessary (assuming first-order autoregressive schemes for the error terms)

Equation	Dependent variable	Intercept	Coefficients of independent variables (standard errors)							ρ [a]	R^2	Root mean square of errors
			Y_N	Y_S	V_S	M_N	p^5	p^7	$\frac{pS \rightarrow N}{pN \rightarrow N}$			
N1 [d]	M_N^5	-18.105	2.622 (0.038)								0.996	0.036
N2	M_N^7	-14.581	2.350 (0.060)							0.529	0.990	0.032
N3 [d]	M_N^{6+8}	-11.843	2.024 (0.038)								0.994	0.036
S1	V_S	-3.552		1.275 (0.009)						0.343	0.999	0.008
S2	M_S^5	-7.870		1.565 (0.051)			-0.201* (0.155)			0.306	0.990	0.039
S3	M_S^7	-7.400		1.688 (0.123)				-1.300* (0.643)		0.547	0.939	0.071
S4	M_S^{6+8}	-4.757		1.243 (0.084)						0.570	0.932	0.056
S5 [d]	X_S	-4.077			1.493 (0.027)						0.995	0.043
S6	$X_{S \rightarrow N}$	-3.491				1.146 (0.058)			-0.509* (0.243)	0.444	0.977	0.056

Table 3. Parameter estimates of the log-linear forms of the model equations in Table 2 (continued)

See Table 2.

b/ The figure shown is a weighted R^2-value for the whole system corresponding to the approximate F-test on all non-intercept parameters.

c/ $\hat{\rho}$ is an estimate of the autoregressive parameter ρ in the first-order autoregressive scheme for the error term u_t

$$u_t = \rho u_{t-1} + \varepsilon_t,$$

where ε_t is normally and independently distributed with mean zero and variance σ^2.

d/ OLS estimates

Source: UNIDO Secretariat estimates.

method which took account of the problem of serial correlation of error terms (Table 3 B). Furthermore, the method seemed to be appropriate for the purpose of the present analysis because it could be supposed to provide fairly good estimates of the sampling variances of regression coefficients which were to play a certain role in scenario construction. Whenever estimates of model parameters will be referred to further on, those estimates will be taken from Table 3.B.

For illustrative purposes, but not for use in the scenario analysis, estimates of alternative import elasticities have been derived by use of the same method of the Cochrane-Orcutt type. In Table 4 those elasticity estimates are shown which characterize the import-domestic activity relationship according to the concept outlined earlier. The coefficients of the respective independent variables are estimates of the corresponding domestic-activity elasticities of imports of the various product categories. The income elasticities of imports of "other manufactures" (M_N^{6+8} and M_S^{6+8}) can be substituted from Table 3B, equations N3 and S4.

Table 4. Parameter estimates of the log-linear forms of import-domestic activity relationships

(annual observations 1960-1977)

Dependent variable	Intercept	Coefficients of independent variables (standard errors)		$\hat{\beta}$	R^2 (root mean square of error)
		V_N	V_S		
M_N^5	-12.473	2.297 (0.049)		0.392	0.993 (0.034)
M_N^7	- 9.429	2.0 (0.067)		0.575	0.983 (0.037)
M_S^5	- 3.6 4		1.257 (0.053)	0.667	0.972 (0.036)
M_S^7	- 2.132		1.212 (0.094)	0.584	0.971 (0.078)

Source: UNIDO Secretariat estimates.

C. SCENARIO ANALYSIS

The model described in the preceding section served as a tool for assessing the orders of magnitude of possible developments in world trade in manufactures in the 1980s. Rather than one single projection of future levels of aggregate trade flows, a set of growth variants of worldwide trade in manufactures over the present decade was derived from the model equations on the basis of various assumptions. As a result, five scenarios were obtained which depict alternative futures of economic growth and trade relationships. Each scenario is based on a set of assumptions about the following four key areas:

(i) the growth of GDP in the North and in the South;

(ii) future developments of relative export prices;

(iii) the broad policy options of the North with respect to imports of manufactures,

(iv) the choice of industrial strategies in the South, where import substitution and export promotion represent the limiting cases of a range of possible policies.

In order to guarantee the internal consistency of each set of assumptions about areas (i) - (iv), two global prospective studies[80/] were taken as guides for the formulation of the five alternative lists of assumptions which formed the basis of the corresponding scenarios. The present partial analysis of the prospects for trade in manufactures drew, therefore, heavily on some results of the above mentioned studies which are of a much wider scope. Accordingly, by use of the model of Table 2, certain trade implications of a spectrum of possible variants of overall economic growth and of anticipated broad trends in industrial and commercial policies were assessed quantitatively.

Projection method

Projected levels of the considered trade flows in each of the scenarios were obtained as solutions of the estimated model of Table 2. The assumptions (i) - (iv) were introduced in the formal system of equations in two different ways according to the structure of the quantitative relationships of Table 2. Assumptions (i) and (ii) about GDP-growth and price relationships entered the system as projected levels of exogenous variables. Historical performance and the above global studies[81/] were the main sources for assumptions about future growth of GDP. Assumptions about relative prices were made on the basis of historically observed patterns and trends only.

A more difficult task than finding plausible projected levels of the exogenous variables of the model was the introduction of the policy assumptions (iii) and (iv) into the quantitative framework used for deriving alternative projections. The adequate method to analyse policy effects would have been the inclusion of specific exogenous variables which could be supposed to explain changes in the levels of the considered trade flows as a consequence of changes in policy orientation. Attempts to identify such quantitative relationships were made, e.g., for the equations (9a) and (9b).[82/] All tested versions of equations which included policy variables, however, failed to perform satisfactorily under the conceptual and statistical criteria set out earlier. Thus, a direct impact of policy-related variables on the trade variables analysed in this study could not be identified by the approach outlined above. This failure is not too surprising, however, if

one considers the usual difficulties associated with the quantification of policy effects together with additional conceptual problems caused by the exceptionally high levels of aggregation of the presently analysed variables.

In order to provide a substitute for the originally intended policy simulation tool, the following methodological approach was developed. Instead of having certain exogenous variables reflect differences between policy options, it was assumed that changes in the orientation of trade-related policies result in changes in certain trade-related growth elasticities. Thereby, the plausible assumption of the dependence of trade-growth elasticities on certain policy factors is implied. While other trade projection exercises have used "apparent elasticities"[83/] and their expected changes as an operational tool for introducing policy effects a.o., the present study took a slightly different view. For all the scenarios described below, the estimates of average growth elasticities obtained from the model equations (Table 2) were taken as the starting point. Assumptions about the broad trends in commerical policies lead to assumed future changes of those elasticity values. The variations of the elasticities concerned were determined as follows. While the direction of change was given by the general characterization of the assumed policy approach, the absolute value of an elasticity change was derived from statistical characteristics of the corresponding elasticity estimate. Thus, according to assumptions about the implementation of general policy guidelines and the effectiveness of related measures, elasticities were allowed to vary within intervals

which corresponded to approximate confidence intervals of constant-elasticity estimates. Although nothing would be more at variance with this approach than to see it as a solution of the problem of quantifying trade policy effects, the presented method was expected to yield some orders of magnitude of trade relationships for a few broad alternatives of economic growth and commercial policies. The technical equivalent of this method of assumed elasticity changes outlined above is a projection approach involving assumed parameter shifts of the model of Table 2.[84/] Thus, the underlying economic concept of changing elasticities is reflected by structural shifts in the econometric framework.

The method of producing alternative scenarios by use of the model described in the foregoing section differs from other approaches in the way of introducing the policy aspect into the quantitative framework. Since the attempts to introduce policy variables explicitly into the system failed, an indirect way of accounting for policy influences was tried by qualitatively relating possible changes in policy orientation with corresponding expected changes of growth elasticities derived from the estimation of the constant-elasticity relationships of the model.

Scenario assumptions

Along the conceptual guidelines discussed above, five sets of assumptions were formulated - as the bases of five scenarios of trade relationships - which are described in detail in Table 5. Each set of assumptions was felt to represent a fairly consistent framework of overall growth performance and policy attitudes which would allow some insight into possible developments of world trade in manufactures over the present decade.[85/]

Part A of Table 5 summarizes the assumptions made about future levels of the exogenous variables of the model. The sources for these assumptions were the historical patterns of the variables concerned - where 1960-1977 was taken as the reference period - and the two global studies mentioned above.[86/] Assumed future values of relative prices were derived from the corresponding 1960-1977 time series. Relative prices of world exports of chemicals (SITC 5) and of machinery and transport equipment (SITC 7) were projected by simply extrapolating the 1960-1977 time series trends to 1990. Concerning the projection of the relative price of South exports of manufactures to the North - which was

Table 5. Assumptions underlying the five scenarios

A. Assumptions about exogenous variables[a/]

Scenario[b/]	Average annual growth of GDP (per cent)				Relative prices of world exports of SITC section				Relative price of manufactured exports from South to North (pS→N/pN→N)	
	North		South		5(p^5)		7(p^7)			
	1977-1985	1985-1990	1977-1985	1985-1990	1985	1990	1985	1990	1985	1990
A	5.1	5.1	5.7	5.7	0.82	0.77	1.08	1.12	1.12	1.12
B	3.2	3.2	5.5	5.5						
C	3.0	3.0	4.7	5.0						
D	4.0	4.5	6.5	7.0					0.94	0.85
E	4.0	4.5	7.0	8.0						

B. Assumptions about trade elasticities[c/]

Scenario	Income elasticity of the North's imports of SITC section(s)						Elasticity of the South's exports of manufactures to the North with respect to				MVA-elasticity of the South's total exports of manufactures	
	5		7		6+8		the North's total of manufactured imports		the relative price			
	1977-1985	1985-1990	1977-1985	1985-1990	1977-1985	1985-1990	1977-1985	1985-1990	1977-1985	1985-1990	1977-1985	1985-1990
A	2.55 (-2)	2.55 (-2)	2.23 (-2)	2.23 (-2)	1.95 (-2)	1.95 (-2)	1.15 (0)	1.15 (0)	-0.51 (0)	-0.51 (0)	1.49 (0)	1.49 (0)
B												
C							1.03 (-2)	1.03 (-2)	-0.02 (+2)	-0.02 (+2)	1.44 (-2)	1.44 (-2)
D							1.15 (0)	1.26 (+2)	-0.51 (0)	-0.99 (-2)	1.49 (0)	1.55 (+2)
E	2.62 (0)	2.62 (0)	2.35 (0)	2.35 (0)	2.02 (0)	2.02 (0)	1.26 (+2)	1.26 (+2)	-0.99 (-2)	-0.99 (-2)	1.60 (+4)	1.60 (+4)

Table 5. Assumptions underlying the five scenarios (continued)

a/ For an exact definition of the listed exogenous variables of the model, see Table 2 and the related explanations in the text.

b/ A detailed description of the five scenarios - a short characterization of which is given below - can be found in Chapter II of UNIDO, op. cit., 1981, forthcoming.

Scenario	Characterization
A	The 1960s resumed, a cyclical view
B	The 1970s continued, a secular view
C	Export pessimism
D	Export orientation
E	Collective self-reliance

c/ In this part of the table only those elasticities are listed for which changes in the future were assumed in at least one of the scenarios. The exact definition of the respective growth elasticities can be obtained from the information presented in Tables 2 and 3. Each single assumption is based on the elasticity estimates shown in part B of Table 3 where, in parentheses below each figure, the number of standard deviations is indicated which were added to (subtracted from) each elasticity estimate to obtain the projected elasticity values.

supposed to reflect the corresponding price competitiveness - scenarios A and B assumed no changes for the future compared to the 1977 value, whereas for the other scenarios a steady decrease was projected leading to the reference period's minimum being attained again in 1990. This latter variant was intended to reflect the assumption of the South's continuing improvement of price competitiveness in the exports of manufactures.

The assumptions about aggregate growth rates of GDP for the first two scenarios were also simply taken from observed average annual growth rates over the respective reference periods (1960-1970 for A and 1970-1977 for B).

Scenario C was designed to describe export pessimism arising in a low-growth environment. The formulation of the related growth assumptions was guided by Interfutures' "Scenario B" and the World Bank Report's "Low case".[87/] While the former study assumed average annual growth rates of 3.6 per cent for the OECD area and 4.3 per cent for the developing areas over 1975-1990, roughly corresponding growth rates found in the latter source were 2.9 per cent and 4.4 per cent for 1980-1985 and 3.0 per cent and 4.6 per cent for 1985-1990. Thus, the assumptions of scenario C in Table 5 drew a slightly more optimistic picture of the developing countries' growth performance than the two cited sources. Scenario D was intended to represent a high-growth future which is also characterized by increased export orientation in developing countries. Starting points for a quantification of these general assumptions were Interfutures' "Scenario A" and the "High case" of the

World Bank report. The annual growth rates projected in the first reference scenario were 4.3 per cent for OECD countries and 6.5 per cent for developing countries on the average over the period 1975-2000. The second source reported corresponding growth rates of 3.3 per cent and 5.1 per cent for the first half of the present decade and of 4.0 per cent and 5.6 per cent for the second half of the 1980s. In comparison, the present study's growth assumptions for scenario D are seen to be again rather optimistic, where an acceleration of growth between the two halves of the 1980s was assumed as a consequence of overcoming certain adjustment problems in the course of the present decade.[88/] In part B of Table 5, the assumptions about elasticity changes made for each scenario were summarized. The three groups of elasticities concerned are:

(a) income elasticities of the North's imports of manufactures by broad product categories;

(b) total-import and price elasticities of the South's exports of manufactures to the North;

(c) MVA elasticity of the South's total exports of manufactures.

All other elasticities and related parameters of the model remained unchanged, i.e. they were given the values shown in table 3B which represent estimates of the respective average elasticities and/or other parameters. According to the concept of linking broad policy assumptions with related elasticity values as outlined above, three types of assumptions, about future elasticities, were put forward:

(i) "Historical elasticities", taking on the values estimated for the reference period, thereby reflecting the continuation of historical average patterns of growth relationships;

(ii) "Low elasticities", lying two standard deviations below the historical estimates;

(iii) "High elasticities", lying two standard deviations above the historical estimates.

The only exception to this scheme was the South's export supply elasticity assumed for the "target Scenario E".[89/] The linkage between broad policy options and assumptions (i), (ii), (iii) about elasticity changes can readily be established from the characterization of the scenarios.[90/]

Finally two characteristic features of the assumptions listed in Table 5 shall be mentioned which accounted for some differences between the present exercise and similar studies. First, the growth assumptions underlying the presented five scenarios were chosen to be more optimistic than those found in the quoted studies. The reason for this modification of inherited assumptions is not to be found in the availability of new quantitative analyses but, rather, lies in subjective judgement biased towards a more positive view of future growth prospects. Second, most of the elasticity changes assumed for the various scenarios have to be termed as rather modest in size,[91/] meaning that no drastic shifts in the structural relationships of the model were postulated.

D. DATA

The data base for the scenario analysis described in the foregoing sections was compiled from two major sources. The national accounts time series (GDP and MVA for the two regions considered) were aggregated from country information contained in the UNIDO data base. Figures were in constant US dollars with 1975 as the base year. Data on total labour force (used in equation 9aii of Table 1) were taken from the same source, whereas the index of industrial employment - needed in the same equation - was obtained from United Nations, Yearbook of Industrial Statistics, various issues.

All data on the value and/or unit value of the considered trade flows were taken from United Nations, Yearbook of International Trade Statistics, various issues. Unit value indices found there - which had to be taken as a substitute for price indices - played an important role as determinants of the aggregation levels of the trade variables considered. For conceptual reasons there was a need to conduct the analysis in constant prices. The availability of sufficiently disaggregate unit value indices of imports and/or exports - which served as deflators - represented the most serious data bottleneck. Both the regional and the product category levels of aggregation found in the study reflect the data situation regarding the availability of disaggregate unit value indices. Thus, each of the two regions North (developed market economies) and South (developing market economies) was taken as a whole and chemicals (SITC 5), machinery and transport equipment (SITC 7) and a heterogeneous "other manufactures" category (SITC 6 & 8) had to be accepted as a three-class breakdown of total manufactured trade. Due to the trade flows being reported as exports in the sources used, all trade data were in f.o.b. values.

1/ UNIDO, Industrial Development Survey, 1981, forthcoming.

2/ UNIDO, op. cit, 1981, forthcoming.

3/ A.L. Hillman, "Observations on the relation between 'revealed comparative advantage' and comparative advantage as indicated by pre-trade relative prices", Weltwirtschaftliches Archiv, Vol.116, 1980, p.315.

4/ B. Balassa, "Trade liberalization and revealed comparative advantage", Manchester School, Vol.33, No.2, 1965, p.103.

5/ See J.B. Donges, J. Riedel, "The expansion of manufactured exports in developing countries: an empirical assessment of supply and demand issues", Weltwirtschaftliches Archiv Vol.113, 1977, p.68-72.

6/ See, e.g., B. Balassa, "The changing pattern of comparative advantage in manufactured goods", Review of Economics and Statistics, Vol.61, No. 2, 1979, pp. 259-266.

7/ B. Balassa, loc. cit., 1965, p.107.

8/ It is obvious that this construction of a RCA-index represents only one of several possibilities and has been selected quite arbitrarily.

9/ Following common practice of trade studies an industry was generally defined as a three-digit SITC category (see B. Balassa, loc. cit, 1965, p.104).

10/ A similar interpretation of the dispersion of an export performance measure can be found in B. Balassa, loc. cit, 1965, pp.107,108.

11/ See expression (1b).

12/ For a discussion of this index and related measurement concepts and problems see H. Grubel and P.J. Lloyd, Intra-Industry Trade, the Theory and Measurement of International Trade in Differentiated Products, Mac Millan Press, London, 1975.

13/ UNIDO, op. cit., 1981, forthcoming.

14/ The dispute about "factor-intensity reversals" arose mainly from the findings presented in W.W. Leontieff, "Domestic production and foreign trade; the American capital position re-examined", Proceedings of the American Philosophical Society, Sept. 1953 and in the same author's "Factor proportions and the structure of American trade", Review of Economics and Statistics, Nov.1956.

15/ Data were taken from A.H.M. Ma'Nuzur Rahman, Exports of Manufactures from Developing Countries, A Study on Comparative Advantage, Rotterdam University Press, 1972, p.131. Supplementary information on capital per man of industries in the United States was found in G.C. Hufbauer, "The impact of national characteristics and technology on the commodity composition of trade in manufactured goods" in The Technology Factor in International Trade, ed. R. Vernon, National Bureau of Economic Research, New York, London, 1970.

16/ This concept together with corresponding US data was taken from H.B. Lary, Imports of Manufactures from Less Developed Countries, National Bureau of Economic Research, New York, 1968.

17/ R. Vernon, "International investment and international trade in the product cycle" Quarterly Journal of Economics, Vol.80, May 1966, pp.190 sqq. and S. Hirsch, Location of Industry and International Competitiveness, Oxford University Press, 1967.

18/ S. Hirsch, "The product cycle model of international trade - a multi-country- cross-section analysis", Oxford Bulletin of Economics and Statistics, Vol.37, No.4, 1975, p.305.

19/ See H.B. Lary, op. cit, 1968, Appendix A and G.C. Hufbauer, op. cit., 1970, Table A-2.

20/ See G.C. Hufbauer, op.cit., 1970, Table 1.

21/ J.M. Finger, "A new view of the product cycle theory", Weltwirtschaftliches Archiv, Vol.111, 1975, p.79.

22/ See J.M. Finger, loc. cit., 1975, pp.82,97-98.

23/ The dividing line between resource-based and non-resource-based industries was drawn according to information presented in H.B. Lary, op. cit., 1968 and S. Hirsch, "Capital or technology: confronting the neo-factor proportions and neo-technology accounts of international trade", Weltwirtschaftliches Archiv, Vol.110, No.4, 1974, pp.535-563.

24/ Data are reported according to the Standard International Trade Classification (SITC), Revised a description of which can be found in Statistical Papers, Series M. No.34 (United Nations publication, sales No. 61. XVII. 6)

25/ UNIDO, op. cit., 1981, forthcoming.

26/ Due to these data limitations, the two regions North (developed market economies) and South (developing countries) could not be disaggregated further. More details on the nature of these limitations can be found in section 2.4.

27/ See, e.g., B.G. Hickman and S. Schleicher, "The interdependence of national economies and the synchronization of economic fluctuations evidence from the LINK project", Weltwirtschaftliches Archiv, Vol.114 No. 4, 1978, pp. 642-707.

28/ See H.S. Houthakkker and S.P. Magee, "Income and price elasticities in world trade", The Review of Economics and Statistics, vol. 51, no.2, May 1969, pp. 111-125. Furthermore, it was demonstrated for a number of countries that the log-linear form was the appropriate form of their export demand equations (see M.S. Khan and K.Z. Ross, "The functional form of the aggregate import demand equation," Journal of International Economics, vol.7, pp. 149-160 and T.A. Boylan, M.P. Cuddy, I.O'Muircheartaigh, "The functional form of the aggregate import demand function: A comparison of three European economies", Journal of International Economics, Vol.10, No.4, November 1980, pp. 561-568).

29/ See M.S. Khan, "Import and export demand in developing countries", IMF Staff Papers, Vol.21, no.3, November 1974, pp. 678-693.

30/ See M.S. Khan, K.Z. Ross, "Cyclical and secular income elasticities of the demand for imports", The Review of Economics and Statistics, Vol 62, No.3, August 1975, pp. 357-361.

31/ The problem of misspecification due to the omission of a variable which would take account of quantitative import restrictions is briefly discussed in M.S. Khan, loc.cit., 1974, pp.680-683.

32/ The three import categories were chemicals (SITC 5), machinery and transport equipment (SITC 7) and other manufactures (SITC 6 + 8).

33/ See Table 4.

34/ See Table 4.

35/ SITC sections 5 and 7 can only roughly be classified as intermediate products and capital goods respectively, so that import demand for those categories must be assumed to be only partly determined by MVA. Moreover, SITC 6 + 8 is too heterogeneous to assign to it a partial aspect of domestic economic activity as the relevant demand factor.

36/ The same concept has been used in an analysis of imports by commodity classes contained in H.S. Houthakker, S.P. Magee, loc. cit., 1969, pp. 120, 121.

37/ This view is represented in its pure form by theoretical models like the one developed in R. Findlay, "The terms of trade and equilibrium growth in the world economy", The American Economic Review, Vol. 70, No. 3, June 1980, pp. 291-299.

38/ See M.S. Khan, loc. cit., 1974, pp. 686-692.

39/ A similar approach to the problem of determining import levels is found in S. Gupta, A. Schwartz and R. Pandula, "The World Bank model for global interdependence: a quantitative framework for the World Development Report", Journal of Policy Modeling, Vol. 1, No. 2, May 1979, pp. 179-200. Whereas those authors deflate sectoral world prices by the world inflation ratio, the present study puts the price development of each selected trade category in relation to that of total trade in manufactures.

40/ Intra-trade of the considered three product categories showed the following current value percentages in 1977:

	SITC 5	SITC 7	SITC 6+8
North	95.8	96.5	85.4
South	11.1	6.0	20.1

41/ See T.A. Boylan, M.P. Cuddy and I. O'Muircheartaigh, loc.cit., 1980, pp. 561-568.

42/ For more details and a discussion of related specification and estimation problems, see K. Sato, "The demand function for industrial exports; a cross-country analysis", The Review of Economics and Statistics, Vol. 59, No. 4, November 1977, pp. 456-464 and N. Peera, "Econometric estimates of India's export demand parameters: a critical survey", Weltwirtschaftliches Archiv, Vol. 115, 1979, pp. 356-371.

43/ Examples are H.S. Houthakker, S.P. Magee, loc.cit., 1969, pp. 111-125, M.S. Khan, loc.cit., 1974, pp.678-693 and J.B. Donges, J. Riedel, "The expansion of manufactured exports in developing countries: an empirical assessment of supply and demand issues", Weltwirtschaftliches Archiv, Vol. 113, 1977, pp. 58-87.

44/ See p.18

45/ This market share aspect of the modified export demand equation relects the influence of an alternative trade projection methodology which is based on world trade matrices or market share matrices instead of export demand functions. Further details on the trade matrix approach can be found in P.S. Armington. "The geographic pattern of trade and the effect of price changes," IMF Staff Papers, Vol. 16, No. 2 July 1969, pp. 179-199 and in J.D.A. Cuddy, "A note on projections of international trade based on co-efficients of trade intensity", Economic Journal, Vol. 83, December 1973, pp. 1222-1235.

46/ Among the numerous articles on the interrelationship between the industrialized countries' problems of structural adjustment, their trade policies and the developing countries' exports, G.P. Sampson, "Contemporary protectionism and exports of developing countries", World Development, Vol. 8, 1980, pp. 113-127, shall be mentioned because of the investigation of various possible sources of protectionism in the North found there.

47/ This hypothesis was taken from K. Sato, loc.cit., pp. 156-164.

48/ For alternative formulations of export supply functions see Y.Y. Yang, "Estimation of the manufactured export supply function from developing countries", Weltwirtschaftliches Archiv, Vol. 114, 1978, pp. 515-525, J.B. Donges, J. Riedel. loc.cit., 1977, pp. 63-68 and K. Sato, loc.cit. 1977, p. 457.

49/ The price-related explanatory variable normally used in an export supply function is the ratio of the export price index to the corresponding domestic price index, representing competition between foreign and domestic markets for supplies.

50/ K. Sato, loc.cit., 1977, p. 457.

51/ See J.B. Donges, J. Riedel, loc.cit., 1977, p. 65 and Y.Y. Yang, loc.cit., 1978, p. 516.

52/ For a similar simplified export supply function see K. Sato, loc.cit., 1977, p. 463.

53/ See e.g. H.B. Chenery, M. Syrquin, Patterns of Development, 1950-1970, London, Oxford University Press, 1975 and UNIDO, World Industry since 1960: Progress and Prospects, (United Nations publication, sales No. E.79.II.B.3), New York, 1979, pp. 43-57.

54/ This conceptual distinction between the cross-country and the time-series frameworks in the studies of development patterns is already present in the pioneering work of H.B. Chenery, L. Taylor, "Development patterns: among countries and over time", Review of Economics and Statistics, Vol.50, No.4, (1968), pp.391-415.

55/ For an exercise in estimating structural change equations of the logistic type by use of nonlinear regression techniques see UNIDO, op.cit., 1979, pp. 43-50, 339-351.

56/ The same equation has been used in the regional growth models described in N.L. Hicks, "A model of trade and growth for the developing world", European Economic Review, vol.7, (1976), pp. 239-255.

57/ An interpretation of cross-section patterns vis-à-vis intertemporal patterns is attempted in E. Kuh, "The validity of cross-sectionally estimated behaviour equations in time series applications", Econometrica, No. 27 (April 1959), pp. 197-214, and P. Gregory, J.M. Griffin, "Secular and cross-section industrialization patterns: some further evidence on the Kuznets-Chenery controversy", The Review of Economics and Statistics, Vol. 56, No. 3 (1974), pp. 360-368.

58/ Since a valid application of most statistical tests requires the validity of a number of assumptions made in classical regression theory, those selection criteria have to be handled with great care. Furthermore, the widely accepted goodness-of-fit statistics have been questioned as a guide in choosing among hypotheses that are expected to be valid beyond the sample period (see T. Mayer, "Selecting economic hypotheses by goodness of fit," The Economic Journal, Vol. 85, No. 340 (1975), pp. 877-883).

59/ For comparable total import elasticities estimated for developing countries see M.S. Khan, loc. cit., 1974, p. 688.

60/ See footnote 40/.

61/ See footnote 40/.

62/ An exact test of the significance of individual coefficients was not possible at this stage because of the high positive autocorrelation of the error terms indicated by the Durbin-Watson-d-statistic. Asymptotic t-values obtained from a refined estimation procedure which took acount of autocorrelated error terms pointed to insignificant price elasticities of developing countries' imports of chemicals and machinery too. Because of the extra-trade character of these two trade flows - as it was outlined in the text - and the slight improvment of the goodness of fit, relative prices were kept as explanatory variables in the relations for developing countries' imports of SITC sections 5 and 7.

63/ For a brief discussion see pp. 17,18.

64/ Equations (6aii) and 6biii). Estimation results are reported in Table A-1.

65/ Likewise, further experiments with alternative equational forms could have improved the fit to historical data, but would have been hardly justifiable by economic reasons.

66/ See Table A-2.

67/ The failure of the dynamic import demand model conforms to the results reported in M.S. Khan, loc. cit., 1974, pp.678-693.

68/ See pp. 20,21.

69/ A five per cent significance level was chosen as the critical level for acceptance or rejection of the null hypothesis of a regression coefficient's being zero.

70/ If the latter interpretation were correct, the corresponding coefficient would rather be expected to be negative.

71/ Estimation of a dynamic version of (9biv) (see Table A-2) yielded a higher d-value, but also an insignificant coefficient of the lagged dependent variable.

72/ A Koyck-type partial adjustment as the form of lagged adjustment of export supply to changes in the independent variable(s) was proposed by Y.Y. Yang, loc. cit., 1978, pp.514-525.

73/ The results of the estimation procedure which allowed for those adjustments (see Table 3.B) are not strictly comparable with the OLS results, however, since e.g. t-ratios derived by the former method are asymptotic and therefore only approximately valid.

74/ The following discussion of parameter estimation is again about the log-linear transformations of the model equations.

75/ If, e.g., the three import equations of the South (S2 - S4) were isolated from the rest of the model, the situation of seemingly unrelated regressions would arise calling for the application of GLS as proposed by Zellner (see A. Zellner, "An efficient method of estimating seemingly unrelated regressions and tests for aggregation bias", Journal of the American Statistical Association, Vol.57, 1962, pp.348-368, and the same author's "Estimates for seemingly unrelated regression equations: some exact finite sample results", Journal of the American Statistical Association, Vol.58, 1963, pp. 977-992). Consequently, for the estimation of the whole model 3SLS should be attempted, since it represents an extension of Zellner's method to simultaneous-equation systems.

76/ Obviously, only for equation (S5) could 2SLS estimates differ from OLS estimates.

77/ For a discussion of various attempts to correct probable specification errors - which are a possible source of autocorrelated disturbances - see pp. 31,32.

78/ See Tables 1 and 2. Under the assumption of a first order autoregressive scheme the error term u_t can be written as

$$u_t = \varrho\, u_{t-1} + \varepsilon_t$$

where the ε_t are serially independent and nomally distributed with mean zero and constant variance σ^2. The main steps of the estimation procedure applied to correct for serial correlation were the following: computation of the auto-correlation of the residuals from an OLS regression, estimation of ϱ and σ^2 by solving the Yule-Walker equations, application of OLS to transformed data - a step which is equivalent to applying GLS with appropriate weights. For further details see J. Johnston, op. cit., 1972, pp. 259-265 and A.R. Gallant, J.J. Goebel, "Non-linear regression with autoregressive errors", Journal of the American Statistical Association, Vol. 71, 1976, pp. 961-967.

79/ The OLS parameter estimates of equations S2, S3 and S6, however, differ quite substantially from the corresponding estimates obtained by 3SLS or by the above described method of the Cochrane-Orcutt type.

80/ Interfutures, Facing the Future: Mastering the Probable and Managing the Unpredictable, (OECD, Paris) June 1979 and World Bank, World Development Report 1980, Washington D.C., 1980.

81/ Owing to the specific character of the present analysis, modifications of the assumptions found there were thought to be necessary. Furthermore, in this study growth prospects of the South were generally viewed more optimistic than in the referenced studies. Nevertheless, the deviations from those sources' assumptions seemed to be small enough to yield pairs of consistent GDP growth rates of the North and the South as the basis of the present scenario analysis.

82/ These equations were of particular importance for policy considerations in the present context, since they describe the widely discussed growth prospects of the North's imports of manufactures from the South.

83/ The "apparent income elasticty" of imports, for example, is simply defined as the ratio of the growth rates of imports and income (GDP). One example of the projection exercises mentioned in this context is B. Balassa, "Prospects for trade in manufactured goods between industrial and developing countries, 1978-1990", Journal of Policy Modelling, Vol.2, no. 3, 1980, pp. 437-455.

84/ The approach taken here must be considered as a very rough approximation to a proper method of policy simulation in the investigated framework of trade relationships. Among the various possibilities for improvements, the statistical analysis of structural shifts or systematic parameter variation shall be mentioned which could provide a more reliable basis for assumptions about elasticity changes than the current approach. A good survey of models with time-varying parameters can be found in Annals of Economic and Social Measurement, Journal of Computers, Information Retrieval, and Research Methodology (special issue on time-varying parameters), National Bureau of Economic Research, Vol. 2, No. 4, 1973.

85/ For a detailed discussion of the economic background of the various scenario assumptions see Chapter II of UNIDO, op. cit., 1981, forthcoming. The present paper will repeat only some of the arguments advanced there.

86/ See p. 43

87/ The exact titles of these publications are given in footnote 80/.

88/ For more details see Chapter II of UNIDO, op. cit., 1981, forthcoming.

89/ The changes of the MVA - elasticity of the South's exports of manufactures assumed for the scenarios C and D seem to be negligible (Table 5B). It can be argued, however, that in a low-growth environment (scenario C) this elasticity's not exceeding the historical average could be interpreted as "export pessimism", whereas merely maintaining the historical elasticity level with high MVA - growth (scenario D) could mean "export orientation".

90/ See footnote b/ of Table 5 and Chapter II of UNIDO, op. cit, 1981, forthcoming.

91/ The price elasticity of the South's manufactured exports to the North provides the exception to the rule. The impact of price movements on the projected export growth is seen to be relatively small, however, because of the modest size of assumed changes in the relative export price (see Table 5A).

ANNEX

Table A-1. OLS - estimates of log-quadratic import functions[a]

(annual observations 1960 - 1977)

Dependent variable	Intercept (t - ratio)	Coefficients of independent variables (t - ratios)						$\bar{R}^2$ (SEE)	DW (d.f.)
		GDP				relative prices			
		$\ln Y_N$	$(\ln Y_N)^2$	$\ln Y_S$	$(\ln Y_S)^2$	$\ln p^5$	$\ln p^7$		
$\ln M_N^7$	-23.34 (- 1.67)	4.51* (1.30)	-0.13* (-0.62)					0.995 (0.039)	0.92 (15)
$\ln M_S^5$	-24.61 (- 3.67)			6.74 (3.27)	-0.40 (-2.52)	-0.03* (-0.16)		0.995 (0.036)	1.48 (14)
$\ln M_S^7$	27.59 (3.46)			-9.26 (-3.74)	0.85 (4.44)		-1.68 (-3.15)	0.985 (0.060)	1.65 (14)
$\ln M_S^{6+8}$	31.42 (6.78)			-10.02 (-6.96)	0.87 (7.82)			0.992 (0.035)	1.53 (15)

[a] Log-quadratic alternatives were tested for those equations of Table 1.A for which the hypothesis of autocorrelated errors could not be rejected. The notation is explained in the text (section B).

Note: Regression coefficients not significant at the five per cent level carry an asterisk. The following symbols were used:

$\bar{R}^2$ multiple correlation coefficient adjusted for degrees of freedom;
SEE standard error of estimate;
DW Durbin-Watson d statistic;
d.f. degrees of freedom.

Table A-2. Parameter estimates for dynamic versions of selected model equations[a/]

(annual observations 1960 - 1977)

Dependent variable	Intercept (t - ratio)	Coefficients of independent variables (t - ratios)								$\bar{R}^2$ (SEE)	DW (d.f.)
		Lagged dependent variable	GDP		MVA	Imports	Relative prices				
			ln Y_N	ln Y_S	ln V_S	ln M_N	ln p^5	ln p^7	ln $(p_{S\to N}/p_{N\to N})$		
ln M_N^5	-20.90 (- 4.93)	-0.14* (-0.62)	3.02 (4.99)							0.994 (0.038)	2.20 (15)
ln M_N^7	-15.58 (- 4.75)	-0.05* (-0.23)	2.50 (4.86)							0.985 (0.035)	2.01 (15)
ln M_N^{6+8}	-14.51 (- 4.38)	-0.18* (-0.71)	2.45 (4.46)							0.991 (0.034)	2.19 (15)
ln M_S^5	- 7.97 (- 2.55)	-0.02* (-0.05)		1.59 (2.60)			-0.18* (-0.96)			0.983 (0.044)	1.95 (14)
ln M_S^7	- 3.70 (- 2.38)	0.66 (3.02)		0.76* (2.17)				-1.65 (-2.95)		0.976 (0.058)	1.86 (14)
ln M_S^{6+8}	- 3.96 (- 1.74)	0.29* (0.67)		0.97* (1.72)						0.967 (0.054)	1.30 (15)
ln $X_{S\to N}$	- 3.74 (- 4.03)	0.13* (0.68)				1.03 (4.33)			-0.45* (-1.61)	0.979 (0.058)	1.47 (14)
ln X_S	- 6.12 (- 6.13)	-0.43* (-1.87)			2.18 (6.25)					0.995 (0.031)	1.84 (15)

Table A-2 Parameter estimates for dynamic versions of selected model equations

(continued)

a/ These equations have been estimated by use of an instrumental variable technique (see e.g. J. Johnston, Econometric Methods, second edition, New York, Mc Graw Hill, 1972, p.319), where the t-ratios shown are asymptotic and therefore only approximately valid. The notation is explained in the text and in Table A-1.