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THE TREATMENT OF INTERNATIONAL TRADE IN GLOBAL MODELS

Andras Nagy

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INTERNATIONAL INSTITUTE FOR APPLIED SYSTEMS ANALYSIS
A-2361 Laxenburg, Austria

ABSTRACT

This paper is a critical survey of the treatment of international trade in global models, concentrating on what—in the author's opinion—is wrong with it.

After a brief review and classification of the different ways in which international trade relations are treated in global models, the neglect of bilateral trade relations is criticised on the grounds that it assumes more freedom in trading relations than there actually is. In the next section the common assumption that trade is demand-determined is questioned; it is argued that the exporters' "push" is at least as important as the importers' "pull" in determining bilateral trade flows. Section 5 raises the question: do trade balances approach zero in the long run, as many policy makers and model builders seem to believe? The author suggests that there is hardly any basis for this belief.

The role of relative prices is discussed in the next section, where it is shown that they provide no explanation of changes in market shares, and that export prices cannot be assumed to move in parallel with cost changes in different countries. Section 7 draws attention to the relative lack and unreliability of foreign trade price data: the "unit values" which can be observed tell us little about prices and it is hard to convert the domestic price statistics into comparable national export price indices.

The final section of the paper discusses different ways in which the structure of an international trade system can be defined, and presents a method by which the effects of trade policy and economic distance can be measured independently of changes in the volume of world trade and the changing shares of different countries in world trade. The usefulness of this kind of analysis in demonstrating the historical effects of trade policies is illustrated by means of some simple examples.

CONTENTS

THE TREATMENT OF INTERNATIONAL TRADE IN GLOBAL MODELS

INTRODUCTION

Why is the analysis of trade usually the weakest point of national planning models? This question, by now familiar to economic modelers, cannot be answered by looking at international trade from the narrow and biased viewpoint of a single country; it is necessary to recognize international trade as a complex system with a certain defined structure which evolves over time in response to particular stimuli. How can this structure be characterized and what are the forces promoting and resisting change? To answer this question we have undertaken a study of structural change in international trade, with the hope of using our findings to forecast its behavior and analyze possible scenarios for the future.

Our approach to the study of structural change in international trade differs significantly from the paths taken by many global-model builders; work has continued in parallel with little contact between the various schools of thought. This paper is an attempt to provide a critical survey of the treatment of international trade in global models, concentrating on what—in the author's opinion—is wrong with it. It is deliberately provocative: it is high time for a frank discussion of important issues such as the factors determining trade (what are they?), the role of prices, the long-run behavior of trade balances, the influence of trade policies, and the measurement of their effects. I hope that a discussion of these issues will not only improve the spirit in which the final version of this paper is received, but will also contribute to the development of better global models.

A short paper cannot possibly give an exhaustive survey of global models, and so I have tried to concentrate on general problems in the treatment of trade, rather than on detailed descriptions of specific models (which can in any case be found elsewhere).

The author is fully aware that this paper is more of a diagnosis than a prescription; but before recommending a cure the wise doctor first establishes the existence and nature of the complaint. Only when there is full agreement on what is wrong is it possible to try to put it right.

1. TREATMENT OF TRADE IN GLOBAL MODELS

We shall start by categorizing the treatment of trade in global models*. Figure 1 shows a situation in which both national economies and international trade are neglected, and global questions such as how the future needs of humanity can be met by the available resources (energy, land, water, minerals, etc.) are considered, irrespective of national boundaries. It can be argued, of course, that both the national economies and the economic relations between them are artificial, i.e., they were created by man and can equally well be changed by him. It is also open to question whether the fact that the persons or firms producing and consuming goods are registered in different countries and that some of the transactions cross political boundaries is economically relevant** and needs to be taken into consideration.

We shall assert, without going into details, that national institutions, legislation, social and political conditions are so different and so important that if we did not take them into

*Following Parikh and Rabar (1981:8-15) up to a point.
**See Haberer (1936:2-9).

account the answers we would get for questions such as those mentioned above would be irrelevant. It is hardly reassuring to know, for example, that there will theoretically be enough land, water, and energy resources to support the rapidly increasing human population 50 or 100 years from now, if millions of them will nevertheless die, starve or freeze in the future as a result of "neglected" national or international trade constraints.

Figure 2 shows the case in which the national economy (or a part of it) is the focus of attention. Most national planning and forecasting models are based on this representation, in which the international environment is treated as a large black box where everything can be bought and sold. The sad fact is that individual national plans or projections of foreign trade are necessarily inconsistent with each other*, i.e., the estimated exports of country i to country j are very unlikely to be equal to the estimated imports of country j from country i. It is enough perhaps to remind the reader of the simple fact that many countries are willing to increase the export of engineering goods and curb the import of the same goods, while increasing the import and restricting the export of raw materials. If this is the case, exporters of engineering goods cannot sell all that they would wish (plan or project), nor can the foreign demand for imported raw materials be satisfied.

One of the characteristics of foreign trade is that the national estimates are not additive as is the case for demand or supply. The demand for food or steel in the individual countries can be added together to get the total world demand; this is not possible in trade. The interests of exporters and importers are opposed: the transaction is a compromise brought about by bargaining and is usually not what either of the two parties would have preferred.

Figure 3 shows the approach adopted by some trade models, in which the national economies are regarded as black boxes and the focus is on bilateral trade flows**. Neglecting what is

*See Nagy (1979:11-23). The number of national plans and forecasts falling into this category is so great that it seems superfluous to give references here.

**See, for example, Marin-Curtoud (1965), ECE (1971a, 1973), Linnemann (1966), Nagy (1977, 1979, 1982).

TRADE IN GLOBAL MODELS

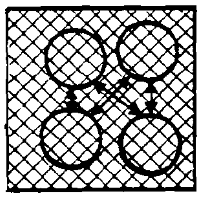

Figure 1. Both national economies and trade as a black box.

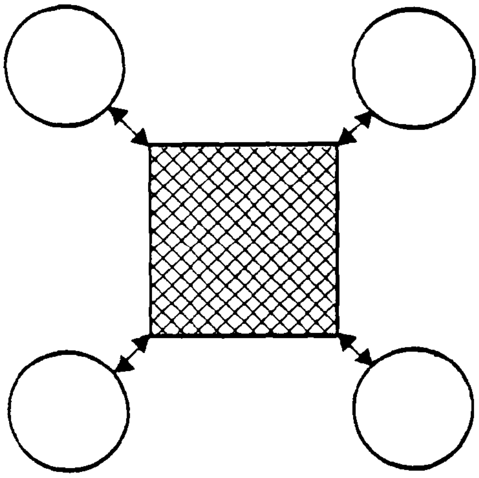

Figure 2. A system of unlinked national models.

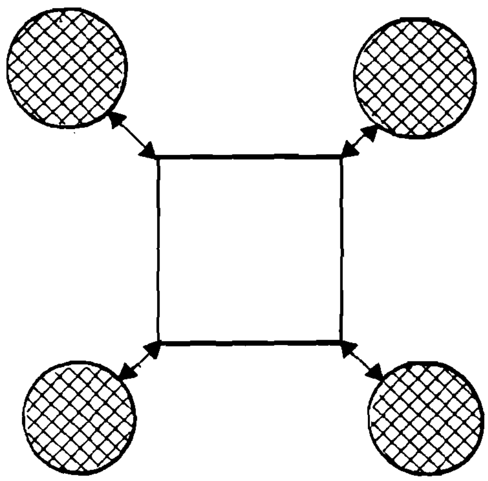

Figure 3. Trade models where national economies are black boxes.

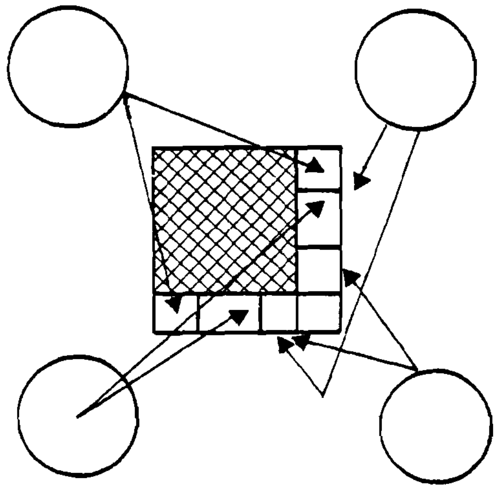

Figure 4. National models linked in a "pool".

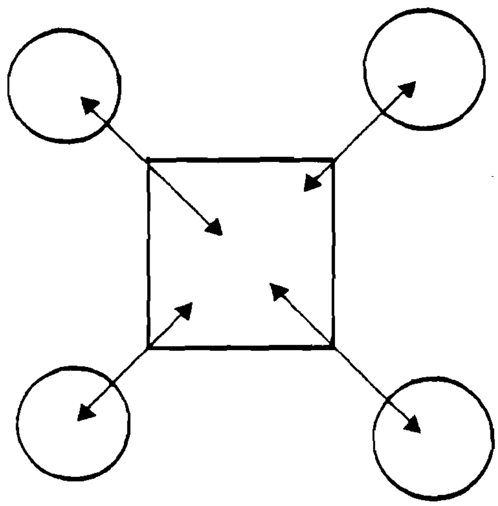

Figure 5. International trade linking national models.

happening within the national economies and how these economies react to changes in the world market is obviously very unsatisfactory, but these models can nevertheless help us to gain a better understanding of the structural characteristics, the rigidities and flexibilities of the international trading system and the forces working within it. The main reason for developing such models was to draw attention to the importance of bilateral trade flows in global modeling and to get a better understanding of the forces working within the trade system.

Figure 4 shows the so-called "pool" approach, in which international trade is again treated as a black box but, unlike Figure 2, total exports equal total imports for each commodity considered in the model*. The internal structure of the trading system, represented by the bilateral flows, is not included in this type of model; instead the national economies (or their branches) are linked through a "pool" of world trade. All exports flow into this pool and all imports flow out of it such that the volumes of these two flows are equal in each time period. This kind of approach can easily be adapted to a general equilibrium framework. In this case the total export supply and import demand determine a unique world market price which is reported to the national economies; they then modify their export and import estimates accordingly, and the iteration is continued until a steady-state solution is reached. The main weakness of this approach is that by neglecting the trade structure it assumes a much greater degree of freedom than actually exists in the real world (we come back to this question again on p.9).

The domestic and external relationships existing within the global system (either for the economy as a whole or for some branches of it) are shown in Figure 5. Here the national models are linked to each other through bilateral flows and there is no black box in the system. The models developed by the LINK Project**, the INFORUM group***, the FUGI Project† and the trade

*See, for example, Leontief (1977), Costa (1980).
**Ball (1973).
***Nyhus (1975), Almon and Nyhus (1977, 1979).
†Kaya et al. (1977, 1980).

model of the INTERFUTURES Project* fall into this category. [The Food and Agriculture Program of IIASA, despite statements to the contrary in Parikh and Rabar (1981), utilizes the "pool" system of linkage** shown in Figure 4.] In such a model, domestic economic activity and external trade are integrated and their interaction can be simulated at a level of detail which depends on the degree of commodity disaggregation.

The rest of this paper concentrates on the cases illustrated in Figures 3, 4, and 5.

2. OPEN-ENDED OR CLOSED MODELS

International models which keep the balance of trade in equilibrium are of two kinds: sectoral trade models, or total trade models. The Leontief Model, for example, belongs to the second category, while models dealing with certain commodity groups such as food or energy belong to the first. Total exports have to be equal to total imports in both cases, which means that the export and import surpluses have to cancel each other out.

The important difference, however, is that in a model which includes all classes of commodities we can follow the extent to which the import surpluses of certain regions in food or energy etc., are covered by other commodities. In the models concentrating on only one commodity group this is not possible. It may be reassuring to know, for example, that the total energy demand of the world can be met by the exports of a limited number of regions, but it is unclear by what commodities these import surpluses will be covered in the net energy-importing countries. In certain models this problem of consistency is "solved" by introducing an additional commodity group called "other commodities", the trade in which can balance out the export or import surpluses of the regions. Needless to say, this can hardly be regarded as a satisfactory solution, especially if these "other" commodities represent some 80-90 percent of the total trade. It would be better, perhaps, to admit that while it is

*Interfutures (1979).
**See Keyzer (1981).

technically possible to meet the demand of net importing regions with the export surplus of other regions, we do not know how this can be financed (i.e., covered by the export surpluses in other commodities or by loans or aid).

3. NEGLECTING BILATERAL RELATIONSHIPS

Models using the "trade pool" method, which neglects the characteristics and rigidities of bilateral relationships, assume that the trading relationship is much freer than it actually is. The only constraint (that total exports must equal total imports in each commodity group) assumes that trade among countries is far freer than any "free-trader" has ever dreamt of, disregarding past patterns, traditions, political links, transportation costs, tariffs, subsidies, trading policies, etc. This hidden feature can be very misleading indeed. National policy makers using such forecasts or planners who are target-oriented and usually tend to be optimistic are pleased to embrace such increased freedom and can eventually be deceived by it.

Let us show, using a very simple example, why bilateral relationships cannot be neglected and the zero total trade balance constraint for each commodity is not sufficient in certain situations. Four cases of bilateral trade between countries A, B, and C are shown in Table 1, where the rows represent the distribution of exports between import markets and the columns the supply of imports by various exporters. In Case 1, trade is distributed equally among the markets and all trade balances are zero. What would happen if over a certain period of time the trade of country A increases by 100 percent and we want to keep the trade balances of all three countries in equilibrium? In this case the trade of countries B and C either has to increase by at least 50 percent, when they can keep their trade between each other at the previous level (Case 2), or their internal trade has to diminish or disappear completely as in Case 3. If, however, it is not possible to increase the exports of countries B and C by more than 20 percent and they cannot reduce their bilateral trade, the only way country A can double its exports is by having an export surplus of 6 units, while each of the other two countries has a deficit of 3 units (Case 4).

Table 1. Trade flows among three countries.

	Exporting countries	Importing countries A	B	C	Total exports	Trade balance
Case 1	A	0	5	5	10	0
	B	5	0	5	10	0
	C	5	5	0	10	0
	Total imports	10	10	10	30	0
Case 2	A	0	10	10	20	0
	B	10	0	5	15	0
	C	10	5	0	15	0
	Total imports	20	15	15	50	0
Case 3	A	0	10	10	20	0
	B	10	0	0	10	0
	C	10	0	0	10	0
	Total imports	20	10	10	40	0
Case 4	A	0	10	10	20	+6
	B	7	0	5	12	-3
	C	7	5	0	12	-3
	Total imports	14	15	15	44	0

It is evident that the divergent growth of trade in different countries is feasible only if we either allow great structural changes in the trading pattern, or a certain freedom of movement in the trade balances (or both). Keeping total exports and imports equal by commodities is by no means a guarantee that the differences in the export and import growth rates will produce a feasible solution as far as the bilateral trade structure and the national balances of trade are concerned.

As the number of trading countries or regions considered increases, the number of degrees of freedom also increases. In the general case we have n^2 trade flows if there are n regions in the model, or n^2-n flows if we are considering individual countries. (A region is regarded here as a group of countries.) We have the following constraints*:

$$\sum_{i=1}^{n} X_{ij} = X_{\cdot j} \qquad j = 1,2,\ldots,n \qquad (1)$$

$$\sum_{j=1}^{n} X_{ij} = X_{i\cdot} \qquad i = 1,2,\ldots,n \qquad (2)$$

$$X_{ii} = 0 \qquad i = 1,2,\ldots,n \qquad (3)$$

$$X_{i\cdot} - X_{\cdot i} = S \qquad i = 1,2,\ldots,n \qquad (4)$$

$$\sum_{i=1}^{n} X_{i\cdot} = \sum_{j=1}^{n} X_{\cdot j} \qquad (5)$$

Consequently, there are $n^2 - (3n + 1)$ degrees of freedom for a regional trade model and $(n^2 - n) - (4n + 1)$ for a model based on trade between individual countries. It is clear from these equations that the number of degrees of freedom is positive for four or more regions and for six or more countries. Ten regions seems to be sufficient for forecasting purposes, but this is far from certain.

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*In the case of regions the matrix diagonal represents intra-regional trade, while for countries the diagonal cells are empty. Constraint (3) comes into effect only for countries.

The questions to be considered are how much the growth of exports and imports of the different regions will diverge, which rigidities in bilateral trade relations we have to take into account and how inflexible these rigidities actually are. The problem with treating bilateral trade relations as a black box and considering only the accounting identity of total exports and total imports in each commodity group is that structural change in international trade relations appears to be much easier than it actually is; consequently it is not clear whether a given result is really feasible or not.

4. DEMAND-DETERMINED OR PUSH-AND-PULL MODELS

Most global models which include international trade are demand-determined in the sense that they usually start with import forecasts based on domestic variables for individual countries or regions; thus, exports will depend on the import demands of other countries*. Then comes the difficult question of which exporters should provide which imports and whether these export forecasts are consistent with the projected growth of the domestic economy. If this is not the case, the modeler usually introduces an iterative process which ensures the consistency of national exports and imports within the limits of the estimated trade balances.

But before we begin a discussion of who exports what to where, we should perhaps question this implicit assumption: is the demand for imports by the national economies really the driving force of international trade? This apparently seems so obvious to economic theoreticians and model builders that it does not warrant any explanation or proof. However, the same belief is not held by economists familiar with trading practices—for them it is equally evident that the efforts of the exporters (or producers) to sell is at least as (if not more) important in explaining trade flows as the willingness of importers (or consumers) to buy. This is not quite true when shortages occur (for example, in certain trade relations between the socialist

*See, among others, Rhomberg (1970, 1973), Nyhus (1975), Waelbroeck (1973), Gupta et al. (1979), Shishido (1980).

countries), but international markets for most products are usually not characterized by shortages, but rather by excess supply or unused capacity. This is the reason why exporters make more effort to sell (by advertizing and all kinds of marketing techniques), than importers do to buy.

The trading transaction itself is obviously the result of efforts made by both the exporter and the importer, the former "pushing", i.e., trying to sell his goods at the highest prices, and the latter "pulling" i.e., trying to find the supplier offering goods at the lowest prices. Who "wins", or who gets more out of the bargain depends to a great extent on the current state of the local market for the given product. However, one thing is certain: transactions are not brought about solely through the demand "pull" of the importer.

One way of measuring this push/pull effect (which is both observable and intuitive) is to look at the results obtained using gravitational trade models*. These models measure the factors influencing trade flows, assuming that these flows are functions of the trading capacities of the countries concerned, and the "resistance" hindering or "attractions" strengthening trade relations between them. Trading capacities can be defined as the potential supply of goods by the exporting country and the potential demand for goods of the importing country. In most gravitational models of total trade flows (i.e., flows aggregated by commodity classes), potential supply and demand are expressed in terms of the gross domestic product (GDP) of the two countries and their population, which represents the domestic capacity to absorb commodities and has a negative effect on trade flows.

Without going into the details of these models**, we reproduce here a table comparing the results of different gravitational model computations (Table 2). We should mention that all computations revealed significant relationships between the trade flows and the explanatory variables employed, even if the

*See Tinbergen (1962), Pulliainen (1963), Linnemann (1966), Aitken (1973), Nagy (1979).

**Detailed descriptions can be found in Linnemann (1966) and Nagy (1979).

Table 2. Comparison of the estimated parameters of selected gravitational models.

	GDP of the				Population of the		
	Exporting country		Importing country		Exporting country	Importing country	Distance
	Nominal 1	Comparable 2	Nominal 3	Comparable 4	5	6	7
TINBERGEN							
18 countries 1958	0.74	—	0.62	—	—	—	-0.56
42 countries 1959	1.00	—	0.91	—	—	—	-0.78
42 countries 1959	—	1.16	—	1.05	—	—	-0.92
PULLIAINEN							
62 countries 1959	0.83	—	0.73	—	—	—	-0.68
LINNEMANN							
80 countries 1958-1960	0.99	—	0.85	—	-0.20	-0.15	-0.81
80 countries 1958-1960	—	1.11	—	0.96	-0.34	-0.28	-0.81
NAGY							
27 countries 1960	—	1.03	—	0.70	-0.35	-0.10	-0.55
AITKEN							
12 countries 1959	1.12	—	0.85	—	-0.48	-0.40	-0.45
12 countries 1967	1.05	—	0.91	—	-0.33	-0.37	-0.35

correlations were not very strong. When presenting the results, we separated the computations based on the nominal values of the GDP from those performed with "comparable" values of the GDP, although these "comparable" values were actually obtained in a number of different ways.

The interesting fact here is that the GDP parameters of the exporting countries are in every case higher than those of the importing countries (see the first four columns of Table 2)*. This means that the export "push" has a stronger effect on trade flows than the import "pull", which is in accordance with the experience of traders and the findings of those investigating trading activities. It is most unfortunate that this aspect of the problem should have been so completely neglected by most global trade modelers**.

However, it is not easy to build up a trade model which takes both of these forces into account. Methods which start with the import demand by countries and sum these values using trade share matrices to produce exports by countries "do not require estimation of an export function for each country. Indeed such export equations would be redundant"—as rightly pointed out by Rhomberg (1970:10). Unfortunately what is regarded here as "redundant" is in fact at least as important as the mechanism used to drive the trade model, if not more so.

It seems quite clear that methods which try to ignore the conflictual character of trading activities and the original inconsistencies inherent in them are not sufficiently realistic. However, it is easier to criticise this approach than to offer something better. Nevertheless, criticism must be a better starting point for improvement than complacency.

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*This feature has also been observed in other gravitational models not presented here for methodological or classification reasons. See Nagy (1979).

**There are notable exceptions however, see, e.g., Samuelson (1973), Interfutures (1978).

5. DO TRADE BALANCES APPROACH ZERO?

It is well known that when global models are extended to include financial and service flows, difficulties are encountered due to the almost complete absence of information on transactions by origin and destination. In certain categories of services the total in- and outflows by countries can be estimated since, for example, transportation is closely related to trade, and travel to consumption. However, in other categories, such as capital flows, there are hardly any theoretical foundations on which testable hypotheses concerning bilateral flows could be based. It is, however, evident that international economic relations, including commodity trade, are very strongly influenced by both service and capital flows and transactions. Waelbroeck wrote in 1973*: "recent events are witness of the forces which are unleashed by interest and exchange arbitrage and dramatically multiplied by speculation." The passage of time has stressed the dramatic importance of these factors.

Because of these difficulties, most global models simply omit the financial sector and if they include any international linkage, consider only commodity trade. But there is one point at which the linkage cannot be neglected: the trade balances. Total exports and imports may very well be equal in each commodity group, with the result that the national export and im-import surpluses sum to zero; but they are obviously *not* zero. And if we look into the bilateral trade balances the discrepancies are even greater than in the national total trade balances.

Trade balances are closely connected with financial and service flows: countries having a high net tourist or transportation income usually have a trade deficit in commodities, while countries offering international loans or foreign aid usually have an export surplus, the recipients having an import surplus.

Trade balances are usually estimated exogenously in global models either as fixed sums, or as values lying between upper and lower limits. In these estimations, future flows in services

*Waelbroeck (1973:59).

and capital movements are taken into account. The balance estimates are frequently quite low, and for longer time projections it is common to assume a zero balance of trade, i.e., debts cannot accumulate indefinitely. Recent alarm concerning the indebtedness of some developing countries and planned economies only strengthens the assumption that trade balances must even out over time, debts must be repaid, import surpluses must turn into export surpluses—except if the income from the export of services or capital covers the trade deficits.

The results obtained with the gravitational trade models (see Table 2) however, point out a different pattern in the balance of trade. If it is true that the forces "pushing" and "pulling" the trade flows are not equal, with the first having a stronger effect than the second, trade between two countries of different sizes (or rather with different levels of GDP) cannot be balanced. Linnemann, who first pointed this out, wrote*: "the patterns of explained trade... lead to positive trade balances for the larger countries and negative balances for small countries. On the whole, such patterns correspond with reality—as follows from the fact that the parameters estimated are derived from observed data."

If we assume that

$$X_{ij} = \alpha_o Y_i^{\alpha_1} Y_j^{\alpha_2}$$

$$Y_i > Y_j$$

and

$$\alpha_1 > \alpha_2$$

where

X_{ij} is the export of country i to country j

Y_i, Y_j are the GDPs of countries i and j

$\alpha_o, \alpha_1, \alpha_2$ are estimated parameters

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*Linnemann (1966:87).

it follows that

$$X_{ij} > X_{ji} \quad ,$$

i.e., country i has an export surplus and country j a trade deficit.

As long as we assume—and can observe—that the "push" and "pull" are not equal, we must accept that trade between two countries of different sizes (or economic potential) cannot be in equilibrium. Or, putting it the other way around, trade can reach equilibrium in these circumstances only if the import "pull" becomes stronger than the export "push". This would happen if, for example, the world market were to demonstrate some sort of cyclical behavior, with surpluses and shortages continually succeeding each other. However, this is not generally the case.

We could also try to interpret this phenomonon by taking GDP *per capita* as an explanatory variable, pointing out that it is natural for capital to flow from rich countries to poorer countries because the investments there are more profitable. This naturally produces an export surplus for the rich (higher *per capita* GDP) country and a deficit for the poorer (lower *per capita* GDP) country. But if we have two countries of different sizes with similar *per capita* GDPs, why should a regular export surplus develop for the bigger country? This is not at all easy to understand. My computations (Nagy 1977) showed that in the majority of cases there is a strong correlation between the total GDP and the *per capita* GDP, and as a consequence we find that countries with high GDPs are usually also rich.

There is obviously a lot we cannot observe, do not know and are unable to explain in the international financial flow and invisible trade system. However, one thing is certain: the assumption that trade balances must be at or near zero is simplistic and unrealistic, even in the long run.

6. THE ROLE OF PRICES

One of the most fundamental hypotheses of trade modeling is that relative prices are the major determinants of trade flows. The usual point of departure is to assume that trade flows, or import shares, are functions of relative prices, where the prices charged by the different exporters are compared with the weighted average paid in the given import market*. The export prices are usually replaced by the domestic prices charged in the exporting country and it is assumed that importers can increase the market share of the suppliers offering lower prices with a certain elasticity of substitution.

These assumptions are even more pronounced in the optimization or general equilibrium models used for forecasting or planning purposes. In these models, within certain market limitations, goods are obtained only from the lowest price suppliers, while prices are such as to clear the markets.

The idea that importers are mainly concerned with buying at the lowest possible price and that export prices are closely related to domestic costs is so strongly embedded in the collective subconscious of trade modelers that it is perhaps never questioned in the literature. However, it is not at all obvious that importers have a free choice among exporters, nor that trading transactions are based on some sort of "cost plus pricing" practice.

From a theoretical standpoint, it seems evident that if there is perfect competition for a given commodity on the world market (in other words, if *there is* a world market!), then prices can differ only because of transportation costs; thus, if we disregard these, there are no relative prices and so they cannot be the driving force behind changes in market shares. A variety of prices in the trade of a homogenous commodity indicates market imperfections, i.e., the lack of perfect competition.

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*This fairly drastic simplification of a Walrasian trade model is assumed to be required to get an empirically managable system. See, for example, Armington (1969), Hickman (1973), Nyhus (1975), Whalley (1980), Filatov et al. (1980), Shishido (1980), Interfutures (1978).

"Cost plus pricing" is presumably more the exception than the rule in export price formation. Changing comparative advantages work through changing cost differences and profit margins. The assumption of a unique profit rate and parallel changes in costs and prices (with no corresponding changes in the profit rate) seems to be untenable if it is generalized.

The idea that importers choose the "best offer" made by the producers (exporters) is closely related to the concept criticized above, i.e., that demand determines trade flows. If we accept that supply plays at least an equally important role, we may just as well assume that the exporters choose their markets on the basis of the "best offer" made to them. In this case trade would be driven not by the lowest, but by the highest prices offered or obtained. In fact, both tendencies can be observed in the international trade game: importers are looking for cheap suppliers (in the *ceteris paribus* case!) and exporters for highly priced markets and both of them are trying to adjust their purchases and sales accordingly. No one-sided approach can capture or simulate the complexity of this multifaceted process.

The theoretical soundness of the assumption that relative prices exert an important influence upon the export performance of competing countries has already been questioned some 20 years ago by Stern and Zuprick (1962), who concluded on theoretical grounds that

> ...there is no reason to believe that the observed price relatives, computed from recorded information available, accurately reflect the price differentials which are *in fact* responsible for the changes observed in the export market shares. This is because the actual prices of substitutable goods move in sympathy with one another... The observed price data reflect the outcome of the operation of market forces, and thus do not reveal the impact price differentials which set these forces into motion (pp. 581-583).

A study of price formation and price differences in practice reveals a great variety of outcomes, which seem to depend on the commodity involved and the market conditions. At one extreme it is possible to find commodities in which the exporters have a complete monopoly so that all importers have to pay the same price (plus transportation costs). At the other end of the scale are the competitive import markets, where prices are homogenous with respect to the origin of the goods*. But more common than either of these is the situation in which prices are differentiated for a great number of reasons, both for the exporters selling in different markets and for the importers buying from different sources. This is the most frequent outcome of the bargaining process, which is naturally influenced by all kinds of local and temporary phenomena.

Price considerations are important, but represent only one of many aspects which influence the protagonists in the bargaining process. Another is the quality of the product, which of course can be evaluated in many different ways, with the result that there is usually a broad spread of assessments and opinions as to how differences in quality can be compared with differences in price. In addition to the measurable differences in quality (the technical parameters), the buyer's confidence in the consistency of the quality is also very important, especially when critical uses are involved**. The initial quality evaluation and the confidence of the buyer can be greatly influenced by advertizement, promotion, and other marketing techniques. These are the areas in which most of the export "push" takes place.

Other, non-price factors which may have some effect on transactions are presale advice, after-sale service, credit terms, speed of delivery, official or private buy-domestic policies, government trade directives, etc.*** Then, of course, transportation costs (including insurance, customs, and extra packing charges) tariffs and actual exchange rates play a role in price formation. The result is that when looking at a price, it is extremely difficult to tell how much of it is due to physical differences in quality, how much to service aspects, and how much to the inefficiency of the trading partners.

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*Gulbranson (1982) gives the example of cereals for the first case and tropical products and metals for the second (Appendix III).

**See Kravis and Lipsey (1971:31-43).

***See Kravis and Lipsey (1971:47-48).

One should also not lose sight of the fact that the set of factual prices is much smaller than that of offered prices. All offers other than that finally accepted are only potential prices, not actual prices. As a consequence it is very difficult to tell how far actual prices are from the "best offer".

If it cannot be assumed that observable prices are closely related to costs, we could take up the old suggestion that costs would be better measures of competition than are prices*. If, for example, export prices adjust to changed conditions more quickly than costs, then cost comparisons may reflect the causes for shifts in the flows of trade more clearly than price differentials. The higher the elasticity of substitution between products of different countries, i.e., the greater the number of buyers changing from one source to another in response to relative price changes, the more likely it is that changes in competitiveness will be reflected in adjustments in quantity rather than in price changes. If, in a competitive market, the prices charged by the exporters move together, a loss (or gain) in competitiveness will appear as a decline (or increase) in the profits. The resulting change in the export share can appear without any observable change in relative prices. But even if competition or substitution is not perfect and there can be substantial price differences between competing exporters or products (as in several manufacturing sectors), it is still not possible to tell how far these differences may be attributed to variations in quality and how far to differences in costs.

It may well be that relative costs are theoretically better indices of competitiveness than prices, but they also have several comparative disadvantages. It is well known that there are various methods of allocating production costs to specific commodities, when, for example, several different commodities are made at the same plant or are produced by the same process. Furthermore, it is much more difficult to obtain information about costs than about prices, and the concept of price is less likely to vary significantly from one reporter to another.

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*See McDougal (1951, 1952), Stern (1962).

Nevertheless, it seems clearer to concentrate on differences in costs and their evolutions over time when linking national models together, and to regard these cost differences as the forces causing market shares to change. Cost differences and their evolution can be traced back to the factors affecting costs. National models should focus on these factor changes in order to provide relevant information for the trade linkage process. But one should also avoid treating this relationship mechanistically: it is not necessary for the cost of the output to follow the changes in the input costs. Leibenstein (1981) drew attention to the importance of changes in efficiency, which can strongly influence the relationship of changes in input costs to changes in output costs. He wrote*

> There is no necessary relationship between the percentage increase in costs of inputs (labor, raw materials, machinery, etc.) and the percentage increase of costs of output. The cost of the output can turn out to be very much smaller, or not rise at all.

7. THE OBSERVATION OF PRICES

So far we have discussed the role of prices in trade, making the basic assumption that prices can be observed. Now we shall consider the extent to which this is actually true.

In practice the available foreign trade price information is extremely poor and unreliable. All we can usually obtain from foreign trade statistics are *unit values*, i.e., the values of an individual item in a particular commodity class as reported by exporters or importers to the custom authorities. Since these classifications (whether they be national categories or the standard International Trade Classifications) have to cover all possible types of commodities, they cannot be defined in a very detailed way. The consequence is that one never knows for sure what a change in unit values really means: is it a price change or a shift from a product of one quality or type to another? Unit values are the weighted average prices of the

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*Leibenstein (1981:104).

goods within one product category and can be altered by changes in the weights, or in the prices, or in both. It happens occasionally that the unit values move in the opposite direction to the changes in prices: for example, if the export structure moves toward better, higher-quality products (which are more expensive), the unit values may increase even if the prices of all items within the commodity category are decreasing.

In international trade models we are less interested in the current level or historical evolution of prices or unit values, than in their relative movements in different countries. But as the internal structure of exports and imports within each commodity class varies with country, "it is not possible to say whether an apparent change in price relations results from differences in price movements or from differences in the weighting of identical price movements"—as Kravis and Lipsey have observed*. One can also assume a related systematic change in the composition of exports: commodities facing severe foreign competition, or whose competitiveness is declining, tend to decrease in importance within the commodity class or to disappear altogether; as a consequence the relative price (or unit value) indices are incapable of reflecting the differentials of competitiveness they are intended to show.

The obvious deficiencies of unit value indices have led modelers and trade analysts to adopt domestic wholesale or industrial selling prices instead**. These indices have a great advantage over unit values because they are usually constructed from the prices of carefully selected commodities. For this reason the weighting problem does not arise at the level of the individual products, appearing only when these product price indices are aggregated to represent the changes in price of a commodity group or of an industrial sector. Consequently, even if national price indices are accurate indicators of the change in a country's economy, they are inadequate measures of international price competitiveness. The national indices are all quite different in terms of coverage, weighting, and methods of computation.

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*Kravis and Lipsey (1971:5).
**See, e.g., the Appendix in Nyhus (1975).

The assumption that domestic price differentials or changes in these differentials are responsible for changes in market shares is based on the inherent belief that export prices (or offers) are equal, or at least closely related, to domestic prices. But if economies are not completely open and markets not perfectly competitive (as is usually the case in practice), domestic and export prices do not have to be equal, or move in parallel. Domestic prices are basically determined by domestic economic conditions, while these conditions play a much less important, even negligible role on the world market, where export prices are determined. There can be a boom at home, so that industries may raise their domestic prices, while at the same time international competition restrains them from increasing their export prices. The opposite can of course also occur. Beside the differences between domestic and international market conditions, a great number of other factors can also result in differences between export and domestic prices; these include transportation costs, government regulations, tariffs, subsidies, and tax exemptions.

It may well be the case that wholesale or industrial selling prices are better measures of international price competitiveness than unit values, which explains why they are preferred in modeling, although we have to agree with Kravis and Lipsey (1971) that they are also very unreliable. But the argument given in the previous chapter is not concerned with the statistical defects of the available price data. We are basically in agreement with Stern and Zupnick* that "even if it were possible to wash the data clean, observed price ratios would still have no explanatory significance" for international trade flows, or changes in market shares.

8. THE STRUCTURE OF INTERNATIONAL TRADE AND THE ROLE OF TRADE POLICY AND DISTANCE

We have already seen that the global models which include bilateral trade flows usually treat them in a rather simple

*Stern and Zupnick (1962:591).

way—they either assume a constant trade pattern taken from past observations or adjust this pattern according to changes in relative prices with a given elasticity, making allowances for a certain degree of economic inertia.

Questions such as how the structure of international trade changes over time, what factors influence this change, and how it can be measured have not received much attention; the limited results of the few studies attempting to answer these questions have as yet not been widely incorporated in global modeling work*.

When dealing with the structures of trade flows, *structures of shares* are the most frequently analyzed quantities. These structures are generally sets of weights $g_1, g_2, \ldots, g_n$ for which

$$0 \le g_i \le 1 \quad , \qquad \text{and} \qquad \sum_{i=1}^{n} g_i = 1 \quad .$$

Several structures of this type may be constructed from international trade flows, according to what we consider to be the "total" of which the shares form a part.

In practice, import shares are most frequently used. Neglecting the breakdown by commodities, the import share index α_{ij} leads to a system of structural coefficients of dimension n^2 with columns that sum to unity:

$$\alpha_{ij} = \frac{X_{ij}}{X_{\cdot j}} \quad ,$$

where

X_{ij} is the export of country i to country j

$X_{\cdot j}$ is the total import of country j.

Evidently, the α_{ij} import shares can be used to construct a table of trade flows, provided that the value of total imports $(X_{\cdot j})$

*See Pulliainen (1963), Tinbergen (1962), Linnemann (1966), ECE (1971a, 1973), Nagy (1971, 1972, 1979), Aitken (1973), Johansson and Persson (1982).

is given. This, of course, also yields total exports by countries, since

$$X_{i\cdot} = \sum_{j=1}^{n} \alpha_{ij} X_{\cdot j} \quad .$$

Moreover, the difference between the export and import totals gives the total trade balance, as well as the bilateral trade balance:

$$E_{i\cdot} = X_{i\cdot} - X_{\cdot i}$$

$$E_{ij} = \alpha_{ij} X_{\cdot j} - \alpha_{ji} X_{\cdot i}$$

The degree of freedom of a structure determined by the import share coefficients is n, the number of countries in the system. This means that when each column contains one positive element all flows can be unequivocally determined and the whole table of trade flows can be completed.

The distribution of exports by countries may be obtained in a similar way:

$$\beta_{ij} = \frac{X_{ij}}{X_{i\cdot}} \quad .$$

Using the above idea of degrees of freedom, we can define "equivalent" or "subordinated" structures in the following way*. Two structures are "equivalent" when their degrees of freedom "n" are equal and they satisfy the requirement that, when assigning freely chosen values to an "n"-tuple of trade flows and inserting these values into both systems, the corresponding elements of the two flow tables are equal. A flow structure is "subordinated" to another when it is more elastic (i.e., has a higher degree of freedom) than the latter, and satisfies the requirement that when a number of flow elements equal to the degree of freedom

*See Marin-Curtoud (1965).

of the more elastic system is taken from the more rigid system and inserted into the elastic one, then the corresponding elements of the two flow tables are equal.

It may be seen that the structures generated by α_{ij} and β_{ij} *are not equivalent* in the above sense, despite their similarity and the fact that they have the same degree of freedom. However, it may be shown that both structures are *subordinated* to the structure

$$Z_{ij} = \frac{X_{ij}}{X_{\bullet\bullet}}$$

i.e., to the structure describing the trade flows as parts of total world trade ($X_{\bullet\bullet}$). The degree of freedom of this structure is one, i.e., it is much more rigid than the others. The three types of shares are closely related to one another:

$$\alpha_{ij} = \frac{X_{ij}}{X_{\bullet j}} = \frac{Z_{ij}\ X_{\bullet\bullet}}{\sum_{i=1}^{n} Z_{ij}\ X_{\bullet\bullet}} = \frac{Z_{ij}}{Z_{\bullet j}}$$

$$\beta_{ij} = \frac{X_{ij}}{X_{i\bullet}} = \frac{Z_{ij}\ X_{\bullet\bullet}}{\sum_{j=1}^{n} Z_{ij}\ X_{\bullet\bullet}} = \frac{Z_{ij}}{Z_{i\bullet}}$$

It follows from this that *share structures of type* α *or* β *are subordinated to a certain Z structure, and they may be consistent only if they are equivalent to the same Z structure.* By consistency we mean that there exists a system of trade flows satisfying both share structures α and β. The degree of freedom of the consistent α and β structures is not "n", but one, as they are equivalent to the Z structure with this degree of freedom.

These statements seem to be self-explanatory but, as we shall see later, they are important in practice, in particular when we have to elaborate consistent projections or scenarios for the future. Past trade-flow data are always consistent in the sense that there is only one value in each cell of the trade-flow table* and the α and β share structures are consistent and equivalent to the corresponding Z share structure. When, however, we want to make forecasts, our model becomes more elastic or more rigid depending on the system of structural coefficients applied, and this will determine the consistency requirements we can set up.

Certain trade models** incorporate the trends in the share structures but in no case is there any reason to prefer the import to the export shares. The investigations of the secretariat of the U.N. Economic Commission for Europe have demonstrated the inconsistency of the projections made by extrapolating trends in export and import shares. They concluded that:

> Indeed, by considering the past trend of an exporting country's share in an importing country's market, and in calculating the corresponding trend, we introduce into the calculation a factor linked with the past growth of total exports of the exporting country in question. If this import share is projected into the future, it is implicitly assumed that the total exports of the exporting country will continue to grow at the same rhythm as in the past. Similarly, if an export share is projected, an implicit assumption is made about the growth rate of total imports of the importing country (ECE 1971b:52).

This research not only revealed the inconsistency in the application of α and β structures and of their trends but also led to the statement:

> The conclusion from the experiments so far attempted thus seems to be that the import or export shares do not, except in very special cases, constitute good indicators of the intensity of trade relations between a pair of countries; other indicators must be found to permit medium-term projections of the matrices of world trade.

These experiences and considerations have induced several researchers to replace import or export shares by another structural system, less one-sided, better suited for interpretation and able to ensure the consistency of projections without attributing any particular importance to either the import demand or the export supply.

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*If we disregard transportation costs and differences in observation.

**ECE (1971b), Nagy and Török (1971).

The origins of this system are generally traced back to the work of R. Froment and J. Zighera, first published in 1964*. The development of trade intensity (or "delta") structural coefficients was largely stimulated by the realization that *individual trade flows depend on the "push" of the exporting country, on the "pull" of the importing country and on the particular factors regulating their bilateral relations.* This concept is closely related to the ideas behind gravitational models, which assume that the economic potential and the size of the domestic markets generally explain trade flows, but that some special factors represented by distance and preference variables are also important. This means that the volume of total national exports and imports is determined by internal economic conditions but that individual trade flows are also shaped by factors that regulate the bilateral exchanges, such as transport costs and trade policy measures.

This distinction of two categories of factors led to the separate analysis of the *"volume effects"* attributed to the economic potential, i.e., the "push" and "pull" effects of the various countries, and of the *"intensity effects"* which influence each trade flow separately, such as economic distance and trade policy relations. The "volume" and "intensity" effects are distinguished in such a way that a fictitious, so-called *"normal" flow can be computed by taking into account the volume effects; then, by comparing this with the corresponding factual trade flow data, the intensity effects are obtained as a residual.* Disregarding the disaggregation by commodities, and denoting the shares of the individual flows in total world trade by Z, we obtain the *"normal" flows* (indicated by an overbar) by multiplying the shares in world exports by the shares in world imports:

$$\overline{Z}_{ij} = Z_{i\cdot}\ Z_{\cdot j} \quad .$$

For instance, if the export share of country i in total world trade is 10 percent, and the import share of country j is

*In actual fact these ideas were expressed somewhat earlier by Savage and Deutsch (1960). But traces also lead back to Leontief and Strout (1963) and to Isard (1956).

20 percent, then the "normal" export flow from i to j is 2 percent. The "normal" flows therefore include both the "push" effect of export supply and the "pull" effect of import demand.

The *intensity effect* is then obtained by dividing the observed trade flow share by the "normal" one; the resulting figure is called the "delta" structural coefficient:

$$\delta_{ij} = \frac{Z_{ij}}{\bar{Z}_{ij}} = \frac{Z_{ij}}{Z_{i\cdot} \cdot Z_{\cdot j}}$$

The δ coefficient represents the effects of all factors influencing the trade flows between a given pair of countries in a given period of time, apart from the volume effects of total exports and imports. If trade policy measures, discrimination, integration, colonial and other historical links, distance, etc., do not have a strong effect on the trade between two countries, the value of δ will be unity or close to it. If, however, these factors considerably reduce or increase the trade flow in question, this coefficient will be lower or higher than unity, respectively.

It must be emphasized that a trade flow of "normal" intensity represents only a *starting point for measurement and that no normative value judgments should be attached to it.* A "normal" trade flow is only one which is *not influenced by trade policy, distance or similar effects*, so that its share in total world trade is equal to the product of the exporting and importing countries' shares in world trade.

The δ coefficients yield a structure of trade intensity that does not depend on the volume of world trade, nor on the changes in the shares of the individual countries in world trade. To calculate the coefficients we first make the individual flows independent of changes in the volume of world trade (by dividing the X_{ij}'s by $X_{\cdot\cdot}$, thus obtaining the Z_{ij}'s); we then take out the changes occurring in the shares of total national exports and imports in world trade (by dividing the Z_{ij}'s by the coefficients $Z_{i\cdot}$ and $Z_{\cdot j}$). This means that the system of coefficients is unaffected by both enduring and cyclical changes as well as volume effects, so that it may be justifiably considered to be a reasonable expression of world-trade structure.

The δ coefficients are closely related to the share coefficients discussed above:

$$\delta_{ij} = \frac{\alpha_{ij}}{Z_{i\cdot}} = \frac{\beta_{ij}}{Z_{\cdot j}} = \frac{\alpha_{ij}\ \beta_{ij}}{Z_{ij}}$$

Thus, the δ_{ij} coefficient may be obtained either by dividing the import share by the share of the total exports of the exporting country in world trade; or by dividing the export share by the share of the total imports of the importing country in world trade. It may also be calculated by multiplying together the import share and export share pertaining to the same trade flow and then dividing their product by the share of this flow in world trade. The δ coefficient is directly proportional to the share coefficients and inversely proportional to the shares of total national imports or exports in world trade or to the share of the given flow in world trade.

In addition, the Z_{ij} structure is *equivalent* to the structure determined by the δ coefficients. This equivalence, however, does not mean that the two systems of coefficients are identical, or that they have the same information value. It means only that every δ structure corresponds to a Z structure and *vice versa*, where this correspondence refers to the whole trade-flow table, and does not imply that a single defined Z share will correspond to a given δ coefficient.

This relationship between the δ and the share coefficients throws some light on the economic content of these indicators, as well as on the assumptions on which they are based. We have already seen that the δ can also be expressed as a fraction comparing the share of an exporting country in an import market with the share of the same exporter in world trade:

$$\delta_{ij} = \frac{\alpha_{ij}}{Z_{i\cdot}} = \frac{X_{ij}}{X_{\cdot j}} \Big/ \frac{X_{i\cdot}}{X_{\cdot\cdot}}$$

Similarly, it is possible to compare the share of an import market in the total exports of another country with the share of the importer in total world trade:

$$\delta_{ij} = \frac{\beta_{ij}}{Z_{\cdot j}} = \frac{X_{ij}}{X_{i\cdot}} \Big/ \frac{X_{\cdot j}}{X_{\cdot\cdot}}$$

This means that the delta structural coefficients will be "normal" or close to unity when the importing regions treat all exporting regions in the same way, i.e., they buy up the same percentage shares from the total supply of each region. Similarly, when all trade flows are "normal", the total supply of every exporting country is allocated among the import markets according to the shares of the latter in world trade.

Another important feature of the δ structures is that when their elements are weighted by the total export and total import shares ($Z_{i\cdot}$, $Z_{\cdot j}$), the weighted elements in each row and column sum to unity:

$$\delta_{ij}\ Z_{\cdot j} = \frac{Z_{ij}}{Z_{i\cdot}} \quad \text{and} \quad \sum_{j=1}^{n} \delta_{ij}\ Z_{\cdot j} = 1 \quad ,$$

$$\delta_{ij}\ Z_{i\cdot} = \frac{Z_{ij}}{Z_{\cdot j}} \quad \text{and} \quad \sum_{i=1}^{n} \delta_{ij}\ Z_{i\cdot} = 1 \quad .$$

It also follows from this that the inverse of the matrix Δ of δ coefficients when summed by rows and columns yields the Z shares:

$$Z_{\cdot j} = \Delta^{-1} \cdot \underline{\underline{1}} \quad \text{and}$$

$$Z_{i\cdot} = \underline{\underline{1}} \cdot \Delta^{-1} \quad .$$

It is easy to see that the structures determined by the δ coefficients and the Z shares both have a degree of freedom of one, so that if a single bilateral or total trade flow is given, the whole table may be unequivocally completed with absolute values.

We mentioned above that a given δ structure is "equivalent" to a certain Z_{ij} share structure. A given δ system determines the shares of total exports and imports ($Z_{i\cdot}$ and $Z_{\cdot j}$), and when both the δ_{ij} coefficients and the total export and import shares are given, the Z_{ij} flows may also be obtained. It has already been demonstrated that the close interrelation of the δ structures and the margins is of great help in making projections*.

The particular feature of the δ structures pointed out above is valid only when no zeroes occur in the diagonal of the matrix. Various methods of dealing with this problem have been suggested**. If regions and not countries are represented in the model, the diagonal of the trade flow matrix represents intraregional trade. To give some idea of the size and evolution of trade intensity coefficients, Table 3 lists a number of these coefficients for the main regions of the world and two major commodity classes at a highly aggregated level***.

As can be seen from Table 3, there are very intensive flows between the socialist countries, mainly in manufactures, but it is also clear that the intensity of this intraregional trade is declining over time with a resulting increase in the trade with the other two regions. However, the export intensity of the socialist countries changes at quite different rates depending on the commodity group and importing region considered. While the intensity of primary goods exports from socialist countries to the other regions rose nearly twofold for both importing regions, that of the exports of manufactures to developed market economies stagnated between 1955-1965 and increased only moderately thereafter. The intensity of the export of manufactures from socialist countries to developing countries rose almost threefold in the first decade, but since then has been slowly declining.

The intensity of exports from developing countries to socialist countries is relatively low and shows an unfavorable pattern of

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*See Nagy (1979,1982).

**See Froment and Zighera (1964), ECE (1973).

***Fink (1977) has pointed out one of the great weaknesses of delta coefficients: they cannot be directly compared if they represent countries of different sizes. He suggested that another indicator should be used to measure integration. This problem will be discussed in a forthcoming paper by Nagy and Stahl. See also Gelei and Kapitany (1982).

Table 3. Trade intensity coefficients.

Exporting regions	Year	Importing regions: Total SC	Total DME	Total DC	Primary goods SC	Primary goods DME	Primary goods DC	Manufactures SC	Manufactures DME	Manufactures DC
Socialist countries (SC)	1955	7.92	0.28	0.27	7.43	0.33	0.32	8.60	0.19	0.24
	1960	6.19	0.29	0.37	5.69	0.39	0.39	6.67	0.16	0.35
	1965	5.68	0.32	0.68	4.95	0.45	0.68	6.34	0.19	0.68
	1972	6.22	0.34	0.68	5.26	0.52	0.70	6.77	0.22	0.66
	1977	6.04	0.43	0.62	5.08	0.60	0.63	6.75	0.27	0.62
Developed market economies (DME)	1955	0.23	1.07	1.12	0.30	1.11	0.95	0.18	1.11	1.06
	1960	0.30	1.09	1.12	0.40	1.10	1.02	0.23	1.13	1.07
	1965	0.34	1.10	1.05	0.43	1.11	0.97	0.29	1.13	1.01
	1972	0.40	1.09	1.01	0.53	1.09	0.92	0.34	1.11	1.01
	1977	0.51	1.06	1.05	0.66	1.07	0.93	0.44	1.09	1.02
Developing countries (DC)	1955	0.26	1.11	0.99	0.26	1.04	1.24	0.25	0.81	1.53
	1960	0.38	1.13	0.99	0.41	1.06	1.17	0.22	0.91	1.52
	1965	0.58	1.06	1.05	0.60	1.03	1.17	0.46	0.86	1.63
	1972	0.51	1.04	1.17	0.55	1.02	1.23	0.42	0.94	1.54
	1977	0.44	1.08	1.04	0.50	1.03	1.15	0.24	1.00	1.31

Source: Nagy (1982).

development, especially in manufactures: though the export intensity rose quickly between 1955 and 1965, the next 12 years saw a rapid decrease to a level even lower than it was in 1955.

The trade intensities of developed market economies are very stable, particularly for intraregional trade. The strong increase in the intensity of trade with the socialist countries is counterbalanced by a slight decline in the intensity of trade with the developing countries.

The tendency of the intensity of intraregional trade between the developing countries to increase between 1955 and 1972 was followed by a decline in the succeeding period: the intensity of the intraregional trade in manufactures was encouragingly strong and showed a definite rise in 1955-1965, but it has since fallen back to a lower level than in 1955.

It is obvious that if we took more detailed geographical and commodity classifications, other interesting patterns and trends would emerge from the trade intensities, but the examples given above should at least give some impression of the use of this type of analysis.

The relationship between the trade intensity coefficients and the shares in total trade given on page 30 can be rewritten as:

$$\tilde{z}_{ij} = \tilde{\delta}_{ij} \; \tilde{z}_{i\cdot} \; \tilde{z}_{\cdot j}$$

where the tildas indicate the percentage change in the value of a coefficient between two periods. Changes in bilateral flow shares ($\tilde{z}_{ij}$) can be traced back to three factors: the change in the total export share of country i, the change in the total import share of country j, and how the influence of the trade intensity factors changed for the given trade flow. Table 4 illustrates the role of these factors in the changes of bilateral flow shares for the three aggregate regions considered earlier. The last column ($\tilde{z}_{i\cdot}$) and last row ($\tilde{z}_{\cdot j}$) show how the total export and import shares of the regions changed over the periods 1961-1972 and 1973-1977. The table contains two indices for each flow: the first shows the $\tilde{z}_{ij}$ values, i.e., the

Table 4. Factors causing change in regional trade flows, 1961-1972 and 1973-1977, as percentages.

Exporting regions	Period	Importing regions: SC $\tilde{z}_{ij}$	SC $\tilde{\delta}_{ij}$	DME $\tilde{z}_{ij}$	DME $\tilde{\delta}_{ij}$	DC $\tilde{z}_{ij}$	DC $\tilde{\delta}_{ij}$	$\tilde{z}_{i\cdot}$
Socialist countries (SC)	61-72	75	101	112	118	125	184	87
	73-77	83	97	109	126	107	91	92
Developed market economies (DME)	61-72	124	134	118	100	76	90	108
	73-77	107	128	83	97	119	104	90
Developing countries (DC)	61-72	96	132	85	92	78	119	84
	73-77	115	87	140	104	162	89	144
$\tilde{z}_{\cdot j}$	61-72	87		110		79		
	73-77	92		94		127		

Note: Multiplying the factors together does not always produce the quoted change in bilateral shares because of rounding errors.

Source: Author's computation from UNCTAD (1979).

percentage change observed in the given flow over the period indicated, while the second index shows the corresponding changes in trade intensities ($\tilde{\delta}_{ij}$).

The table shows that the share of the intraregional trade of the socialist countries in total world trade decreased in both periods, but although this decrease was greater in the first period (-25 percent compared with -17 percent), there was a small decline in trade intensities only in the second period. Trade between socialist and developed countries increased in both periods, mainly due to an increase in trade intensities which offset the declining world trade share of the socialist countries (in both periods) and the developed economies (in the second period).

Intraregional trade between the developed countries increased its share by 18 percent in the first period, this decreasing by 17 percent after 1972. The increase in the first period can be attributed solely to the region taking an increasing share in world trade; in the second period all three factors contributed to the decline.

The export and import flow shares of the developing countries all decreased in the 1960s, with the exception of imports from socialist countries, where an extremely strong intensification of trade (84 percent) offset the declining share of both regions in total trade. In contrast, the trade flow shares of the developing countries in the second period all increased, mainly due to the increase in the price of oil and other raw materials. In more technical terms this happened because the share of developing countries in total world exports and imports grew very strongly (+44 percent and +27 percent respectively), while trade intensities increased slightly only with the developed regions, decreasing elsewhere. A very spectacular (62 percent) rise in the intraregional trade of the developing countries when the corresponding trade intensity decreased by 11 percent was possible only because the share of the developing countries in world trade was increasing so strongly.

A study of the dynamics of changing trade patterns reveals that the factors distorting trade flows from their "normal" structure operate strongly on a great number of flows and that these factors change over time. These changes are obviously rooted in trade policy rather than distance effects because the latter—even taking into account the evolution of transportation costs—do not change as frequently as do policies. Consequently the approaches and models which assume a certain inertia in patterns of trade are probably more realistic than models which allow rapid structural changes, although they neglect the causes of these rigidities and their changes in time.

To increase the realism of these models and the probability of making reasonable estimates of future trade patterns, one can only attempt to take into account their evolutionary history—it cannot be assumed either that they will remain unchanged, or that they will change according to any tendency observed in the past. Most international trade projections suffer as a result of such erroneous assumptions.

It is evident that the major factors determining the trade policies of various countries, such as regional integration, liberalization and discrimination, economic neocolonialism and struggle for independence—all of the factors which together shape the trade intensities and structural coefficients—will neither remain unchanged over time nor will any changes that occur necessarily follow the directions and rates of previous changes. If the intention is to estimate the changes that are most likely to occur in the future rather than mechanically following some trend observed in the past, it is impossible to avoid the rather troublesome and highly disputable procedure—loaded with many subjective elements—of analyzing and projecting individual trade intensity coefficients.

A study of the past development of the factors influencing trade intensities points to three main types of change:

(a) continuation of a previously observed course, which can mean either the continued stability of the coefficient in question, or the continuation of its observed trend;

(b) a "flattening-out" of the previously observed trend, where, under the influence of various factors, the rate of change diminishes as the coefficient approaches a certain value;

(c) a change in the previously observed level or trend of the coefficient, due to significant changes in trade policy or other factors, or to changes in the relative weights of these factors.

Behind these typical changes in structural coefficients we may observe two kinds of fundamental processes:

(1) the "normalization" of international trade, as reflected in coefficients approaching unity, and

(2) the integration of certain groups of countries, which tends to increase the intraregional trade coefficients to values above unity, and to decrease those of interregional trade to values below unity.

For both processes we may observe that, as a rule, the greater the changes the more the coefficients diverge from the "center of attraction", which is about unity in the case of "normalization" processes and above unity in the case of integrated intraregional trade. This explains what we have called "the flattening-out of trends": when, for instance, the δ coefficient corresponding to a flow of low intensity is increasing towards unity, the relative rates of increase are generally diminishing. These two types of movement are illustrated in Figure 6. The upper part of the figure presents "normalization", the lower part the case of regional integration, where the δ coefficients of intraregional and interregional trade approach different levels of attraction. In both cases, a dotted line indicates changes of direction brought about by temporary evolution of the δ coefficient in a direction other than the dominant trend.

The two types of movement can cross and overlap one another. For instance, the tendency toward "normalization" restrains the growth of intraregional trade, while enhancing interregional trade. Conversely, the tendency toward integration acts against "normalization", forcing the structural coefficients to deviate from unity. These two tendencies, presented separately here, are often mixed together in practice, leading to a kind of compromise, i.e., to a "weighted average" of their effects.

The "normalization" of world trade may be attributed to a change in the political relations and trade policies of various countries over the past 25-30 years. Considerable progress has been made in eliminating the trade restrictions introduced in the early 1930s, strengthened by World War II, and encouraged by the subsequent cold-war atmosphere. The liberalization of trade, the reduction of tariffs, the restored convertibility of

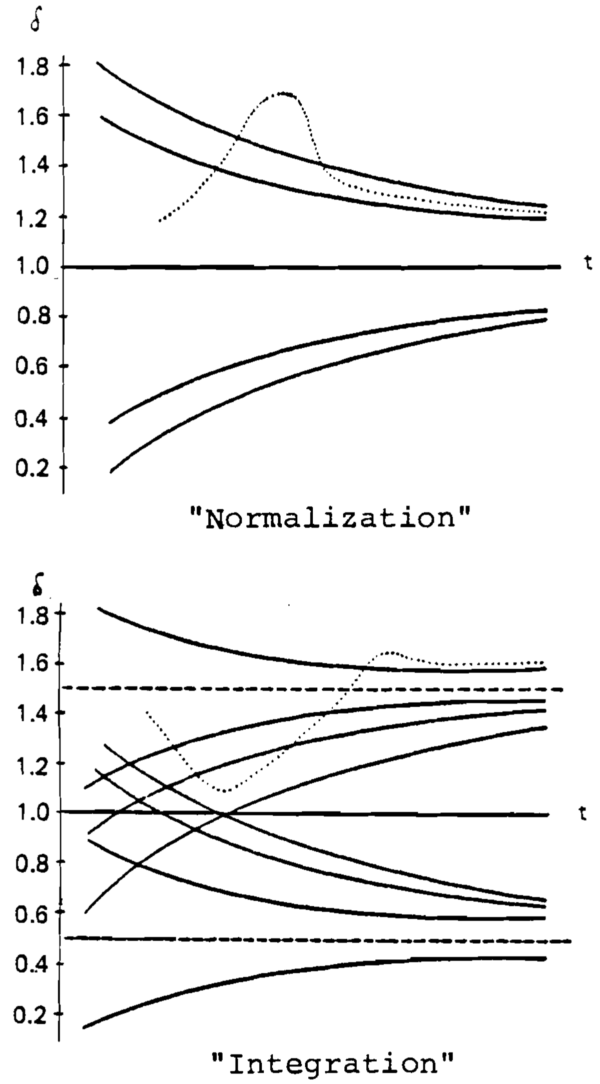

Figure 6. Typical changes in the δ coefficients over time.

a number of currencies, the development of East-West trade, and decolonization were the main factors acting towards "normalization". The changes in the intensity of trade flows reflect some spectacular achievements in this field, but they also reveal the scope for further improvement. Unfortunately, however, the recent economic recession and the resulting revival of protectionist measures have generally slowed down the process of "normalization", and have actually reversed it in certain areas.

One consequence of the reorganization and realignment of nations during this century was the formation of various politically and economically integrated groups of countries. The intensification of trade within these regions can be traced to a large number of causes, and it would be incorrect to explain it simply by integration; it would be even more erroneous to consider the increase in intensity as a measure of integration. It is, however, undeniably true that a vast rearrangement of political and economic relations has taken place in the last decades: the economic community of socialist countries was created, the economic integration of West European countries advanced considerably, the economic relations of former colonies were significantly transformed, Japan and more recently the newly industrialized countries of Asia emerged as major exporters of manufactures—all of this has changed the intensity of trade flows among countries and regions. One of the advantages of the δ coefficients is that they reveal the overall effect of this multifaceted process, taking into account a host of different factors with a variety of economic consequences.

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