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An Historical Analysis of International Trade in Forest Products

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FOREWORD

The objective of the Forest Sector Project at IIASA is to study long-term development alternatives for the forest sector on a global basis. The emphasis in the Project is on issues of major relevance to industrial and governmental policy makers in different regions of the world who are responsible for forestry policy, forest industrial strategy, and related trade policies.

The key elements of structural change in the forest industry are related to a variety of issues concerning demand, supply, and international trade of wood products. Such issues include the development of the global economy and population, new wood products and substitution for wood products, future supply of roundwood and alternative fiber sources, technology development for forestry and industry, pollution regulations, cost competitiveness, tariffs and non-tariff trade barriers, etc. The aim of the Project is to analyze the consequences of future expectations and assumptions concerning such substantive issues.

The research program of the Project includes an aggregated analysis of long-term development of international trade in wood products, and thereby analysis of the development of wood resources, forest industrial production and demand in different world regions. The other main research activity is a detailed analysis of the forest sector in individual countries. Research on these mutually supporting topics is carried out simultaneously in collaboration between IIASA and the collaborating institutions of the Project.

In order to examine the long-term development of international trade in wood products, it is useful to study the patterns of past behaviour of trade. In this paper we therefore present an analysis of the structural characteristics of international trade in wood products over the last twenty years. The analysis reveals the structure of trade flows and their tendencies over time, together with the effects that trade policies have had on trade patterns. An attempt is then made to develop an understanding of the factors which have influenced these trade flows, via the application of gravitational models.

Markku Kallio
Project Leader
Forest Sector Project

CONTENTS

AN HISTORICAL ANALYSIS OF INTERNATIONAL TRADE IN FOREST PRODUCTS

A. Francescon, G. Kornai and A. Nagy

INTRODUCTION

The primary goal of the Forest Sector Project is to study the long-term development of the world market of wood products, and to look at the competitive situation in the future of a detailed bilateral trade flow system, It seems evident to us that this can only be done if an analysis has previously been prepared on how the pattern of international trade in forest products has changed in the past over a 15-20 years time period.

A proposal was put forward in September 1982, of how the data base for such an analysis could be collected and the main questions and methods of such an analysis were outlined. The construction of the data base proved to be much more difficult, and much more time and energy consuming than was expected and it is not yet finished in the sense that data on volumes (in physical units) are not yet aggregated and analyzed. But since we did not intend to postpone the completion of a first version of the historical analysis, we decided to make some short cuts and simplifications in the data base. Some of the problems will be discussed in detail in Appendix I, but it is worth pointing out here that the data we have used is rather weak in two respects; namely in its representation of intra-regional Eastern European trade, which we expect to be much higher than indicated; also trade between developing regions may not be well reported by either exporters or importers, and thus the data we have used under-estimates this trade.

It should be emphasized right at the beginning that our report on the analysis of structural change in international trade of wood products *is primarily intended for internal use of the project*, including naturally our collaborators in the network of national forest sector models, but it is not intended for general use outside the project. The reason for this is that our analysis revealed a large amount of information -- even though we concentrated only on the major issues and trade relationships -- which will be useful for the project members and collaborators studying trade patterns of certain commodities or bilateral relationships, but which would probably not be interesting for the general public.

Our report consists of three parts, analyzing different aspects of the structural characteristics of trade in wood products and their evolution over time and studying some of the factors influencing bilateral trade patterns. The first part, written by Ann Francescon studies the structure of past trade flows and their changes over time by analyzing various types of trade shares. For each given product the import and export market trade shares are examined; this reveals the importance of different importing and exporting regions. Then, to understand the pattern of major bilateral flows and how this has changed, the trade flows are examined as a percentage of total world trade in a product. This kind of analysis builds up a useful picture of historical patterns of trade, and tendencies which can be observed in the share structures of different commodity groups. These can then be analyzed to understand why the flows are as they are and why they have changed.

The second part, written by András Nagy concentrates on measuring the influence that trade policy has had on historical trade patterns by studying the trade intensities of the major bilateral flows. Trade intensity analysis divides the factors influencing trade flows into two categories: on the one hand, the "push" of the exporting region and the "pull" of the importing region, expressing the trading potentials of the partners; and on the other hand, the particular factors regulating bilateral relations, like distance, trade policy measures, discrimination, integration, historical links, etc. Intensity indicators try to capture the changing behavior of the second group of factors and measure their influence on the bilateral allocation of trade for different commodity groups. They also indicate the inertia or flexibility of these structures and their patterns of change. Intensity coefficients can measure for example, the effects of trade liberalization, of integration and disintegration processes over the past two decades. The direction and the velocity of change in the intensities are instructive in determining the stability and the trends of certain parts of the trade flow structure. This can prove useful in future scenario analysis by helping to estimate the feasibilities and probable limits of structural change in bilateral trade relations.

The third part, written by Gábor Kornai applies gravitational models to obtain a better understanding of the factors influencing trade. It is assumed in these models that trade flows between countries, or regions are functions of their trading capacities and a certain "resistance" hindering, or "attraction" strengthening trade between the given pairs of countries. The parameters of the gravitational equation which specifies this relationship between the trade flows as dependent variables and the explanatory variables can be estimated by regression analysis. This can

shed light on generally valid interrelationships between trade flows and some of the factors influencing them and on the relative "strength" of the forces shaping the trade patterns of different product categories.

All three types of analysis were based on the same trade flow data bank for which an interactive program has been written by Gábor Kornai, which can produce, print or plot a great number of share indices, growth rates, trade balances, trade intensity indices, etc. according to product groups, exporting and importing regions and for different time periods. The use of this program is so simple that it can be run by anybody without a manual, and with little experience. A description of the data base plus the product and region classifications used, can be found in Appendices I and II respectively. The program for handling the data base is described in Appendix III.

This first draft version of our report was written in great haste and in difficult conditions, as two of the authors could participate in the work only on short visits to IIASA. It is our intention to revise and correct it after the meetings of the Forest Sector Project in August. Consequently, all remarks and recommendations are welcome.

THE STRUCTURE OF INTERNATIONAL TRADE

International trade of a given product can be presented in trade flow tables, where rows represent the allocation of exports among countries and columns the origin of imports. The entries stand both for exports and imports, i.e., the exports from country i to country j is assumed to be equal to the imports of country j from country i, and therefore the corresponding data is called "trade flow" a neutral expression meaning both.

Trade flows in this sense represent commercial transactions, where even if the volumes in physical units are the same, the values paid by the importers and received by the exporters are in reality not the same. In this case we have to neglect the divergence in value caused by transportation, insurance and other costs, which are usually paid by the importers. The difference in time between the money flow and the actual movement of commodities is also neglected, which may be quite important if credit transactions are linked to trade.

The trade flows by commodities and by countries constitute a system of international trade, the structure of which can be analyzed in several ways. The most simple of these consists in establishing the proportions of the parts, to the system as a whole, expressed as percentages of the latter. In this case, we have one kind of "share structure" which can be defined as:

$$Z_{ijk} = \frac{X_{ijk}}{X_{..k}}$$

where

Z_{ijk} =Share of world trade in commodity k that is exported from country i to country j

X_{ijk} =Trade flow of commodity k from country i to country j

$X_{..k}$ =Total world trade in commodity k

A structure, however, may be characterized in several other ways, e.g., by its divergence from another structure, constructed according to certain principles.

An important feature of a given trade structure is its degree of freedom. By this, we mean the number of trade *flows* for which we are free to choose independent values and which determine the other flows in the table in an unequivocal and consistent way. Thus the "rigidity" or "elasticity" of a flow structure depends on its lesser or higher degree of freedom.

It was on this basis that B. Marin-Curtoud (1965) introduced the concept of "equivalent" or "subordinated" ("sous-jacent") structures. Two structures are "equivalent" when their degrees of freedom "n" are equal and they satisfy the requirement that, when attributing 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 as many flow elements of the more rigid system are inserted into the more elastic one as the degree of freedom of the latter, then the corresponding elements of the two flow tables are equal.

If X_{ijk} is the trade flow of commodity k from exporting country i to importing country j, and total imports of commodity k by country j is $X_{.jk}$, then the import share index

$$\alpha_{ijk} = \frac{X_{ijk}}{X_{.jk}}$$

will determine a system of n^2 structural coefficients (n being the number of countries), the column totals of which equal unit. Evidently, with the aid of the α_{ijk} import shares it is possible to construct a table of trade flows, provided that the size total imports ($X_{.jk}$) is given. This, of course, determines also the total exports by countries, since

$$X_{i.k} = \sum_{j=1}^{n} \alpha_{ijk} X_{.jk}.$$

The degree of freedom of a structure as determined by the α_{ijk} structural coefficients is n, or equal to the number of countries in the system. This means that when one positive element is given for each column, all flows can be unequivocally determined, and the whole table of trade flows can be filled out.

Similarly, also the distribution of exports by countries may be obtained:

$$\beta_{ijk} = \frac{X_{ijk}}{X_{i.k}}.$$

It is also possible to construct from this the individual flows, as well as the total imports. This structure has similarly "n" degrees of freedom; and when one positive flow is given for each row, the values of all flows can be obtained.

The structures determined by α_{ijk} and β_{ijk} are not "equivalent" in the sense explained above, in spite of their similarity and having the same degree of freedom. However they are both "subordinated" to the structure

$$Z_{ijk} = \frac{X_{ijk}}{X_{..k}}$$

i.e., to the shares in total world trade. For this structure the degree of freedom is one; in other words it is much more rigid.

The import and export share structures (α and β) are subordinated to a certain Z structure, and they may be consistent only if they are equivalent with the same Z structure. By consistency we mean here 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 with the corresponding Z structure.

Past trade-flow data are always consistent in the above sense: there is only one value in each cell of the trade-flow tables and the α and β share structures are consistent and equivalent with the corresponding Z share structure. When, however, we are making forecasts, depending on the system of structural coefficients applied, our model becomes more elastic or more rigid, and this will determine the requirements of consistency.

In international trade modeling import share structures are most frequently used in practice. In this case it is assumed that in foreign trade projections total imports of the various countries is the more stable element, as it is determined by the estimated levels of consumptions, investments and domestic productions. It is also assumed that import demand is the determining factor of foreign trade and consequently the export of a country is determined by the imports of her trading partners*.

There is no theoretical reason why we should, in the explanation of economic behavior or processes, attribute greater weight to demand than to supply; and this is true also for the case of international trade. Moreover, not only theoretical considerations but also applied analysis have shown that, in the generation of trade flows, the "pull" of demand has no more role to play than the "push" of supply. As a matter of fact, according to the results of gravitational models** the "push" effect of the exporters' supply was always stronger than the "pull" of the importers' demand.

*A critical appraisal of this approach can be found in A. Nagy (1983).
**See: Linnemann (1966) and Nagy (1979).

1. SHARE STRUCTURE ANALYSIS

Share structure analysis can study the patterns of trade flows by *commodity* or by *region*. In other words we can examine which are the major importers/exporters for a given product, or we can examine which are the major products exported/imported by a given region. The following analysis is organized by commodities.

For each commodity, we firstly give an overview by describing what proportion of world trade is trade between socialist, developed (non-socialist), and developing regions. This can be done by examining a *summary* of the Z_{ijk} share structure table (see page 4 for definition of Z_{ijk}). An example of a summary table is as follows:

		1 TOTAL DEVP	2 TOTAL CMEA	3 TOTAL DPIN	4 TOTAL WORL
1.	TOTAL DEVP	56.37	0.31	6.89	63.57
2.	TOTAL CMEA	18.81	0.11	0.38	19.30
3.	TOTAL DPIN	13.33	0.	3.80	17.13
4.	TOTAL WORL	88.51	0.41	11.08	100.00

Thus we can see for example that trade in Coniferous Logs between developed regions covers 56% of world trade in 1981. A time series of this and the other major shares in the table can be plotted cumulatively as in Figure 5 (see Appendix V) to show how the proportion of trade between these three groups of regions has changed over time. Note that exports from developing regions are shown always by the shaded part of the graph, while the unshaded part represents the proportion of world exports originating from developed regions. Since only the major shares in the above table are plotted, the cumulative graph does not quite cover 100% of world trade.

Following this overview, we then proceed by looking at the *detailed* Z_{ijk} share structure table. Given the Z_{ijk} share structure of a particular commodity for 1962 to 1981, we can check the total import and total export shares ($Z_{.jk}$ and $Z_{i.k}$ respectively) of each region; thus major importers and exporters of the product are revealed. Trends in the import and export share structure are revealed by plotting the largest shares over time. (These graphs are to be found in Appendix V). We can also check whether regions have been net importers or net exporters. It is then useful to study the α and β (import and export) share structures of the product. The former indicate for a given importer what proportion of its imports come from different regions. The latter indicate for a given exporter, what proportion of its exports are sent to different regions. Thus for each major importing and exporting region the importance of different trading partners is assessed.

This however does not indicate the importance of *individual trade flows* with respect to overall trade in a product; for this purpose, the Z_{ijk} share structure is examined to reveal major bilateral flows and their changing pattern over the last two decades. For simplicity we have noted

only those flows whose share is greater than 1% of world trade during any one of six selected years. This information is presented for each product in the form of a table, and also the major flows are plotted on a world map, which can be found in Appendix V.

We begin with an overview of all products and then consider each product separately.

Trade of All Forest Products

Looking at all the eleven commodity groups we have studied, we find that the total value of trade in 1981 was 52 billion dollars. The share of this covered by each product is as follows:

Coniferous Logs	5.1%	Panels	8.3%
Non-Coniferous Logs	4.8%	Pulp	19.2%
Pulpwood	1.4%	Newsprint	11.5%
Fuelwood	0.4%	Other printing & writing paper	10.6%
Coniferous Sawnwood	14.7%	Other paper & board	18.4%
Non-Coniferous Sawnwood	5.6%		

If we look at the share of the total value of trade that each product has had over the last twenty years, we find that in the case of Non-Coniferous Logs and Coniferous Sawnwood, this has decreased (by nearly one half and one third respectively). On the other hand, Coniferous Logs, "Other printing and writing paper" and "other paper and board" have all become more important in terms of value (their shares have doubled, tripled and increased by half respectively). Very little change is observed for Pulpwood and Fuelwood, but Panels and Non-Coniferous Sawnwood have slightly increased their share. The share for Pulp has remained around 20% apart from the late seventies when it dropped to around 15%, while the share for Newsprint decreased to a minimum in the early seventies, after which it increased.

Overall, a very large proportion of trade in forest products has come from developed regions throughout the period; over 85% in 1963 but decreasing to 78% in 1980 (see the unshaded area of Figure 1). In contrast, the shaded area of Figure 1 shows how the developing regions share of exports has increased slightly up to 1980. This is due to both increased trade between developing regions, and their increased exports to the developed world. It is noticeable that in 1973, the latter flow was at its highest, while trade in the reverse direction was at its lowest, but on average, the world share of these flows has remained around 10% each.

North America and Northern Europe have been the major exporters, covering over half the world's exports (see Figure 2). The share of the former remained around 36% until 1972, after which it dropped to a lower level, and only picked up again in 1981. The latter has always been the second largest exporter but its share has dropped fairly steadily apart from a temporarily high level in 1974 and 1975. The third major exporter throughout -- Western European -- has been steadily increasing its share of the market, while Eastern Europe's share has changed little. The main exporter in the developing world has been the ASEAN group of countries.

Its share has increased, particularly in 1973 when it overtook Eastern Europe as the fourth largest exporter, and peaked at 11% in 1979 but afterwards decreased. Its increased exports were mainly sent to Japan (see Table 1).

Nearly half of all exports have gone to Western Europe throughout the last twenty years, while North America has decreased its imports by one third but has remained the second major importer with an 18% share in 1981 (Figure 3). (North America has remained a net exporter throughout the period.) Japan remained the third major importer, with an increased share around 10%, this coming mainly from North America and the ASEAN countries (Table 1). The share of imports by "other Asian countries" has more than doubled but still only represents 7% of world trade.

As Table 1 and the corresponding map of major bilateral flows (Figure 4) show, nearly 50% of world trade in forest products has always been covered by only three flows; namely intra-regional Western European and North American trade, and Western European imports from Northern Europe (see Table 1). The first of these has nearly doubled its share of world trade over the last twenty years, while both the others have decreased. The overall concentration of trade flows of forest products has also decreased slightly during the period (15 flows covered 80% of world trade in 1982, compared with 12 in 1962).

Table 1. Shares of world trade of major bilateral flows of all forest products.

FROM	TO	1962	1966	1970	1974	1978	1981
WEST EU	WEST EU	9.96	10.19	11.82	14.39	15.80	16.85
NORTH EU	WEST EU	23.45	20.96	19.22	18.99	15.70	15.86
NORTH AM	NORTH AM	22.99	19.95	15.68	13.30	17.27	15.60
NORTH AM	WEST EU	7.55	7.71	8.98	7.71	6.89	8.08
NORTH AM	JAPAN	2.14	3.51	6.01	5.54	5.23	5.40
EAST EU	WEST EU	5.99	5.60	4.45	3.76	3.47	2.86
NORTH AM	LATIN AM	1.94	2.21	2.38	2.22	1.76	2.57
ASEAN CO	JAPAN	1.95	2.27	3.41	3.52	3.16	2.21
AFRICA	WEST EU	3.80	3.64	3.22	2.80	2.53	2.16
NORTH AM	OTHER AS	.	.	.	.	1.12	1.86
NORTH EU	EAST EU	.	1.47	1.47	1.29	1.25	1.68
ASEAN CO	WEST EU	.	.	.	1.05	1.76	1.65
NORTH EU	OTHER AS	.	.	.	.	.	1.39
NORTH EU	NORTH EU	.	1.05	1.30	.	.	1.28
NORTH EU	AFRICA	.	.	.	.	.	1.05
JAPAN	NORTH AM	1.15	.	.	.	.	.
NORTH EU	NORTH AM	1.41	1.12	.	.	.	.
NORTH EU	LATIN AM	1.08	.	.	.	.	.
OTHER AS	JAPAN	.	1.02	.	.	.	.
EAST EU	JAPAN	.	.	1.49	1.67	1.28	.
LATIN AM	LATIN AM	.	.	1.03	1.02	.	.
WEST EU	EAST EU	.	.	.	1.18	.	.
WEST EU	AFRICA	.	.	.	1.08	.	.
ASEAN CO	OTHER AS	.	.	.	1.15	2.33	.

Coniferous Logs

In 1981, trade in Coniferous Logs amounted to 2.7 billion dollars, thus representing a fairly small proportion (5.1%) of world trade in forest products. Figure 5 shows a cumulative plot of the percentage of world exports of Coniferous Logs coming from socialist and developed (non-socialist) regions (unshaded area) and from developing regions (shown by the shaded area). Within the unshaded area we see that the bulk of developed regions exports is to other developed regions; a small amount goes to developing regions, and exports from socialist to developed regions accounts for one fifth of world trade. The shaded area portrays clearly the greatly increased role of developing countries as exporters (and as importers, since trade between developing countries has also increased).

Throughout the period from 1963 to 1981, North America remained by far the largest exporter of Coniferous Logs, (with most of the exports coming from the USA) with a share of world trade over 40%, compared to a share of around 20% for the second major exporter -- Eastern Europe. However, the former decreased sharply after 1973 from a high of 60% to around 40% in 1977, but has since increased to about 55% (Figure 6). After the energy crisis, Eastern Europe exports also appear to have dropped from a 30% high in 1974 to around 16%. The only region whose share sharply *increased* after 1973, is the ASEAN countries (from less than 2% to a high of 26% in 1979, but later decreasing to less than Eastern Europe's share). Both Western and Northern Europe have an export share less than 10% of world trade in Coniferous Logs. The former trades mainly within the region.

The major importer of Coniferous Logs throughout the period, has been Japan. Its share increased between 1963 and 1968 from 60% to 87%, but there is a noticeable decrease after 1973 to a low of 70% in 1977 (Figure 7). Corresponding to this decrease in Japan's imports, is the increased imports of "other Asian countries," from 2% in 1973 to a high of 14% in 1978. Western Europe imports dropped from 20% in 1963 to 8% in 1968 and remained around that level, but Western Europe remained a net importer.

Between 1963 and 1966, over 70% of North American exports went to Japan, while 14% went to Oceania, but the latter dropped to less than 1% in 1966, while exports to Japan increased. Since 1966 over 80% of North America's exports have gone to Japan, but this percentage has been decreasing. About 4% is also traded within North America (mainly from the USA to Canada) and some goes to "other Asian countries" (since the mid seventies, this percentage has been increasing to 10%). Thus North America's export share decreased after 1973 mainly due to lower trade with Japan. Over 80% of Eastern Europe exports also go to Japan (this proportion has been decreasing), with a small percentage to Northern and Western Europe (these percentages have been decreasing and increasing respectively). Since the total shares of imports by Northern and Western Europe have remained fairly constant (Figure 7), the reason for Eastern Europe's decreased market share, is therefore its lower trade with Japan. The ASEAN countries currently export Coniferous Logs predominantly to Japan and "other Asian countries" (over 65% and 25% of

ASEAN exports respectively), It is interesting that before 1965 over 50% of ASEAN exports went to "other Asian countries" with the rest going to Japan (apart from 1964 when one quarter of exports went to Oceania). Between 1965 and 1974 over 90% went to Japan but this decreased during the mid-seventies, while the percentage going to "other Asian countries" decreased. However, both of these bilateral flows account for ASEAN's increased share of the export market up to 1980. This is more clearly seen by looking at the *bilateral flows as a percentage of total world trade* in coniferous logs. Table 2 shows all flows in six selected years which are over 1% of total trade. (Note that a dot is used in Table 2 to show that the share is less than or equal to 1% of world trade. Figure 8 represents this information on a world map of major trade flows.) We can easily see that the share of total trade accounted for by the flows from the ASEAN countries to Japan and "other Asian countries" sharply increased in the early seventies (from 1% to 13% and less than 1% to 8% of world trade respectively), while Japanese imports from North America and Eastern Europe decreased. It is interesting to note that nearly two thirds of "other Asian countries" imports are from North America; the rest mainly coming from ASEAN countries.

We have so far generaly talked about major established trade flows, but an interesting question is whether new important bilateral flows have appeared, or old ones disappeared. Table 2 shows severs candidates for this. In fact, when we investigate the flow from Northern Europe to Africa, we find that there always has been a small flow, but it is only in 1981 that it becomes more than 1% of world trade. Western Europe imports from North America and Northern Europe have decreased to less than 1% of world trade (see also Figure 8).

Table 2. Shares of world trade of major bilateral flows of Coniferous Logs.

FROM	TO	1962	1966	1970	1974	1978	1981
NORTH AM	JAPAN	37.24	51.03	58.39	49.05	40.34	46.42
EAST EU	JAPAN	18.03	17.27	21.24	26.19	16.05	15.47
ASEAN CO	JAPAN	.	.	1.70	1.43	13.02	10.90
WEST EU	WEST EU	11.51	5.37	2.80	4.92	3.40	5.86
NORTH AM	OTHER AS	1.31	1.39	1.10	2.75	3.68	5.34
EAST EU	WEST EU	8.38	4.00	1.43	2.15	1.68	2.44
ASEAN CO	OTHER AS	.	.	.	.	7.83	2.04
NORTH AM	NORTH AM	4.74	4.05	2.97	2.38	1.61	1.97
OCEANIA	JAPAN	4.32	3.74	5.57	3.96	1.50	1.84
NORTH EU	NORTH EU	1.59	2.23	.	.	.	1.56
NORTH EU	AFRICA	.	.	.	.	.	1.01
NORTH AM	WEST EU	2.70	.	.	.	.	.
NORTH EU	WEST EU	7.40	2.49	1.09	.	.	.
EAST EU	NORTH EU	.	2.66	.	1.83	1.06	.
AFRICA	WEST EU	.	.	.	.	2.80	.
ASEAN CO	ASEAN CO	.	.	.	.	1.42	.

Non-Coniferous Logs

World trade in Non-Coniferous logs was worth 2.5 billion dollars in 1981; approximately 4.8% of trade in forest products. We see from Figure 9, which is a cumulative plot of the percentage of world exports of Non-Coniferous Logs from developed and developing regions, that a major role has been and still is played by developing regions as exporters (shaded area). Also trade *between* developing regions is fairly high. Looking more closely at the shares of world trade of the major exporters over the last two decades (Figure 10) we can see that the ASEAN countries and Africa are the most important. The former's share nearly doubled since 1963, to a high of 58% in 1979, but afterwards dropped sharply. On the other hand, Africa's was nearly halved between 1963 and 1978 to about 20%, but then sharply increased. One other particularly noticeable feature of Figure 10 is the way in which "other Asian countries" exports appear to fall by almost four-fifths in 1969 and then remain under 4% of world exports. The reasons for these changes, in terms of which bilateral flows change, are discussed below after we have examined the world shares of the major importers (Figure 11).

Western Europe and Japan have been the largest importers of Non-Coniferous Logs, throughout the period (around 40% of world imports each). It is particularly noticeable from Figure 11 that the shares of both regions have fluctuated; moreover, when Japan's imports share is at it's maximum in a cycle, Western Europe's is at its minimum, and vice-versa. "Other Asian countries" became net importers in 1969 and steadily increased their imports to a maximum of 21% in 1978 but over the next three years, this share returned to its original level around 5%. It is interesting that the energy crisis does not seem to have had a marked effect on either the import or export shares apart from a moderate increase in Western Europe exports. Regarding North America, one of the smaller importers and exporters, we see that it has remained a net exporter throughout the period, and this is mainly from the USA.

Looking at the destinations of ASEAN exports; in 1975 over 60% went to Japan, with the rest mostly to "other Asian countries". The share going to Japan increased to over 86% in 1981. However, when ASEAN exports dropped in 1980, this was nearly all due to the drop in "other Asian countries" imports (see Figure 11). Table 3 below shows flows with world shares over 1% in six years; note the drop from 18% to 2% of world trade in the ASEAN -- "other Asian countries" flow. This can also be seen from Figure 12 which presents a summary of Table 3 on a world map. Africa has since 1975 sent over 85% of its Non-Coniferous Logs exports to Western Europe; thus the fluctuations in its exports follow closely the Western Europe import fluctuations. We can see from Table 3 that there is some trade within Western Europe and that North America, Eastern Europe and four other regions also export to Western Europe. However, looking at the share structure of Western Europe imports, over 55% comes from Africa and over 20% from within the region in 1981. These two proportions have remained fairly constant since 1975. Japanese imports originate mainly from ASEAN countries (around 85%) and a small (increasing) percentage comes from Oceania.

Table 3. Shares of world trade of major bilateral flows of Non-Coniferous Logs.

FROM	TO	1962	1966	1970	1974	1978	1981
ASEAN CO	JAPAN	22.92	25.34	36.38	37.17	29.13	30.42
AFRICA	WEST EU	31.32	28.58	26.35	23.11	21.42	29.01
WEST EU	WEST EU	7.34	5.80	5.08	6.97	8.92	11.09
NORTH AM	WEST EU	3.19	2.90	2.55	1.54	3.25	3.23
EAST EU	WEST EU	1.98	2.18	1.85	2.10	2.58	2.88
OCEANIA	JAPAN	.	0.	1.09	1.48	.	2.73
NORTH AM	NORTH AM	3.74	1.84	1.57	1.40	1.11	1.66
ASEAN CO	OTHER AS	2.30	2.63	9.07	10.90	18.20	1.66
ASEAN CO	ASEAN CO	.	.	2.60	1.76	.	1.47
AFRICA	EAST EU	.	.	.	1.18	1.16	1.42
NORTH EU	OTHER AS	.	.	.	.	.	1.35
NORTH EU	WEST EU	4.27	1.61	1.15	.	.	1.16
ASEAN CO	WEST EU	1.20	2.18	1.25	2.31	1.52	1.12
OTHER AS	OTHER AS	1.87	1.80	.	.	.	1.10
OTHER AS	JAPAN	6.29	10.95	.	1.21	1.20	1.07
LATIN AM	LATIN AM	1.09	1.33	.	.	.	.
OTHER AS	WEST EU	3.69	3.29	1.53	1.06	.	.
OTHER AS	ASEAN CO	1.07	1.64	.	.	.	.
LATIN AM	WEST EU	.	1.40	.	.	.	.

The "other Asian countries" appear in 1969 to have switched from being major exporters -- mostly to Japan, to being major importers. Table 3 shows that their exports to Western Europe also declined throughout the period. In 1979, 90% of their imports came from ASEAN countries. This share had been steadily increasing up to that year, but afterwards declined sharply, to a 1981 level of 28%. In 1981, much more of their imports were coming from Northern Europe and from trade within the region. But trade with both in 1981 was still only around 1% of world trade (Table 3).

Pulpwood

Trade in Pulpwood represented only 1.4% of world trade in forest products in 1981, thus being the second smallest product category, with a total value of 0.7 billion dollars. Developed regions of the world (both socialist and non-socialist) have accounted for over 90% of world exports of Pulpwood, as shown by the unshaded area of Figure 13. Moreover, developing regions play only a very small role as either importers or exporters. The share of the major exporter -- Eastern Europe has been increasing from 35% in 1963 to a high of 60% in 1978 (Figure 14). Two regions which were major exporters during the sixties (world shares around 30% each) but have since reduced their share to less than 15% are Northern Europe and North America. Their decrease has been compensated by steadily increasing exports from Western Europe; although Western Europe has remained a net importer.

Over 70% of Pulpwood imports have been by Northern and Western Europe through most of the period. Imports by these regions show a cyclical movement (Figure 15), the average share slightly increasing for the former, and decreasing for the latter. After 1973 the cycles become more exaggerated around a common average trade share of around 35%. Throughout, high Western Europe import shares are matched by low Northern Europe import shares and vice versa. North America has steadily decreased its import share from 22% in 1963 to 3% of world trade in 1981, but due to its export share declining as well, has remained a net exporter by a small amount.

Bilateral trade flows of Pulpwood are fairly concentrated; only 6 flows account for over 80% of trade in 1981. This concentration has remained constant for most of the period (Table 4). Looking at the destinations of Eastern Europe exports; in 1962, 70% of their exports went to Western Europe and 20% to Japan. Both flows decreased, while trade with Northern Europe and within the socialist countries increased to 40% and 19% respectively of Eastern Europe exports by 1981. These changes are also reflected by the bilateral trade shares in Table 4 below (and Figure 16, which shows the major flows on a world map). These suggest that the reasons for North America's declining export share are that trade within the region decreased (from 67% of North American exports in 1963 to 47% in 1981) as did trade with Western Europe. It is interesting to note that 99% of Northern Europe's trade in Pulpwood was within the region in 1981, as opposed to only 54% in 1962. At that time Western Europe received the rest of its exports.

Table 4. Shares of world trade of major bilateral flows of Pulpwood.

FROM	TO	1962	1966	1970	1974	1978	1981
EAST EU	NORTH EU	1.42	12.08	5.36	11.86	18.26	20.16
EAST EU	WEST EU	20.20	18.25	26.19	29.07	25.12	16.31
NORTH EU	NORTH EU	18.03	19.89	23.87	12.36	7.93	15.49
WEST EU	WEST EU	6.15	5.52	8.81	14.46	17.37	13.82
WEST EU	NORTH EU	.	.	.	2.80	3.24	11.38
EAST EU	EAST EU	.	1.51	1.18	5.37	9.73	9.57
EAST EU	JAPAN	5.75	7.93	4.83	6.22	5.92	4.05
NORTH AM	NORTH AM	18.94	14.96	8.86	6.32	6.28	3.32
NORTH AM	EAST EU	.	.	2.11	.	.	1.90
NORTH AM	WEST EU	9.09	12.04	6.83	1.80	1.93	1.29
NORTH EU	WEST EU	15.53	1.57	4.33	.	.	.
EAST EU	OTHER AS	1.00	.	.	.	.	.
LATIN AM	NORTH AM	2.86	2.42	2.24	.	.	.
WEST EU	EAST EU	.	.	2.06	1.35	.	.
ASEAN CO	JAPAN	.	.	1.14	1.97	.	.
NORTH AM	JAPAN	.	.	.	1.61	.	.
OCEANIA	JAPAN	.	.	.	1.47	.	.

Fuelwood

Total trade in fuelwood amounted to 0.1 billion dollars in 1981, i.e., only 0.4% of world trade in forest products and thus the smallest product category. We shall therefore look fairly briefly at this product. Developed regions of the world have accounted for over 75% of world exports of fuelwood (Figure 17); the major exporters being Western and Eastern Europe (Figure 18). The former's export share has slightly increased over the period, (and is mainly intra-regional trade) while the latter's has more than halved with particularly sharp decreases after 1968 and 1975. Western Europe is the only large importer, and has remained a net importer throughout the period. In 1962, 46% of its imports were from Eastern Europe; this proportion halved during the last two decades as trade within Western Europe increased. As Table 5 and Figure 20 show, trade within East and West Europe has covered more than 50% of total trade in Fuelwood throughout the period. There has also been a marked decrease in Northern Europe's import share after 1966 (Figure 19). This is due to smaller trade with Eastern Europe (Table 5). It is interesting to note that before 1964, over 70% of Northern Europe's imports were from within the region, but for the rest of the period, over 70% were from Eastern Europe.

Other smaller exporters (with an increasing share of world trade) have been North America and ASEAN. The latter trades mostly within the region and with Japan, but has recently increased its trade with Western

Table 5. Shares of world trade of major bilateral flows of fuelwood.

FROM	TO	1962	1966	1970	1974	1978	1981
WEST EU	WEST EU	31.75	30.20	32.15	30.44	37.36	38.60
EAST EU	WEST EU	30.50	23.58	26.73	21.61	15.13	15.13
NORTH AM	NORTH AM	4.01	3.55	3.57	4.90	7.57	6.63
ASEAN CO	JAPAN	1.20	.	5.24	7.13	3.63	4.91
NORTH AM	WEST EU	.	.	.	.	1.33	3.75
NORTH AM	JAPAN	.	.	4.12	4.47	5.21	3.63
ASEAN CO	ASEAN CO	3.42	.	.	1.00	1.99	2.89
EAST EU	NORTH EU	.	22.15	9.51	13.63	4.48	2.68
AFRICA	WEST EU	.	.	.	.	1.59	2.68
NORTH EU	NORTH EU	1.80	3.11	2.23	1.44	1.79	2.05
ASEAN CO	OTHER AS	3.40	.	.	1.15	1.90	1.98
WEST EU	NORTH EU	.	.	1.04	1.09	1.94	1.61
NORTH EU	WEST EU	2.24	2.45	2.93	.	.	1.41
OTHER AS	WEST EU	1.24	.	.	3.09	2.34	1.38
ASEAN CO	NORTH AM	.	.	.	.	.	1.22
NORTH AM	NORTH EU	.	.	.	.	.	1.11
ASEAN CO	WEST EU	.	.	.	.	.	1.06
NORTH AM	LATIN AM	9.80	.	.	.	.	.
AFRICA	OTHER AS	3.48	1.59	2.12	1.73	.	.
OTHER AS	ASEAN CO	1.00	.	.	.	.	.
OTHER AS	OTHER AS	1.83	1.18	.	.	1.34	.
EAST EU	EAST EU	.	3.09	.	1.56	2.19	.
WEST EU	AFRICA	.	.	1.70	.	.	.
AFRICA	AFRICA	.	.	1.38	.	.	.
OTHER AS	NORTH AM	.	.	.	1.28	.	.
LATIN AM	NORTH AM	.	.	.	.	1.92	.
OTHER AS	JAPAN	.	.	.	.	1.15	.

Europe. The former exported mostly to Japan in the past, but has recently increased its trade to "other ASEAN countries" and within the region.

Coniferous Sawnwood

Trade in Coniferous Sawnwood reached a level of 7.7 billion dollars in 1981, accounting for nearly 15% of trade in forest products, making it the third largest commodity group. The import and export market of this product is dominated by developed regions, with less than 6% of exports originating from developing regions (see Figure 21 – shaded area).

North America, the major exporter, has increased its share of exports from 35% in the early sixties to an average of 45% in the late seventies (Figure 22). However its share does show cyclical movement, with a large drop occurring after 1973, picking up in 1976. These exports are mainly from Canada. Northern Europe's export share has remained around 27%, while Eastern Europe has steadily decreased its share nearly by half to around 11%. The only major developing exporter is Latin America; during the seventies its share decreased from 5% to 1%, so that in 1981 it was a net importer.

By far the largest importer is Western Europe, although its share has dropped from 70% to 50% during the last two decades (Figure 23). Its share has fluctuated up and down, but not so noticeably as that of North America, the second largest importer. (North America has in fact remained a net exporter throughout the period.) Peaks in North America's import share correspond to a low level of Western Europe's import share, and vice versa, (the last two peaks being in 1972 and 1978). Together these two regions account for 75% of imports in 1981.

Looking at the major bilateral flows; Table 6 shows us that trade within North America has been one of the largest throughout the period. Over 50% of North American exports have been traded within the region and these are in fact mostly Canadian exports to the USA.

North America also exports to Western Europe, Japan and Oceania (in 1981, 16%, 15%, and 3% of its exports respectively.) The second flow represented 7% of world trade in 1981 compared with only 2% in 1962 (Table 6), thus being a major component of North America's increased exports. After 1980, North America also began to increase its exports to Latin America, Africa, and "other Asian countries" although these flows all remained less than 2% of world trade in 1981.

Trade in Coniferous Sawnwood is strongly concentrated with only 5 or 6 flows accounting for over 80% of trade throughout the last two decades (see Figure 24). Northern Europe and Eastern Europe exports to Western Europe have been consistently among these major flows, although both have decreased slightly, thus accounting for the decreased export shares of both of these regions. Throughout the period over 75% of Northern Europe's exports went to Western Europe, but this has gradually decreased as an increased proportion started going to Africa, "other Asian countries," and trade within the region.

Table 6. Shares of world trade of major bilateral flows of Coniferous Sawnwood.

FROM	TO	1962	1966	1970	1974	1978	1981
NORTH AM	NORTH AM	21.83	19.79	20.01	18.95	37.20	26.22
NORTH EU	WEST EU	28.55	25.93	26.22	29.68	21.68	21.48
WEST EU	WEST EU	10.99	7.86	8.54	9.38	8.33	10.34
EAST EU	WEST EU	18.04	19.08	14.08	12.03	9.22	8.27
NORTH AM	WEST EU	7.75	10.86	10.09	8.26	5.65	7.44
NORTH AM	JAPAN	1.97	2.53	5.61	5.99	5.20	7.00
NORTH EU	AFRICA	.	.	.	.	1.11	2.38
EAST EU	AFRICA	.	2.11	1.55	2.66	.	1.82
NORTH EU	OTHER AS	.	.	.	.	.	1.78
NORTH AM	OCEANIA	1.51	1.53	1.61	1.91	1.21	1.53
NORTH AM	LATIN AM	.	.	.	.	.	1.51
NORTH EU	NORTH EU	.	.	.	.	1.17	1.44
NORTH AM	AFRICA	.	.	.	.	.	1.28
NORTH AM	OTHER AS	.	.	.	.	.	1.12
LATIN AM	WEST EU	1.91	2.29	1.66	1.06	.	.
LATIN AM	LATIN AM	1.94	2.44	2.63	1.64	1.01	.
EAST EU	OTHER AS	.	.	1.22	.	.	.

Looking at the pattern of Western European imports, we can also see that an increasing proportion has been from trade within the region, and this has also remained a major flow of Coniferous Sawnwood, being approximately 8–10% of world trade in the last two decades.

Non-Coniferous Sawnwood

In 1981 the value of trade in Non-Coniferous Sawnwood was 2.9 billion dollars, representing 5.6% of world trade in forest products. The proportion of exports coming from developing regions has been steadily increasing (see shaded area in Figure 25) from 45% in 1963 to 55% in 1981. The bulk of this has gone to developed regions, although trade between developing regions is also fairly high -- around 14% before 1973, increasing to 17% afterwards.

The ASEAN group of countries are as expected the largest exporters; their share has fluctuated cyclically, but also more than quadrupled since 1962, up to a level of 37% in 1981 (Figure 26). The other important developing exporters are Africa and Latin America -- the former's share decreased by more than half to a 1981 level of 6%, while the latter's share remained around 6%. North America had the largest export share in 1962, but this dropped by half in 1973 to a low of 10% and only after five years began to recover to 18%, the second largest share in 1981. Western and Eastern Europe export around 15% each of world trade in Non-Coniferous Logs.

The major importer throughout the period was Western Europe; its trade share fluctuated around 55%, with a noticeably sharp drop in 1974 (Figure 27). North America steadily decreased its share of imports from 24% in 1962 to 11% in 1981. Up to 1971 it was a net importer, but then switched to being a net exporter, apart from 1973 and 1974 when it was a net importer of Non-Coniferous Logs. "Other Asian countries" doubled

their share of imports after 1973 from an earlier constant level around 4%.

The ASEAN countries export mainly to Western Europe (over 50% of their exports throughout the period). The *proportion* of their exports going to North America, Oceania, and Africa has tended to decrease over the past two decades, while the proportion of trade to other countries within the region has more than quadrupled since 1970. About 9% of their exports go to "other Asian countries" and they also export to Japan. As can be seen from Table 7, the main reasons for their increased export share are their increased trade with Western Europe and within the region.

North America has sent an increasing proportion of its exports, much of which originates in the USA, to Western Europe over the last two decades (50% in 1981) while the proportion traded within the region has decreased to 30% in 1981. The proportion of North America's imports from within the region and from Latin America and ASEAN has remained

Table 7. Shares of world trade of major bilateral flows of Non-Coniferous Sawnwood.

FROM	TO	1962	1966	1970	1974	1978	1981
ASEAN CO	WEST EU	2.79	9.05	14.92	13.66	19.07	21.17
WEST EU	WEST EU	12.10	10.15	10.52	13.01	14.79	12.54
NORTH AM	WEST EU	5.88	3.78	2.72	2.98	6.56	9.01
ASEAN CO	ASEAN CO	.	.	1.33	3.94	5.55	6.52
NORTH AM	NORTH AM	13.46	13.27	7.88	5.99	5.08	5.50
AFRICA	WEST EU	11.27	9.67	9.93	7.28	6.09	5.41
EAST EU	WEST EU	9.78	11.02	12.11	7.95	7.16	4.90
LATIN AM	WEST EU	.	1.26	1.09	1.64	1.57	3.47
LATIN AM	NORTH AM	2.84	3.11	2.57	2.79	2.04	3.02
ASEAN CO	OTHER AS	1.76	1.82	1.21	1.70	2.81	2.67
ASEAN CO	OCEANIA	.	1.68	2.83	3.44	1.89	2.28
ASEAN CO	JAPAN	.	.	2.55	2.88	1.40	2.28
ASEAN CO	NORTH AM	2.32	2.63	2.25	3.45	2.21	1.84
LATIN AM	LATIN AM	1.47	1.39	2.00	2.87	1.74	1.24
NORTH EU	OTHER AS	.	.	.	.	.	1.20
EAST EU	EAST EU	1.41	1.55	1.00	.	.	1.03
EAST EU	OTHER AS	.	.	1.80	2.36	1.14	1.00
JAPAN	NORTH AM	4.08	1.78	.	.	.	.
JAPAN	WEST EU	2.16	1.65	1.57	1.11	1.25	.
WEST EU	NORTH EU	1.28	1.15	.	.	.	.
OCEANIA	WEST EU	1.16	.	.	.	.	.
AFRICA	NORTH AM	1.13	1.40	.	.	.	.
OTHER AS	WEST EU	5.44	4.89	1.34	1.00	.	.
OTHER AS	OCEANIA	1.71	.	.	.	.	.
OTHER AS	ASEAN CO	1.05	1.11	.	.	.	.
OTHER AS	OTHER AS	2.69	2.16	1.37	1.42	.	.
EAST EU	AFRICA	.	1.02	.	1.35	4.67	.
OTHER AS	NORTH AM	.	1.00	.	.	.	.
NORTH AM	JAPAN	.	.	1.80	.	.	.
ASEAN CO	AFRICA	.	.	2.48	1.92	.	.
NORTH EU	WEST EU	.	.	.	1.86	.	.
WEST EU	OTHER AS	.	.	.	1.58	1.14	.
NORTH EU	AFRICA	.	.	.	.	2.03	.

about the same, but North America's overall reduced share of the import market is mostly due to lower trading between the USA and Canada. This is shown in Table 7 by the drop of this trade flow share from 12% to 5% of world trade.

There is a high level of trade within Western Europe; this is the second largest source of that region's imports after the ASEAN countries. Eastern Europe has exported mainly to Western Europe, but also to Africa and "other Asian countries". It is interesting to note from Table 7 that Japan and "other Asian countries" were quite important exporters of Non-Coniferous Sawnwood (mainly to North America and Western Europe respectively) in the early sixties, but these flow shares have steadily decreased to less than 1% in 1981.

Overall, trade in this product is much less concentrated than other forest products previously mentioned; over 16 flows accounted for 80% of world trade, decreasing to 13 flows during the late seventies.

Panels

The value of trade of Panels in 1981 was approximately 4.4 billion dollars, representing 8.3% of world trade in forest products. A major, but decreasing proportion of this came from developed regions (85% in 1962, 68% in 1981). This can be seen by the unshaded area in Figure 29. The shaded area indicates developing regions' exports -- both to developed and other developing regions -- which have been increasing due to increasing industrialization of the developing world. After 1973 the trade within developing regions noticeably increased to 13% of world trade while their exports to developed regions decreased from a maximum level in 1973.

By far the largest exporter and (net) importer of Panels is Western Europe (Figures 30 and 31). This intra-regional trade flow has been increasing from 22% of world trade in 1962 to 28% in 1981 (Table 8). It represents the bulk of Western European countries' exports, but only 40% to 50% of their imports. Other regions which they import panels from, are mainly Northern Europe (14% of Western Europe imports in 1981 -- this proportion has been decreasing). North America, ASEAN countries and Eastern Europe. The ASEAN countries have accounted for an increasing share of Western Europe imports during the seventies. This a is one of the main reasons for ASEAN's export share quadrupling since 1962, to 16% in 1981, i.e., the second largest exporter of Panels. They also sent an increasing part of their exports to "other Asian countries" -- 30% of their exports in 1981. This flow picked up during the seventies and is a major component of "other Asian countries" increased imports after 1973 (Figure 31).

Of the other major exporters of Panels (see Figure 30), Northern Europe's share has been nearly halved to 13% in 1981, although it remained a net exporter; mostly to Western Europe (the second largest bilateral flow) but also to other countries within the region. North America's share has fluctuated around 14% and due to its steadily decreasing import share was a net exporter for the first (and only) time in 1980. North American intra-regional trade accounted for 60% of its

Table 8. Shares of world trade of major bilateral flows of Panels.

FROM	TO	1962	1966	1970	1974	1978	1981
WEST EU	WEST EU	21.88	23.75	23.64	25.76	28.10	27.98
NORTH EU	WEST EU	17.87	13.51	13.28	10.70	8.46	8.44
NORTH AM	WEST EU	4.35	6.28	7.37	6.70	7.21	7.70
NORTH AM	NORTH AM	8.42	6.83	4.42	7.24	5.19	5.58
ASEAN CO	OTHER AS	.	.	.	1.35	2.89	4.84
ASEAN CO	WEST EU	.	.	1.71	3.01	4.54	4.65
OTHER AS	NORTH AM	1.13	4.51	7.10	5.63	7.27	3.54
ASEAN CO	NORTH AM	4.74	5.26	3.93	2.82	2.22	3.38
EAST EU	WEST EU	5.11	5.02	4.13	3.63	3.15	2.89
ASEAN CO	ASEAN CO	.	.	.	.	1.49	2.33
AFRICA	WEST EU	3.55	3.51	2.90	3.31	2.30	2.15
OTHER AS	OTHER AS	.	.	.	.	1.87	2.12
NORTH EU	NORTH EU	1.07	1.53	1.86	2.03	1.93	1.89
OTHER AS	WEST EU	.	.	.	.	2.86	1.55
LATIN AM	NORTH AM	.	.	.	.	1.52	1.51
LATIN AM	WEST EU	.	.	1.79	1.28	1.33	1.46
LATIN AM	LATIN AM	.	.	.	.	1.02	1.39
NORTH EU	OTHER AS	.	.	.	.	.	1.32
JAPAN	NORTH AM	13.47	8.83	5.33	2.24	2.23	1.27
WEST EU	AFRICA	.	.	1.17	1.31	1.07	1.06
JAPAN	WEST EU	1.15	.	1.18	.	.	.
NORTH EU	NORTH AM	3.87	3.28	1.86	.	.	.
WEST EU	NORTH AM	1.54	.	.	.	.	.
WEST EU	NORTH EU	2.10	2.12	2.22	1.65	1.07	.
WEST EU	EAST EU	.	.	2.12	2.50	1.02	.
OTHER AS	JAPAN	.	.	1.50	2.48	.	.

exports in 1962, with the rest going mainly to Western Europe; this position is reversed in 1981, with 49% going to Western Europe. "Other Asian countries" steadily increased their exports to a maximum share of 15% in 1977, but this then decreased to 7%, and after 1980 they switched to being net importers. Table 8 confirms that their increased exports up to 1977 were mainly due to trade with North America, although they also exported intra-regionally and to Western Europe. It is interesting also that Japan is currently one of the smallest exporters of Panels, but in 1962 was the third largest with a 16% share. (Its imports have remained below 5% of world trade.) This can clearly be seen in Table 8, and in the corresponding map of major bilateral flows (Figure 32). Japanese-North American trade dropped from 13% of the world total in 1962 to 1% in 1981.

Overall, trade in Panels has become much less concentrated during the last two decades; 9 flows accounted for over 80% of world trade in 1962, compared with 15 during the seventies. This is much less concentrated than flows of raw material but similar to the concentration of flows of Non-Coniferous Sawnwood, and "other paper and board".

Pulp

Pulp has the largest value of trade of the eleven forest products studied, with a 19.2% world share in 1981 amounting to 10 billion dollars. Throughout the last two decades over 85% of exports came from developed regions (Figure 33) although the share from developing regions has increased slightly to 8% in 1981. Figure 34 shows that in 1967, North America overtook Northern Europe as the largest exporter and apart from a drop during 1972 and 1973, continued to increase its share to 54% in 1981 (from 41% in 1962). Meanwhile Northern Europe's export share nearly halved to 25% in 1981 with a small upturn in 1973. Together these two regions have accounted for over three quarters of world exports throughout the period. Of the developing exporters, Latin America is the largest; its share having increased from less than 1% in the early sixties to 5%. There is also a small level of exports from Africa.

Trade in Pulp is strongly concentrated; there being only 8 bilateral flows in 1981 covering 80% of world trade (Table 9). This number was even fewer in 1962 -- only 5 flows. The reason for this is that there is one major importer. As with many other products, this is Western Europe, covering over 50% of world imports, although its share has decreased slightly (Figure 35).

According to Figure 35, the second largest importer is North America. In fact this is all USA imports from Canada, and their share has slightly decreased from 26% in 1962 to 19% in 1981. Of the smaller importers, Japan has nearly doubled it share to 9% in 1981, while "other Asian countries" and Eastern Europe have slightly increased their export share to 5% each.

Table 9. Share of world trade of major bilateral flows of Panels.

FROM	TO	1962	1966	1970	1974	1978	1981
NORTH EU	WEST EU	38.20	37.37	32.13	25.57	22.17	19.34
NORTH AM	WEST EU	10.36	10.42	16.88	16.60	18.42	19.27
NORTH AM	NORTH AM	22.91	21.61	17.73	17.93	18.98	17.91
WEST EU	WEST EU	5.50	5.49	7.08	8.39	7.41	7.98
NORTH AM	JAPAN	3.08	5.16	5.71	7.03	6.18	7.00
NORTH AM	OTHER AS	2.10	1.28	2.03	1.87	2.49	3.88
NORTH EU	EAST EU	3.29	3.13	2.60	2.45	2.97	3.08
NORTH AM	LATIN AM	2.08	2.11	2.90	3.53	2.70	2.87
LATIN AM	WEST EU	.	.	.	.	.	2.11
EAST EU	WEST EU	1.76	1.54	1.12	1.00	1.60	1.58
AFRICA	WEST EU	1.27	1.59	1.49	1.09	1.25	1.19
NORTH EU	NORTH AM	2.76	1.83	.	.	.	.
NORTH EU	LATIN AM	1.27	1.29	.	.	.	.
NORTH AM	EAST EU	.	.	1.43	.	.	.
NORTH EU	NORTH EU	.	.	1.05	.	.	.
LATIN AM	LATIN AM	.	.	1.10	1.45	1.39	.
NORTH EU	JAPAN	.	.	.	.	1.49	.
EAST EU	EAST EU	.	.	.	.	1.09	.

We can see from Table 9 that Western Europe imports, Canada → US trade and Western Europe, intra-regional trade have always been the largest bilateral flows of Pulp, accounting for 77% of world trade in 1962, but only 65% in 1981. Intra-regional Western Europe trade accounts for over 85% of Western Europe exports, but in 1981, only accounted for 15% of their imports. Their major sources of Pulp have been Northern Europe (the proportion imported from here has decreased from 67% in 1962 to 38% in 1981) and North America (this trade flow has increased to 37% of Western Europe's imports by 1981, from a level of 18% in 1961), but also a small amount comes from Latin America.

In 1981, 36% and 33% of North America's Pulp exports were accounted for by its trade with Western Europe and within the region respectively but some were also sent to Japan, Latin America and "other Asian countries". The proportion going to Western Europe has increased from 25% in 1962, while intra-regional trade decreased from 55% but accounted for nearly all North American imports. The reason for North America's increased exports is its higher trade with Western Europe and Japan. This is shown in Table 9 and the corresponding world map of major flows of Pulp (Figure 36) by the fact that these trade flows represent double the share of total trade in 1981 than they do in 1982.

As noted above, Northern European exports to Western Europe have decreased, thus being the major factor in the former is declining export share. Latin America's increased export share is due to higher trade with Western Europe; in 1979 this was over 1% of world trade for the first time, and in this year Latin America became net exporters.

Japan has been the third largest importer of Pulp throughout the last two decades, with a share starting around 4% and doubling by the end of the seventies due to increased trade with North America. It is closely followed by "other Asian countries" and Eastern Europe. The former took 70% of its imports from North America in 1981, the rest coming from Northern Europe, Japan, and Oceania. The proportion coming from North America was at its lowest in the early seventies, but remained over 45% of "other Asian countries" imports; while trade with Japan increased particularly during the seventies.

Newsprint

In 1981, the value of trade of Newsprint was 6.0 billion dollars, representing 11.3% of world trade in forest products, the fourth largest of the commodity groups studied. Trade in this product is the most strongly concentrated of all the products studied, with only 4 flows covering over 80% of world trade (Table 10), namely Canada → US trade, Western Europe imports from Northern Europe and North America and Latin American imports from North America (49%, 21%, 6% and 5% respectively in 1981). It is noticeable from Table 10, and also from Figure 37, that developing regions play a very minor role as Newsprint exporters, but imported about 16% of world trade in 1981. Their imports increased particularly between 1973 and 1974.

Table 10. Shares of world trade of major bilateral flows of Newsprint.

FROM	TO	1962	1966	1970	1974	1978	1981
NORTH AM	NORTH AM	63.67	62.99	55.82	46.86	49.75	48.53
NORTH EU	WEST EU	11.38	12.62	15.20	22.89	21.43	20.69
NORTH AM	WEST EU	6.93	4.65	5.13	5.73	6.89	6.38
NORTH AM	LATIN AM	3.38	3.46	5.24	4.99	4.12	5.18
WEST EU	WEST EU	2.11	2.00	1.70	1.65	2.36	2.37
NORTH EU	OTHER AS	1.17	.	.	.	1.17	2.29
NORTH AM	OTHER AS	.	.	1.42	1.14	1.64	1.67
NORTH AM	JAPAN	.	.	.	.	.	1.41
NORTH EU	LATIN AM	3.16	2.56	2.43	2.51	1.84	1.34
NORTH EU	ASEAN CO	.	.	.	.	.	1.19
OCEANIA	OCEANIA	.	1.43	1.11	.	.	1.09
NORTH EU	AFRICA	.	.	.	.	.	1.08
NORTH AM	OCEANIA	1.39	1.33	1.63	1.18	.	.
NORTH EU	NORTH AM	1.92	2.26	2.44	1.07	.	.
NORTH AM	ASEAN CO	.	.	.	1.12	.	.

North America used to cover over 70% of world Newsprint exports during the the sixties, (with nearly all exports coming from Canada) but this share decreased noticeably during the mid-seventies to a low of 62% (Figure 38). At the same time, this was matched by increasing Northern European exports with a high level of 29% in 1974. When North American exports picked up in 1978, this was matched by a drop in the formers' exports; this complementary fluctuation in shares for the two major regions continued for the rest of the decade indicating the competition between them on the export market. North America has in fact remained a net exporter of Newsprint since its share of the import market also decreased during this period, particularly during the early seventies (Figure 39). In 1962 it covered 66% of world imports, but reached a low of 48% in 1974 and then remained around that level apart from a temporary upturn in 1978. Canada → US trade has always accounted for nearly all of the region's imports, but in 1981 for only three-quarters of its exports. Other export destinations have been Western Europe and Latin America. Table 10 and the corresponding map of major flows (Figure 40) show that the share of world trade accounted by the North American intra-regional flow, dropped particularly during the early seventies, thus being the major component of its decreased import and export shares. At the same time, Northern Europe's exports to Western Europe represented an increased share of world trade, but dropped in 1978, thus being the major component of the former's export share fluctuations. In 1981, this trade flow represented 72% of Northern Europe's exports; its other main trading partners were all the developing regions (particularly "other Asian countries"). Its trade with Latin America has decreased, while that with "other Asian countries" increased slightly towards the end of the period.

Western Europe, the second largest importer, took 69%, 21% and 8% of its 1981 imports from Northern Europe, North America, and from within the region respectively. These proportions have changed little over the period Its overall share of the import market has steadily increased

apart from a temporary drop in 1978 (due to lower trade with Northern Europe as noted above). Latin America is the third largest importer, with a share around 7%. This share was at its lowest in 1973 and at its highest during the following four years. Its imports from Africa and within the region have tended to decrease, in favor of imports from North America and Western Europe. Imports from Africa began only in 1973, while intra-regional trade was at its highest (11% of their imports) in 1974.

Other Printing and Writing Paper

In 1981, trade in "other printing and writing paper" represented the fifth largest commodity group of forest products studied, with a value of 5.5 billion dollars (10.6% of world trade). Due to the increased international division of labor, particularly within Western Europe, a large (increasing) proportion of this trade has been between developed regions; (56% of world trade in 1962 compared to 75% in 1981) while developing regions' imports from the developed world have steadily decreased by half over the last twenty years (to 19% of world trade in 1981 - Figure 41). The two major developed exporting regions have been Western Europe and Northern Europe (Figure 42). The former's share increased by more than one-third between 1962 and 1973 to a level of 5%, but then dropped back to 41% in 1975, and had another low share in 1977 before recovering to 50% in 1978. The picture for the latter's share is completely the reverse: first decreasing, then picking up in 1975 and 1977, but later dropping back to its low level of 29% in 1978. North America and Japan's shares of the export market have decreased slightly to 11% and 5% respectively and do not show the same large fluctuations in the mid seventies. Trade between developing regions is very small (Figure 41), the major (increasing) exporter being Latin America, but this still covered less than 3% of world exports in 1981.

Western Europe has remained a net importer, its share of world imports has been fluctuating slightly but overall have been increasing, and in 1981 accounted for 60% (Figure 43). Two thirds of this came from within the region and also accounted for 82% of Western European exports. Thus the fluctuations in its share of the export market noted above are mainly due to fluctuations in intra-regional trade. These shares are also indicative of the higher level of integration of countries within the EEC, and an increasingly saturated market. It is noticeable that the years when the lowest proportion of Western Europe imports came from within the region, are 1975 and 1977, and up to 1973 this proportion had been increasing (i.e., the same pattern as the export share in Figure 42). Conversely, in 1975 and 1977, the proportion of Western European imports coming from Northern Europe was at its highest. This trade flow also accounted for over 60% of the latter's exports and is thus a major factor in the way its export share has changed. Northern Europe also exports to all the other regions studied, but particularly to Eastern Europe and Latin America (this flow has been decreasing).

North American exports have increasingly been intra-regional (66% of their exports in 1981 -- this being mainly from Canada to the USA) with less going to Western Europe during the seventies. Their trade with Latin America has fluctuated but still represented 17% of North American

exports of "other printing and writing paper" in 1981. It is interesting that up to 1974 their share of the import market decreased as well as their share of the export market, but after 1974, the former nearly doubled; thus they were net importers in 1978 and 1979. In these two years they had one third of their imports together from Western Europe and Northern Europe, a much higher proportion than in previous years. (See also Table 11 -- in previous years these flows are not significant.)

The developing regions accounted for over 40% of world imports in 1962 with Latin America and "other Asian countries" each having a share around 10%. By 1981, these regions along with Africa each had shares around 5%. Other Asian countries imported mainly from Japan, Western and Northern Europe (all these flows have decreased), while Latin America has imported mainly from North America and Northern Europe, but an increasing proportion has come from within the region. Africa has imported mostly from Western and Northern Europe and North America, but all of these flows have decreased. Also the proportion coming from North America has dropped, in favor of more coming from Latin America.

Looking at the pattern of bilateral flows in Table 11, and in the corresponding world map (Figure 44) we can see that intra-regional Western Europe trade has always been the most important flow, and has become much larger. At the same time, however, the concentration of

Table 11. Shares of world trade of major bilateral flows of "other printing and writing paper".

FROM	TO	1962	1966	1970	1974	1978	1981
WEST EU	WEST EU	23.03	29.46	32.25	32.78	39.67	40.53
NORTH EU	WEST EU	19.52	18.77	14.82	16.64	16.88	16.44
NORTH AM	NORTH AM	5.91	6.41	7.89	5.00	7.67	7.53
NORTH EU	EAST EU	.	3.91	4.80	2.87	2.75	3.43
WEST EU	AFRICA	3.84	4.05	3.50	3.49	2.21	2.37
NORTH AM	LATIN AM	4.64	1.95	2.42	2.17	1.07	2.01
JAPAN	OTHER AS	3.83	2.38	2.22	2.45	1.04	1.87
WEST EU	OTHER AS	2.39	2.26	1.19	2.30	1.68	1.72
NORTH EU	LATIN AM	4.17	2.95	2.03	2.17	1.43	1.63
NORTH EU	NORTH AM	.	.	.	.	3.08	1.44
NORTH EU	OCEANIA	2.19	1.55	1.36	1.35	1.21	1.40
JAPAN	WEST EU	.	.	.	1.16	2.03	1.33
NORTH EU	AFRICA	1.89	2.62	1.61	1.73	1.16	1.28
NORTH EU	OTHER AS	1.90	1.72	.	1.03	1.03	1.27
WEST EU	EAST EU	.	1.13	3.61	3.01	1.95	1.21
NORTH AM	WEST EU	3.12	3.58	4.99	2.69	1.25	.
NORTH AM	AFRICA	1.08	.	.	.	.	.
JAPAN	ASEAN CO	3.40	1.49	2.12	.	.	.
WEST EU	NORTH EU	1.20	1.51	1.27	.	.	.
WEST EU	OCEANIA	3.81	1.48	.	1.14	.	.
WEST EU	LATIN AM	1.73	1.18	1.83	1.70	.	.
AFRICA	WEST EU	1.09	.	.	.	.	.
NORTH AM	OCEANIA	.	.	1.23	.	.	.
EAST EU	OTHER AS	.	.	1.09	.	.	.
NORTH EU	JAPAN	.	.	.	1.03	.	.
WEST EU	JAPAN	.	.	.	1.45	.	.
WEST EU	NORTH AM	.	.	.	.	1.72	.

flows has slightly increased; in 1981, eleven flows covered over 80% of world trade, compared to fourteen in 1962.

Other Paper and Board

Trade in "other paper and board" was the second highest of the product groups we have studied, with a value of 9.6 billion dollars n 1981 (18.4% of world trade). As with the previous product, a very high proportion of this (over 65% throughout the period) has been trade between developed regions (Figure 45). In fact two flows alone (intra-regional Western European trade and Western European imports from Northern Europe) have always covered more than half of world trade. Developing regions' imports from developed regions have remained around 20% of world trade throughout, while trade between developing regions is negligible

Northern Europe used to be the largest exporter of "other paper and board", but its share dropped steadily from 44% in 1962 to 32% in 1981, and in 1973 it was overtaken by Western Europe whose share rose from 27% in 1962 to 37% in 1981 (Figure 46). North America has remained the third largest exporter, but with a decreasing share of the market between 1967 and 1979; its share increased again during the last two years of the period. Japan has been a small (net) exporter throughout the last twenty years.

Western Europe has always accounted for over 57% of imports, although its share has been decreasing slightly. Four other regions -- "other Asian countries", North America, Latin America, and Eastern Europe -- have each had an import share around 6% throughout the period. In other words the world import share pattern has changed very little overall (Figure 47). However, the proportion of Western Europe imports coming from different regions has changed. This can be seen from Table 12 and the corresponding world map (Figure 48) which show how the major bilateral lows of "other paper and board" have altered. Intra-regional Western European trade has accounted for an increasing proportion of world trade (17% in 1962 compared with 27% in 1981) while Western Europe imports from Northern Europe and North America have accounted for a decreasing share of world trade. Looking at the proportion of Western Europe imports from these three regions, only a quarter came from within the region in 1962 compared to 48% in 1981, while 39% and 11% came from Northern Europe and North America respectively in 1981, (compared to 56% and 17% in 1962).

Intra-regional trade accounted for three-quarters of Western Europe exports in 1981, the rest went mainly to Eastern Europe, Africa, "other Asian countries", and Northern Europe in fairly equal proportions; this pattern has changed little during the period. The main reason for Northern Europe's decreased export share is its lower trade with Western Europe, since it also sends three-quarters of its exports there. It also exports to Eastern Europe, within the region, "other Asian countries" (these flows have increased as a share of world trade during the seventies) and to Africa (this decreased during the seventies).

Table 12. Shares of world trade of major bilateral flows of "other paper and board".

FROM	TO	1962	1966	1970	1974	1978	1981
WEST EU	WEST EU	16.56	17.85	21.85	25.09	28.60	27.41
NORTH EU	WEST EU	36.59	30.80	27.16	25.17	23.43	22.10
NORTH AM	WEST EU	10.91	10.80	12.15	8.59	5.80	6.12
NORTH AM	NORTH AM	4.54	4.46	3.28	3.65	4.76	4.98
NORTH AM	LATIN AM	3.85	6.29	5.00	3.75	3.92	4.49
NORTH EU	EAST EU	.	3.60	3.15	2.50	2.65	3.24
NORTH AM	JAPAN	.	.	.	1.22	1.75	2.01
NORTH EU	NORTH EU	.	.	1.30	1.61	1.54	1.83
NORTH EU	OTHER AS	1.14	1.52	1.52	1.49	1.71	1.81
NORTH AM	OTHER AS	.	.	.	.	.	1.77
WEST EU	EAST EU	1.04	1.63	2.16	2.53	2.28	1.72
JAPAN	OTHER AS	1.07	1.20	1.55	2.03	1.80	1.67
WEST EU	AFRICA	2.36	2.00	1.94	2.09	2.32	1.61
WEST EU	OTHER AS	1.29	1.17	.	1.15	1.55	1.55
NORTH EU	AFRICA	1.43	1.60	1.83	1.75	1.43	1.42
WEST EU	NORTH EU	.	.	1.27	1.13	1.43	1.39
NORTH AM	AFRICA	1.61	1.20	1.10	1.15	.	1.34
NORTH AM	OCEANIA	1.11	1.04	.	.	.	1.18
EAST EU	WEST EU	.	.	.	.	1.08	1.10
NORTH AM	ASEAN CO	.	1.13	.	.	.	1.01
NORTH EU	NORTH AM	1.75	1.00	.	.	.	.
WEST EU	NORTH AM	2.28	.	.	.	.	.
WEST EU	OCEANIA	1.30	.	.	.	.	.
NORTH EU	LATIN AM	.	.	1.00	.	.	.
WEST EU	LATIN AM	.	.	.	1.13	.	.

North America's share of the export market decreased primary due to lower trade with Western Europe; 44% of its exports went to Western Europe in 1962, compared with 27% in 1981. Table 12 also shows how its trade with Africa and Oceania decreased, but picked up at the end of the period. Three other flows from North America appear to have picked up or become more than 1% of world trade during the late seventies; namely flows to Japan, "other Asian countries", and the ASEAN group of countries.

Latin American imports from North America have fluctuated around 4 to 5% of world trade. However, this flow has accounted for an increasing proportion of Latin America's imports. It has also received a greater proportion of its "other paper and board" from within the region, while imports from Northern and Western Europe decreased. "Other Asian countries" import mainly from Northern Europe, North America, Japan and Western Europe (each 20% of their imports in 1981), but also from within the region.

Overall, trade in this commodity group is fairly concentrated, but has been less so during the last decade, with 13 flows accounting for over 80% of world trade in 1981, compared to 9 in 1962.

2. TRADE INTENSITY ANALYSIS

Trade share structures can tell us a lot about the characteristic patterns of international trade, but they do not tell us why these patterns are as they are, or why they are changing. Gravitational models -- as we shall see in the next chapter -- can tell us what kind of exogenous variables play a role and how strong they are in the formation of trade flows, but this is based on the average effect of a great number of observations and cannot be used for explaining the bilateral pattern of trade.

Trade intensity analysis is designed to identify and quantify some of the factors influencing trade flow structures in their bilateral and commodity details. The concept of trade intensities* is based on the assumption that trade flows depend on the "push" of the exporting country, the "pull" of the importing country and on particular factors regulating bilateral relations.

This classification of factors into two categories leads to a method which treats the "volume effects", i.e., the trade potential of the two countries** and the "intensity effects" separately. This is done by firstly computing a hypothetical "normal" flow, taking into account only the volume effects, and then comparing this with the actual flow data, thus obtaining the intensity effect as a residual. For the sake of simplicity, we shall introduce exporter's and importer's trade flow shares in the trade in a particular group of commodities:

$$Z_{ijk} = \frac{X_{ijk}}{X_{..k}}, \quad Z_{i.k} = \frac{X_{i.k}}{X_{..k}}, \quad Z_{.jk} = \frac{X_{.jk}}{X_{..k}}$$

and we can obtain a "normal" flow share (denoted by an overbar) by multiplying the exporter's share in total exports by the importer's share in total imports:

$$\bar{Z}_{ijk} = Z_{i.k} \; Z_{.jk}$$

The idea of "normal" trade flow in the above sense is an abstraction. Actual bilateral flows would be "normal" only if exporters distributed their exports according to the size of the import markets and importers bought goods according to the shares of the exporters in the overall trade in the given commodity.

The intensity of bilateral trade relations is taken to be the factor causing observed bilateral flows to deviate from "normal" behavior:

$$\delta_{ijk} = \frac{Z_{ijk}}{\bar{Z}_{ijk}} = \frac{Z_{ijk}}{Z_{i.k} Z_{.jk}}$$

The trade intensity coefficients reflect all factors affecting trade flows apart from the "volume effects", including distance, trade policy measures, discrimination, integration, historical links, etc. If these factors have little effect on bilateral trade, the value of δ will be one, or

*See: Froment and Zighera (1964), Marin-Curtoud (1965), Theil (1967), Nagy (1969), ECE (1973).

**The "volume effect" -- as can be seen -- has nothing to do with the usual notion of "volume", measured in physical units or in constant prices.

thereabouts, while if they increase or reduce the trade flow, the coefficient will be greater or less than unity, respectively.

A trade flow of "normal" intensity is only a starting-point of measuring, and no "normative" value judgments can be attached to it. Here a trade flow being "normal" means nothing more than that it is not influenced by trade-policy, distance and similar effects (or at least that the effects of this type offset one another), so that its share in the total of world trade is equal to the product of the exporting and the importing country's share in world trade.

The δ coefficients determine a structure of trade intensity that does not depend on the size of world trade, nor on the changes in the shares of the individual countries in world trade. Thus, the computation of this coefficient can be conceived in such a way that, first, we clear the individual flows from the changes in the volume of world trade (by standardizing them with the volume of the latter, thus obtaining the $Z_{ijk}-s$) and, second, we abstract from the changes occurring in the shares of the total exports and imports of individual countries in world trade (by dividing the $Z_{ijk}-s$ with the coefficients $Z_{i.k}$ and $Z_{.jk}$). This way the system of coefficients is cleared from the effects of enduring and cyclical changes, as well as from the volume effects, consequently it may be justifiably considered as a characteristic expression of world-trade structure and of bilateral trade relations.

The trade intensity coefficients are closely related to the above-mentioned share coefficients:

$$\delta_{ijk} = \frac{\alpha_{ijk}}{Z_{i.k}} = \frac{\beta_{ijk}}{Z_{.jk}} = \frac{\alpha_{ijk}\beta_{ijk}}{Z_{ijk}}$$

Thus, the δ_{ijk} coefficient may be obtained either by dividing the import share with the share of the total exports of the exporting country in world trade; or by dividing the export share with the share of the total imports of the importing country in world trade. Moreover, we can obtain it also by multiplying the import share with the export share pertaining to the trade flow and by 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 exports or imports, or to the share of the given flow in world trade.

Furthermore, it may be seen that the Z_{ijk} structure is equivalent with the structure determined by the δ coefficients. The equivalence, however, does not mean in this case that the two systems of indicators are identical, or have the same information value. It means only that every δ structure corresponds to a Z structure and vice versa, but this correspondence, refers to the whole trade-flow table, and does not mean that only one defined Z coefficient will correspond to a given δ coefficient.

This relationship between the δ and the share coefficients may be well interpreted as it throws a light on the economic content of these indicators, as well as on the assumptions on which they are based. The previous equation can be written in the form of:

$$\delta_{ijk} = \frac{\alpha_{ijk}}{Z_{i.k}} = \frac{X_{ijk}}{X_{.jk}} : \frac{X_{i.k}}{X_{..k}}$$

i.e., comparing the share of an exporter country in an import market to the share of the same exporter in total world trade of the given commodity. And 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:

$$\delta_{ijk} = \frac{\beta_{ijk}}{Z_{.jk}} = \frac{X_{ijk}}{X_{i.k}} : \frac{X_{.jk}}{X_{..k}}$$

The trade intensity index will be close to unity, when the importing country accord the same treatment to all exporting countries, in the sense that they buy up the same percentage shares from the total supply of each country. In the practice, the value of this index may be higher or less than unity because the importing regions prefer the products of certain exporting regions (with a view to geographical distance, competitive quality or price and, last but not least, to preferences accorded on political or integrational grounds); consequently they buy smaller shares from the supply of other regions. Thus, the value of structural coefficients will be higher than unity in the case of the preferred exporting regions, and less than unity for the rest.*

Similarly, it can be said about the export shares that, in the case when all trade flows are "normal", the total supply of every exporting country is allocated among their import markets according to the shares of the latter in world trade.

One important feature of the trade intensity coefficient (δ) matrices is that their row and column totals weighted by the total export- and import-shares equal unity**:

$$\delta_{ijk} Z_{.jk} = \frac{Z_{ijk}}{Z_{i.k}}, \text{consequently} : \sum_j \delta_{ijk} Z_{.jk} = 1 \text{ and}$$

$$\delta_{ijk} Z_{i.k} = \frac{Z_{ijk}}{Z_{.jk}}, \text{consequently} : \sum_i \delta_{ijk} Z_{i.k} = 1.$$

It therefore follows that if we take the inverse of the matrix of δ coefficients (Δ_k), and sum the rows and the columns, we obtain the total export and import shares:

$$Z_{.jk} = \Delta_k^{-1} . \underset{=}{1} \quad \text{and} \quad Z_{i.k} = \underset{=}{1} . \Delta_k^{-1}$$

The structures determined by the δ and the Z coefficients both have one degree of freedom. A given δ coefficient system determines the total export- and import share vectors, and the close interrelation of the δ_{ijk} coefficients with the $Z_{i.k}, Z_{.jk}$ share vectors is very useful when trying to

*An important characteristic of the trade intensity coefficients was pointed out by Fink (1977) and Gelei-Kapitany (1982), that they cannot be directly compared if they refer to countries of very different total export or import shares. Another feature is that the coefficients are not symmetric above and below one.

**This is only true when no zeroes occur in the diagonal of the matrix, as, for example when we have regions instead of countries. There are several technical means of overcoming this problem, see for example: Marin-Curtoud (1965).

produce consistent projections or scenarios.

The importance of the above relations for the purposes of analysis is that if trade intensities are increasing in certain directions, others have to decrease, as their weighted average has to remain one. Weights and intensities can of course move together strengthening this effect, but this is not necessarily so, therefore we have to look carefully both to the changing structure of the shares and to those of trade intensities expressing changes in trade policy relationships*.

The results of previous studies on trade intensities** showed that these coefficients usually undergo certain distinct types of change, such as:

(a) "normalization" of international trade relations, meaning liberalization of trade, which reduces the deviation of real from so-called "normal" flows; this is reflected in δ coefficients by a closer approach to unity from either above or below;

(b) integration of certain groups of countries, increasing the intensity coefficients for intra-regional trade to values above unity and decreasing those for extra-regional trade to values below unity;

(c) "flattening out" of the trend, meaning that the rate of change diminishes as the intensity coefficient approaches a certain level (unity, in case (a), or a higher or lower level (in case (b));

(d) in a situation in which the direction of movement of the intensity coefficient is opposite to the trends described in (a) and (b), the trends usually revert to (a) or (b) over time.

These types of changes have been found in very highly aggregated trade flows, as in the case of total bilateral trade, or in commodity groups such as machinery, food and agricultural products. To our knowledge no studies have been previously carried out with such a detailed commodity breakdown as is presented in the following. It can be expected that the less commodity (or regional) aggregation is applied, the more varieties and divergencies will be found in the behavior of individual trade intensity coefficients.

Note that all figures referred to in the following sections of this chapter, are to be found in Appendix V.

Trade Intensities of the Forest Products

Trade intensities of the individual flows can be studied by commodity groups, when the effects of distance and trade policy can be studied on the bilateral transactions of the same commodity; or by exporting and importing regions, when the question can be asked how these factors influence the trade of different commodities of the same region. In the following we shall proceed by commodities, but the data handling

*Trade intensities express both the effects of distances and of trade policies, as it was mentioned. But as distances usually do not change (or transportation costs change slowly), intensity changes reflect trade policies mainly.

**See: I.R. Savage, K.W. Deutsch (1960); L.A. Goodman (1963); H.R. Alker, D. Puchala (1968); J. Roger (1971), A. Nagy, E. Török (1971).

program of our data base* can answer the second type of question also. In the analysis of each commodity we initially outline the major exporters and importers and mention important bilateral flows. A detailed description of these and their changes over the past twenty years can be found in the first chapter.

Let us start with an overview of all commodities to see the importance of total bilateral trade and the size of the trade intensities (Table 13 and 14) in the last year of observation, i.e., 1981. The two biggest exporters in value terms were North America (with 35.5%) and Northern Europe (with 22.9%) while nearly half of all imports were by Western Europe (48.9%). North America had a 17.7% share and Japan a 9.5% share of total world imports of all forest products. If we look at the bilateral flows, one can see that about 41% of all goods were traded within Europe, or probably more than this if the low representation of intra Eastern European trade is taken into account. The share of US-Canadian trade (15.6%) and North American exports to Japan (5.4%) are also quite large.

The largest exporter among the developing regions is the ASEAN group of countries (6%) and the biggest importers are the "other Asian countries" (6.5%). Most of their exports and imports are traded with the developed regions, intra-regional trade being relatively significant only in the case of the ASEAN and Latin American countries (34.1% and 15% of their total imports).

Trade intensities are usually high within the regions (the diagonal elements of Table 14) partly for reasons of closeness, transportation costs, partly because several of the regions are integrated country groupings. High intensities can be found in the trade of the three European regions, in the Japanese exports and imports with the ASEAN countries and Oceania. Latin American export intensities are relatively high with Africa and Northern Europe, North American exports to Latin America and in the trade of the two Asian regions.

The two tables presented tell us that trade is strongly concentrated: out of the 100 bilateral flows only 15 are above one percent and trade intensities in the case of 65 flows are below unity, the so-called "normal" level.

Figures 49-52 show the time series of major trade intensities. It can be seen that both Western European import and North American export intensities do not fluctuate much over time; mostly they remain constant or follow a time-trend. This is also true for North European exports (Figure 51), with the exception of intra-regional trade and exports to Eastern Europe, both of which, even if fluctuating a lot, remain highly intensive. The Japanese import intensity from the USSR remains constant and imports from the ASEAN countries is decreasing in intensity even if it remains high (Figure 52).

After this survey of the average behavior of very different product categories, let us study the trade intensities of individual commodities (some of which are broad product categories themselves). One should keep in mind that since we have ten regions and eleven commodity

*See Appendix III.

Table 13. Percentage share of total world trade (z) in 1981.

	1 NORTH AMER	2 JAPAN	3 NORTH EURO	4 WEST EURO	5 EAST EURO	6 OCEANIA	7 AFRICA	8 LATIN AMER	9 ASEAN COUN	10 OTHER ASIA	11 TOTAL WORL
1. NORTH AMER	15.60	5.40	0.13	8.08	0.11	0.69	0.67	2.57	0.43	1.86	35.52
2. JAPAN	0.20	0.	0.02	0.25	0.01	0.17	0.03	0.02	0.22	0.68	1.60
3. NORTH EURO	0.30	0.15	1.28	15.86	1.68	0.33	1.05	0.46	0.35	1.39	22.85
4. WEST EURO	0.27	0.09	0.65	16.85	0.77	0.20	0.85	0.25	0.16	0.67	20.75
5. EAST EURO	0.03	0.88	0.38	2.86	0.59	0.00	0.43	0.00	0.01	0.29	5.48
6. OCEANIA		0.01	0.40	0.00	0.05	0.00	0.48	0.01	0.00	0.12	0.14
7. AFRICA	0.11	0.08	0.03	2.16	0.07	0.01	0.07	0.04	0.00	0.03	2.61
8. LATIN AMER	0.44	0.18	0.09	0.91	0.00	0.01	0.15	0.59	0.02	0.16	2.56
9. ASEAN COUN	0.39	2.21	0.02	1.65	0.00	0.15	0.05	0.00	0.75	0.79	6.02
10. OTHER ASIA	0.35	0.14	0.02	0.20	0.00	0.01	0.02	0.00	0.13	0.50	1.38
11. TOTAL WORL	17.72	9.53	2.62	48.88	3.23	2.05	3.32	3.93	2.20	6.52	100.00

Table 14. Trade intensity indicator for all forest products in 1981.

	1 NORTH AMER	2 JAPAN	3 NORTH EURO	4 WEST EURO	5 EAST EURO	6 OCEANIA	7 AFRICA	8 LATIN AMER	9 ASEAN COUN	10 OTHER ASIA
1. NORTH AMER	2.48	1.57	0.14	0.47	0.09	0.95	0.56	1.84	0.55	0.80
2. JAPAN	0.63	1.00	0.36	0.29	0.09	4.67	0.58	0.33	5.60	5.92
3. NORTH EURO	0.08	0.07	2.14	1.42	2.28	0.71	1.38	0.51	0.70	0.93
4. WEST EURO	0.07	0.04	1.20	1.66	1.15	0.48	1.23	0.30	0.36	0.49
5. EAST EURO	0.03	1.65	2.65	1.07	3.35	0.01	2.37	0.01	0.12	0.81
6. OCEANIA	0.06	3.39	0.03	0.09	0.00	19.23	0.26	0.02	4.41	1.78
7. AFRICA	0.23	0.33	0.41	1.70	0.87	0.16	0.80	0.41	0.07	0.17
8. LATIN AMER	0.98	0.71	1.34	0.73	0.00	0.26	1.73	5.89	0.37	0.99
9. ASEAN COUN	0.37	3.79	0.15	0.56	0.01	1.20	0.25	0.01	5.68	2.02
10. OTHER ASIA	1.44	1.05	0.61	0.29	0.08	0.21	0.47	0.05	4.37	5.59

groups, we have 1100 trade intensity coefficients for each year, which means we have 22.000 for the whole period of observations. Naturally we cannot go into great detail but will try to concentrate on the more important products and trade links.

Coniferous Logs

Trade in Coniferous Logs is a relatively minor part of total trade in forest products (about 5% in 1981) and one has to keep in mind that 75% of all imports goes to Japan, mainly from North America, the USSR and the ASEAN countries. The intensities of these major flows are relatively stable over time and they are usually somewhat above unity (see Figure 53). Export intensities from North America and the ASEAN countries to Japan show certain complementary cyclical movements: when one is

lower, the other is higher and vice versa.

Intra-regional trade in Northern and Western Europe and North America is extremely high (Figures 53 and 54) and even if there are ups and downs, they do not show a declining tendency. In 1981 97% of all Coniferous Logs exports of Western Europe were traded within the region, 49% of North European exports among themselves, while only 3.6% of all North American exports were traded between the US and Canada as 86% went to Japan.

Eastern European export intensities to Western Europe showed much fluctuation, and a significant increase can be observed since the mid-seventies (Figure 53).

Non-Coniferous Logs

The share of Non-Coniferous Logs in total world trade of forest products was similar to Coniferous Logs in 1981. Two regions accounted for 68% of exports and 86% of all imports; they were Africa and the ASEAN countries on the one hand, and Japan and Western Europe on the other. 91% of African exports went to Western Europe, 85% of Japanese imports were met by ASEAN countries, while 22% of Western European imports were covered by intra-regional trade. As a consequence 70.5% of all Non-Coniferous Logs trade was covered by the three flows mentioned above.

Trade intensities of all three flows were high, in the neighborhood of two, and they stayed fairly constant over time (Figure 55). The ASEAN export intensity to Japan decreased significantly during the sixties with a parallel increase in the intra-regional trade intensity of the ASEAN countries. Trade intensities were high (above ten) in certain regions' intra-regional trade, for example, North America, Northern Europe, Oceania and the ASEAN countries and also in ASEAN exports to the "other Asian countries." The North American export intensity remained around the "normal" level throughout that period. All other flows were unimportant in value terms.

Pulpwood and Fuelwood

Both of these commodity groups had a very small share in 1981 of world trade of forest products: 1.4 and 0.4 percent. Besides being small, the share structure is highly concentrated: six trade flows among the European regions cover 87% of all traded Pulpwood and two import flows of Western Europe represent 54% of Fuelwood trade in 1981.

Eastern Europe is the most important exporter of Pulpwood having a 50% share in world exports in 1981. Its export intensities moved in the direction of one, i.e., became "normalized" in time with its major markets: Northern Europe, Western Europe, and intra trade of the Eastern European region (Figure 56). Intra-regional trade of the other two European regions and that of North America is high, showing that the value of the product cannot bear much transportation cost.

The two major Fuelwood trade flows show a fairly constant intensity: about one in the case of East European exports to Western Europe and about 1.5 in the case of West European intra-regional trade. The intensities of Japanese imports from the ASEAN countries and that of North American intra-regional trade follow similar patterns as can be seen in Figure 57 decreasing from a very high level in the mid-sixties, but still remaining relatively high.

Coniferous Sawnwood

Trade in coniferous sawnwood reached a level of 7.7 billion dollars in 1981, representing one of the biggest commodity groups (14.7%) among the eleven forest product categories. Nevertheless exports and imports are strongly concentrated: 46% of all exports originate in North America, and 27% in Northern Europe, while 48% of all imports go to Western Europe, 26% being intra-regional trade in North America and nearly 8% oriented to Japan. Among the developing countries Africa and the "other Asian countries" are major importers, with 6.2% and 4.1% of total trade.

Both North American export intensities and West European import intensities show regular trends (see Figures 58 and 59). US-Canadian trade and their exports to Japan and Asia is highly intensive and slowly diminishing over time. Northern European export intensity to Western Europe is stable throughout the whole period, while their export intensities to Africa and "other Asian countries" increased substantially in the mid-seventies, reaching a similar level of 1.5 (Figure 60). East European exports is directed mainly to Western Europe (since East European intra-regional trade is not represented correctly in our data base) where the export intensity is as high as that of West European intra-regional trade.

Transportation costs and climatical constraints on endowment are obviously playing a major role in determining trade relationships in the case of Coniferous Sawnwood and these relationships seem to be quite stable over time. Trade policy factors nevertheless have a great influence on certain trade flows; one cannot explain, for example, by the factors above why Soviet export intensity to Japan is so low (0.16 in 1981), while in the case of Coniferous Logs it is regularly in the neighborhood of the "normal" level, as we have seen in Figure 53.

Non-Coniferous Sawnwood

57% of all Non-Coniferous Sawnwood was exported from the developing world in 1981 and 37% from the ASEAN countries. The largest importer was Western Europe with a 59% share in 1981, out of which 13% was intra-regional trade, 21% came from the ASEAN countries and 9% from North America.

Figures 61 and 62 show how the trade intensities of the major exporter (the ASEAN countries) and the major importer (Western Europe) developed in the period under observation. As can be seen, most relationships have a rather smooth trend. In the case of the trade of the ASEAN countries among themselves a quick change in intensity came in the late sixties, when from a very low level it jumped to a relatively high level and

became stabilized. The ASEAN countries have a high export intensity also with Oceania and Japan and one on the "normal" level with their major import market, Western Europe.

Western European import intensity is stable and relatively high from Africa, on the same level as their intra-regional trade. An opposite movement can be observed in the Western European import intensities from Eastern Europe and from North America. Since the early seventies, the first decreased, the second increased and both reached a near "normal" level of trade intensity by the end of the decade.

It is interesting to compare the high level of North American import intensity from Latin America with the much lower intensity of their imports from the ASEAN countries. This can be compared with the Western European import intensities from the same regions and Africa. It seems to be obvious that in these highly divergent trade intensities, trade policy factors, such as the remnants of colonial links play a significant and slowly changing role, counteracting in certain cases the rational expectations of transportation cost minimization.

Panels

The share of Panels in total world trade of forest products showed a constant increase and reached 8.3% in 1981. Another characteristic of this product group is that with industrialization of the developing countries their share in Panel exports increased from 13% to 32% in the period of 1962-1981. About half of it was exported by the ASEAN countries. Other major exporters were the developed regions: North America with 16%, North Europe with 13% of total exports and Western Europe with 32% out of which 28% was intra trade of the West European countries.

In imports West Europe had also the biggest share 57% (29% coming from other regions), followed by North America (16%) and the non-ASEAN countries of Asia (11%).

Figures 63 and 64 show the West European import and export intensities with its major trading partners. African exports show a high and slightly increasing export intensity, while import intensities from North and East Europe are slowly decreasing and approaching the "normal" level. Import intensities from America (both North and Latin) to the West European market were significantly below one in the sixties; they increased to the "normal" level by the early seventies, but Latin American imports fall back after that.

West European intra-regional trade in panels is very intensive and stable. Export intensities to Eastern Europe increased to a very high level in the late sixties/early seventies, decreased since, but remained relatively high. Exports to Africa and Asia showed a slowly declining intensity, the former being much higher than the latter.

The closeness of producers and customers seems to be an important factor in Panel trade, which explains why intra-regional trade intensities of such regions as North America, North Europe, Latin America, the ASEAN countries, or the trade intensity between the two Asian regions is high (Figure 65).

American import intensities are presented in Figure 66 showing that intensities from Japan, the ASEAN region, and the "other Asian countries" are very high, while the intensities of Latin American and ASEAN imports changed places, the first increasing, the second decreasing in the seventies. But all of the above regions had trade intensities with North America above the "normal" level and as a consequence there were extremely low intensities in Panel imports from the European regions, and from Oceania and Africa.

Pulp

The value of world trade in Pulp was the largest among all the commodity groups investigated by us: above 10 billion dollars in 1981, i.e., 19.2% of the total value of forest products traded in that year. 89% of all Pulp exports originated in the developed countries, 54% in North America, and 25% in Northern Europe. The major importers were Western Europe (52%) and North America (19%), followed by Japan, Asia and Eastern Europe.

The two major exporters' intensities are presented in Figures 67 and 68. North American export intensities show quite regular trends and the tendency of "normalization": coefficients approaching one from above and from below can be observed. The export intensities to Japan decreased and that to Africa increased significantly. The highly intensive exports to Latin America and in the US-Canadian trade remained constant.

The Northern European countries had highly intensive exports of Pulp to the two other European regions; to Western Europe it remained stable while to Eastern Europe it showed an increasing tendency. Their intra-regional trade is very intensive and seems to fluctuate cyclically.

Western European import intensities can be seen in Figure 69, showing that intra-regional trade remained intensive and stable throughout the period, while the other four major exporters to this market slowly "normalized" their trade intensities. East European and African export intensities moved slowly downward while North and South American intensities moved upward.

In the Japanese imports, North America had the largest share with a very stable, slowly declining intensity. Imports from Oceania and Latin America increased their intensity (and share) in the seventies (Figure 70).

Newsprint

The total value of Newsprint traded was nearly 6 billion dollars; nearly 12% of total trade in forest products. It was heavily concentrated in the developed countries; 97% of it was exported from there, and their import share was 80% in 1981. The largest exporters were North America and North Europe with 65% and 29%, which gives 94% of total world exports. But two trade flows covered much of this: the US-Canadian trade represented 49% and exports from North to Western Europe another 21% of total world trade. The total Newsprint needs of all other

regions were met by these two big exporting regions (with the exception of the trade among socialist countries not reported in the UN data base).

Figure 71 shows North American export intensities with its major trading partners (with the exception of Japan to be discussed later). Intra-regional trade -- as shown by the high share -- is high and slowly increasing. The export intensity to Western Europe is low and slowly decreasing. Consequently, no "normalization" of trade can be observed on these two major markets for American exports. On the other hand exports to the two major developing regions, to Latin America and the "other Asian countries" follow an upward trend. All four major export directions have a very stable intensity trend with relatively little fluctuation.

Export intensities of the Northern European countries are presented in Figure 72. This shows a general trend of "normalization", which means in the case of exports to Western Europe that the intensity indices are slowly decreasing from about 3 towards 2. Export intensities to the East European markets fluctuate a lot, probably because of the irregularities and shortages of internal production and intra-regional trade, but they also show a declining tendency of between 3 to 4 towards between 2 to 3. North European exports to their major developing markets like Latin America and the two Asian regions moved towards and approximately reached the "normal" level.

The results of competition between North America and North Europe in the Japanese market are shown on Figure 73. The latter started to export Newsprint to Japan in 1972 and increased its export intensity from zero to 3.6 in five years. As a consequence the North American export intensity had to decrease from 1.3 to 0.3. In 1977 a sudden turn came in both trade relations. North European export intensity sank below the "normal" level, while the North American intensity increased to its former state*.

Intra-regional trade of Newsprint is very intensive even in the case of some developing regions; the coefficient was for example, 24 in the case of Oceania in 1981, 23 for the ASEAN countries and 14 for Latin America.

Other Printing and Writing Paper

The products of the paper industry belonging to this category represent about 10.6% of total trade in forest products and their trade amounted to 5.5 billion dollars in 1981. The developed market economies represented about 95% of total exports in the same year: Western Europe 49%, Northern Europe 29%, North America 12%, and Japan 5%. Western Europe accounted for 60% of total world imports out of which 41% was intra-regional trade. North America had very little inter-regional imports and Japan was also practically self-sufficient. Trade was more evenly distributed among the regional markets than in other commodity groups discussed above and consequently there were much more non-zero cells in the trade flow matrices.

*One should keep in mind that the trade intensity coefficient is not symmetric above and below one.

Figure 74 presents the export intensities of the North European countries. The general tendency is "normalization" of trade relations; with all major markets except the East European countries, the divergencies of the intensity coefficients are diminishing in time. Their interval was 0.2-1.4 in the early sixties and it became 0.7-1.2 in the late seventies, with North America, "other Asian countries" and Africa being below the "normal" level, and Latin America and Oceania above it. Distance alone certainly cannot explain all these differences; there are trade policy factors obviously at work. Export intensities from North to East European countries is remarkably high (partly due to the missing data on intra-regional trade) and it increased in the seventies.

Western European import intensities can be found in Figure 75, showing a high and somewhat increasing intra-regional trade intensity and a decreasing intensity of North European exports reaching a below "normal" level by the early eighties. Import intensities from Eastern Europe decreased considerably, while those from Japan increased to about the same level. This showed that trade policy factors and probably problems with quality were stronger than the effect of distance in the choice of import markets in this case for the West European countries.

Figure 76 shows the Western European export performance as far as trade policy factors are concerned. Exports to North America remained at a very low level; they was not more than 10% of the "normal" level in 1981. Exports to North Europe were very intensive in the early sixties but decreased steadily, reaching a below "normal" level at the end of the seventies. Exports to Africa were relatively intensive, to Eastern Europe and Asia they were about half of the "normal" level in 1981 and in the case of the CMEA market they decreased significantly in the second part of the seventies.

Figure 77 shows a few of the highly intensive trade flows: US-Canadian trade intensity was extremely high throughout the period (around 6) and showed no sign of decline. It is no surprise then, that all the other importers' intensities were very low in the North American market (with the exception of North Europe). North American exports to Latin America were also quite high and increased in the seventies at the expense of the Nordic countries (compare with Figure 74). Japanese exports to non-ASEAN Asia were very intensive but started to fluctuate strongly since the early seventies, when Latin America started to compete on the Asian market. It is remarkable that since that time, the export intensities of these countries on the Asian market showed a mirror image, when one increased, the other decreased and vice versa.

Much of these high intensities (and as a consequence the low trade intensities in the other cases) cannot simply be explained by distance factors, there are obviously a lot of trade policy factors at work, hindering for example European exports to North America, supporting North American exports to Latin America and keeping others out, etc.

Other Paper and Board

This second group of products from the paper industry is even more important in terms of trade value than the previous one; the value of world exports was 9.6 billion dollars in 1981, i.e., 18.4% of all traded goods of the forest products according to our definition of this commodity. The developed market economies exported 95% of it in the same year and their imports represented 70%. As a consequence the imports of the developing world were more important (24%), than in the case of other paper products. The major importer was again Western Europe (57%), nearly half of it being intra-regional trade.

On the exports side, Western and Northern Europe had the biggest shares, but in inter-regional trade the latter had the lead. North America's share was bigger (23%) than in the previous paper product group, but not as great as in Newsprint.

Major North American export intensities are shown in Figure 78, they are high not only in US-Canadian trade, but also in exports to Japan (where the intensity increased substantially in the seventies from 1.7 to 3.9) to Latin America and Oceania. All these trade flows even though highly intensive, showed nevertheless an increasing tendency, indicating that trade policy factors (some sort of preferences) are at work. As a difference American exports to Africa were around the "normal" level.

North and West European export intensities can be found in Figure 79, and West European import intensities of their major suppliers in Figure 80. The intra-regional trade of both regions increased steadily throughout the period, but did not reach a high level of intensity (1.7 and 1.3). Their trade with each other showed a stable relationship in one direction: the trade intensity from North to West Europe hardly fluctuated at all around the level of 1.2, while the opposite direction of trade decreased in intensity from 1.8 to 1.1.

The North European export intensity to Eastern Europe was one of the highest in European trade relations, while East European exports to Western Europe increased in intensity very substantially starting from the late sixties.

The Trade intensity between North America and Western Europe decreased strongly in both directions (0.46 and 0.37 in 1981), with the value of the trade flows being between half and one third of what would be the "normal" level. Looking at the Figures 79 and 80, one can observe that practically all major trade flows illustrated there have a clear tendency and the fluctuations over time are not usually big. Changes in the direction of the trade policy factors can hardly be observed.

Both Japan and Oceania have highly intensive exports to the Asian regions, as can be seen in Figure 81. But even if these flows are very intensive and fluctuate a lot, at least three out of the four major flows show a certain tendency of "normalization", but it does not mean more than that the intensity coefficients are decreasing from 10-11 to 5-8.

The intra-regional trade of Oceania, Latin America and the Asian regions are very intensive (usually above 10) and they are quite stable showing that the closeness of producers and customers play an important role in the trade of this product category also.

The Role of Trade Intensities in the Changing Pattern of Trade Shares

Up till now we have studied trade intensities in a comparative static sense i.e. how trade intensities of the major flows have changed over time. But we have not asked how these trade intensity changes influenced the pattern of trade shares. To put it another way; what was the weight of trade policy changes in shaping the major bilateral trade flows?

From the definition of the trade intensity coefficients on page 28, it follows that the share of bilateral flows in the world trade of a given commodity can be defined in the following way:

$$Z_{ijk} = \delta_{ijk} Z_{i.k} Z_{.jk}$$

This is equally true for the indices of trade share changes and trade intensity changes (denoted by $\tilde{Z}_{ijk}$). If for example we divide our period of observation into two parts; the first from 1962 to 1970 and the second from 1970 to 1981, we get two types of time indices:

$$\tilde{Z}^1_{ijk} = \frac{Z^{70}_{ijk}}{Z^{62}_{ijk}}, \quad \tilde{\delta}^1_{ijk} = \frac{\delta^{70}_{ijk}}{\delta^{62}_{ijk}}$$

$$\tilde{Z}^2_{ijk} = \frac{Z^{81}_{ijk}}{Z^{70}_{ijk}}, \quad \tilde{\delta}^2_{ijk} = \frac{\delta^{81}_{ijk}}{\delta^{70}_{ijk}}$$

From the equations

$$\tilde{Z}^1_{ijk} = \tilde{\delta}^1_{ijk} \tilde{Z}^1_{i.k} \tilde{Z}^1_{.jk}$$

$$\tilde{Z}^2_{ijk} = \tilde{\delta}^2_{ijk} \tilde{Z}^2_{i.k} \tilde{Z}^2_{.jk}$$

we can see what the weight of trade policies was in shaping the changes in the share of the Z_{ijk}, and also the role of the changing exporters' and importers' shares in shaping the changes in the individual trade flows.

We could not compute and analyze the role of the factors mentioned above for each commodity at this stage, but tables 15 and 16 show it for the sum of all wood products included in our study for two periods mentioned above.* The factors influencing the changing trade patterns can be read from the tables in the following way. The share of North American exports to Japan (shown by the upper figure in the second cell of the first line) increased by 181% between 1963 and 1970 even though the share of total American exports fell by 3%. This was because total Japanese imports increased by 117% and the trade policy attraction increased by 33%. In the next period of 1971-1982 the share of world trade represented by this flow fell by 10%, because both the American export share and the Japanese import share decreased in total world trade (by 2% and 9%) and the 13% increase in the trade intensities was not enough to counterbalance it. The change in the time index of the trade flow is equal** to the multiplication of the three factors mentioned in the

* Only the indices of the major flows are shown in Tables 15 and 16.

** This equality is not exact in the data of our tables because of rounding errors.

equations above:

$$2.81 \approx 1.33 \cdot 0.97 \cdot 2.17$$

$$0.90 \approx 1.13 \cdot 0.98 \cdot 0.81$$

Looking at tables 15 and 16 one can see that North American export shares increased significantly in the first period on their major markets, even if their total export share fell back somewhat. This was due to the increase of trade intensities and in some cases to increasing shares of their importers. On the other hand the share of US-Canadian trade decreased by 32% without any trade policy change. In the seventies North American export shares decreased in all of their major developed markets, but they were able to increase them in Asia and Latin America. The role of the different factors can be read from the first line of Table 16.

The export performance of the Northern European countries in their three major markets can be seen from the third line of the tables. In the first period the share of their intra-regional trade and their exports to the Eastern European countries increased strongly. In the first case this was because both their import share and their intra-regional trading conditions had a positive effect; in the second case the import "pull" factor increased very strongly, while the trade policy factors played a negative role. In the seventies their export shares diminished both in Northern and Western Europe; they were able to increase it only with the Eastern European countries, and only because the trade policy conditions improved. The share of total exports of the Northern European countries in world trade decreased in both periods, by 15% in the sixties and 8% in the seventies.

Western European countries increased their export shares in both periods quite strongly; by 22% in the first and 34% in the second period, while their import share decreased. The development of integration contributed to the increase of their intraregional trade share, which was 19% in the sixties and 43% in the seventies. Their export share to the Eastern European countries increased very strongly (by 367%) in the first period, because all three factors played a very positive role, but then in the seventies it fell back by 21%, only because the trade policy changes were strongly negative. The great difference in the changing political climate between the Northern and West European countries vis-a-vis the Eastern European countries is very noticeable in table 16. Between 1970 and 1981 the trade intensity increased by 22% in the first case and decreased by 42% in the second.

The Japanese import share rose very fast in the sixties, which, coupled with growing trade intensities with North America and the Soviet Union, increased their shares very strongly. In the seventies the Japanese import share decreased by 19%, and only Latin America could increase their export shares very substantially, mainly because of improving trade policy conditions.

Table 15. Factors of change in the share of trade flows of all wood products between 1963-1970 (%).

	NAM	JAP	NEU	WEU	EEU	OCE	AFR	LAM	ASE	ASI	TWO
NAM	68 103	281 133		119 128				122 113			97
JAP											
NEU			146 117	82 102	179 84						85
WEU			138 78	119 103	467 155		121 70	133 100		109 73	122
EEU		248 111		74 76			390 257			243 187	103
OCE											
AFR											89
LAM											
ASE		175 40							600 196	293 119	201
ASI									44 40	70 76	74
TWO	68	217	146	95	250		143	112	149	124	

Notes: The upper line in each cell shows $\tilde{Z}^1_{ijk}$ share changes, the lower line the $\tilde{\delta}^1_{ijk}$ coefficient changes in percentages. In the last column, the $\tilde{Z}^1_{i.k}$ total share changes and in the last line, $\tilde{Z}^1_{ijk}$, the total import share changes can be found.

Table 16. Factors of change in the share of trade flows of all wood products between 1971-1981 (%).

	NAM	JAP	NEU	WEU	EEU	OCE	AFR	LAM	ASE	ASI	TWO
NAM	99 105	90 113		90 94				108 126	116 73	216 136	98
JAP											
NEU			98 97	83 91	114 122						92
WEU	169 117		120 82	143 107	79 58		97 62	69 58		191 86	134
EEU		59 99		64 88			110 128			52 43	73
OCE											
AFR				67 97							70
LAM	147 114	1800 1183	450 344	172 130				59 50			133
ASE		65 82							250 158	90 56	98
ASI									162 114	179 119	92
TWO	96	81	111	99	102		116	87	162	163	

Notes: see Table 15.

The ASEAN countries strongly increased both their export and import share in the sixties; later they practically kept their export share and increased their imports even faster. Their trade intensities increased strongly in their intra-regional trade in both periods, resulting in a very fast growth of the share in intra-regional trade.

We cannot go into every detail, but the examples above can give an idea how this tool can be used for analytical purposes. The explanatory power of the factors of change can be even more powerful in the case of individual and more homogeneous commodities.

Concluding Remarks

Trade intensity analysis has shown us that trade policy factors play a significant part in shaping trade patterns and in choosing export and import markets. Also changes in trade policies usually have significant effects on trade patterns of forest products.

The case of the eleven commodity groups above show a very divergent picture in this respect; consequently it is difficult to arrive at conclusions generally valid for all commodity classes and even more so for all trade flows. Nevertheless we can observe some characteristics of the trade intensities which are true for the trading pattern of a large part of the trade flows analyzed.

1) We found a great number of cases where trade intensities were stable, i.e. showed little fluctuation through time; either in the sense that they hardly changed, or that a smooth change followed a particular trend. This is an important observation for forecasting purposes, because it can be assumed that these intensities will continue to be stable in the future, or if we assume trade policy changes in the future, the inertia of these flows will be strong and their change will be slow and relatively smooth.

2) "Normalization" of trade intensities has been observed in a significant number of cases. This is the result of trade liberalization, breaking down or diminishing the effect of previous colonial links or preferential ties on the one hand, and opening up trade relations where political and other artificial barriers hindered trade, on the other. This was reflected in a closer approach of the trade intensity coefficient to unity from above, or from below.

3) Both distance* and political and economic alliances created preferential trade relationships with a high intensity; parallelly diminishing or keeping at a low level the intensities of other trade flows. These preferential and non-preferential relationships seem to be quite stable or even increasing in many cases, opposing the forces working for "normalization" of the trade intensities.

4) In a relatively smaller number of cases, sudden changes of trade intensities were observed showing that political factors can play a significant role influencing trade patterns in certain cases. This happened mainly in East-West and North-South trade relations, where political

* Time was short, to separate the effect of transportation costs and trade policy factors as it was intended in Nagy (1983a:8).

factors obviously have a more pronounced influence on trade. This characteristic can be well applied in future scenario analysis if specific assumptions are made on how trade policies will change in these sensitive areas.

5) Trade in forest products is usually strongly concentrated in our regional aggregation; there are but a few major exporters and importers, and a few trade flows cover a great majority of the value of total trade in a given commodity. As a consequence trade intensity analysis can be concentrated on a relatively small number of trade flows and neglecting the minor flows does not influence the results very much. This can be very helpful if we intend to use trade intensity information in projecting or estimating future trade patterns, because the number of trade flows where future trade intensities (and behind them, trade policy changes) have to be estimated and quantified, will be relatively low in the case of most wood products.

6) In the cases where trade policy, or purely political considerations have an obvious influence of trade relationships, the assumption that it diminishes in time cannot be generalized. It seems to be doubtful that in such cases the inertia approach can be applied, because it is based on the assumption that the role of non-price, non-competitive factors have a decreasing influence on the trade flows.

In a certain number of cases this is true, this was observed in our case by the tendency of "normalization" of trade intensities. But in other cases the opposite has been observed, either by the formation of new, or stronger integrations (and consequently disintegrations), or by sudden trade policy changes which went into both positive and negative directions. This leads us to think that in modeling the future of trade in forest products it will be necessary to go into some detail in specifying how trade policies will be changed and no generally applicable recipe can be found in forecasting the factors shaping trade patterns, if we want to save the realism and relevance of the results.

3. GRAVITATIONAL ANALYSIS

Gravity models, in general, are applied to obtain the factors that significantly contribute to the explanation of size of the trade flow between any pair of regions. The application presented here, we should emphasize, is of a very preliminary nature. The short time available for this research is responsible both for the rough methodology and for the lack of real results. Our "model" is the most simple one not only in the economic-theoretical sense, but also in terms of econometrics. Moreover, as it will soon become apparent to the reader, our "results" are basically of a negative nature showing the outcome of some unsuccessful experiments.

Nevertheless, the reasons for presenting them here are twofold:

- Even negative results can be considered valuable, since they show which factors are to be disregarded in the course of further analysis.
- Readers may have ideas and comments helping our future work to be more successful.

In the first section the gravity hypothesis is introduced briefly, then issues of the dependent variable are presented. A short description of the empirical work done is given in the sections on explanatory variables tested so far. The last part of this chapter describes some strategies that might be applied at a later stage.

The Gravity Hypothesis

Our task is to find the main factors governing the size of trade flows in a quantitative way. We should start by enumerating the factors that might enter into our gravitational analysis. The list of variables is examined here only on theoretical grounds. Empirical considerations - since they constitute the vast majority of our work - are to be discussed later on.

According to *Linnemann* (1966), the influencing factors (or explanatory variables, as they are often referred to), may be classified in three categories:*

(i) factors indicating total *potential supply* of the exporting region on the world market;

(ii) factors indicating total *potential demand* of the importing region on the world market;

(iii) factors representing the *"resistance"* or *"attraction"* to a trade flow from any given supplier to any given buyer.

While the notions of *"resistance"* and *"attraction"* are rather evident not only in physics, but also in economics (trade barriers, transportation costs, political links, etc.), the meaning of *"potential" trade* should be defined. *Potential supply* is defined as that part of production which exceeds domestic needs, assuming, that exactly the same trade resistance prevails for all participants in world trade. This definition may turn out to be rather helpful, since it enables us to separate - at least

* C.f. Linnemann (1966), p. 8.

theoretically - the *general* or systematic factors governing the participation in foreign trade (i.e. the potential supply and demand), and the *specific* or individual effects of "resistance" and "attraction".

The clue to success in our gravitational analysis is whether we can give proper *economic* content to the above concepts (i)-(iii). This will be investigated in the next empirical sections.

Combining the three explanatory categories into one gravity expression, following Linnemann* our formula is:

$$X_{ij} = \gamma_0 \frac{(E_i^P)^{\gamma_1}(M_j^P)^{\gamma_2}(A_{ij})^{\gamma_3}}{(R_{ij})^{\gamma_4}} , \qquad /3.1/$$

where:

X_{ij} is the trade flow from region i to region j;

E_i^P is the potential supply of exporting region i;

M_j^P is the potential demand of importing region j;

A_{ij} is the attraction to trade between region i and region j;

R_{ij} is the resistance to trade between region i and region j;

$\gamma_{0,1,2,3,4}$ are trade flow elasticities with respect to E_i^P, M_i^P, A_{ij} and R_{ij}, respectively.

The expression /3.1/ indicates that the joint effect of the potential trade variables is *multiplicative*. Taking the logarithms of /3.1/ we obtain a formula to which we can easily apply *standard linear regression* to estimate the values of the γ *parameters*.

The Dependent Variable

As was mentioned before, gravitational analysis is applied to the same set of statistical data used for the share structure and trade intensity analysis.** Our database consists of exactly 2000 trade flow observations for each of our products. As in the previous chapters, our conclusions are to be drawn for each product separately.

This data set provides the possibility of *three types of approaches:*

— Given the data for 20 years, trade flows may be analyzed so that *dynamic* considerations are taken into account. (e.g. Equations for some major individual flows can be estimated on 20 observations.)

— Since there are 100 observations for each year, a *cross-section* analysis can be done, while dynamic effects are disregarded. (e.g. Equations for some selected years can be estimated on 100 observations.)

* Opt. cit., p. 34.

** See Appendix I. for a detailed description of the data base.

— A *combination* of the above time-series and cross-section approaches may yield the more convincing results, since parameters would refer to both dynamic and cross-section properties. (e.g. equations can be estimated on all 2000 observations.)

The first and third approaches mentioned above cannot be considered as good tools for finding the pure gravitational properties we are looking for (i.e. the factors of potential trade and of resistance or attraction), since they incorporate the role that *time* played in the development of world trade. One should take into account the fact that our trade flow data to be explained by gravitational equations is given in *current prices*. The data on trade must therefore be strongly connected to world wide inflation, which, however may be very different for each region. Preliminary tests have shown, for example, that successive trade flows are highly autocorrelated (i.e. trade flow values for a given year are in a close functional relationship to trade flows of the previous year.)* Moreover, dynamic relations call for time-series data for the explanatory variables as well, which was impossible to construct within the time constraints given for this research. However, it is obvious, that for other purposes (e.g. for forecasting), these dynamic properties should be carefully analyzed.

Therefore, a *cross-section* of the trade flows should be used for estimating the model. However, we may utilize the information residing in the time-series; averages of trade flows over time should be constructed. This way, on the one hand, we can reduce the effect of incidental transactions of unusual size, and the incidental difficulties in trade relations. On the other hand, all remaining dynamic properties disappear.

When computing averages over time we should bear in mind that the trade flow data is given in current prices. Thus, using an *arithmetic average* over 20 years would be misleading, since 1962 data is rather negligible compared to 1981 flows, due to expanding world trade and inflation. To avoid this problem, unweighted arithmetic averages of *shares in total world trade* were computed – i.e. the Z_{ijk} share structure.** In this way our dependent variable comprises information obtained from the data of every single year with equal weights: year 1962 is just as important for our analysis as year 1981, irrespective of actual value of world trade in these years.

The basic set of data thus derived from the trade flows consists of exactly 100 elements for each of our products. Table 17 gives the frequency distribution of these average trade shares according to their size given as percentages.***

The most outstanding feature of the above table is that shares of less than 0.1 % of world trade constitute around half of all observations. This very strong concentration of world trade was already revealed in Chapter 1.**** There are only 2-5 individual flows which exceed 10% of world trade,

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* C.f Batten-Johansson-Kallio (1983) p.21-29, and Anderstig (1982)

** See Chapter 1 for definition.

*** C.f. Table 21. of Appendix I.

**** See Appendix VI for the world maps of trade flows.

Table 17: Frequency distribution of average trade shares, %

lower bound upper bound	< .001	.001 .005	.005 .1	.1 1.	1. 10.	10. 100.	TO- TAL	>> .1	>> .005
1 LOGS (C)	40	12	20	16	10	2	100	28	48
2 LOGS (NC)	17	13	31	26	11	2	100	39	70
3 PULPWOOD	46	13	16	14	6	5	100	25	41
4 FUELWOOD	26	13	28	18	12	3	100	33	61
5 SAWN (C)	25	19	28	18	7	3	100	28	56
6 SAWN (NC)	9	11	26	33	19	2	100	54	80
7 PANELS	5	6	38	34	15	2	100	51	89
8 PULP	16	9	39	26	7	3	100	36	75
9 NEWSPRINT	31	14	24	21	8	2	100	31	55
10 PR & WR	16	11	26	29	16	2	100	47	73
11 PA & BO	14	11	30	29	14	2	100	45	75
12 ALL PRODU	4	5	32	45	11	3	100	59	91

plus 6-19 flows bigger than 1%.

It is obvious, that we cannot take into account all observations for the gravity model, since equation /3.1/ is considered to be linear in the logarithms. However, observations which are zero should be treated somehow. From the economic point of view, all shares smaller than 0.1% of world trade can already be considered to be zero.

However, sample sizes indicated in the " > 0.1 " column of Table 17 may provide too few degrees of freedom for the estimation of gravity equations. Therefore, only trade flow shares that are smaller than 0.005 % (!) were recorded as being zero. The numbers of observations we use for each commodity are given in the last column of the above table.

We have two choices: either to give some small positive value to these elements, or to exclude them. For practical reasons we intended to use the treatment suggested by *Linnemann.** We should first estimate the parameters of equations using the observations considered as being non-zero. The relations we thus arrive at are to be simulated to give "expected" trade flow shares, even for the flows omitted above. Then, the "theoretically expected" trade share is checked against our 0.005% criterion. Each of our 100 original observations should fit into one of the following classes:

(i) actual and calculated ("expected") trade shares are both above 0.005: the observation has rightly been included in the regression;

(ii) actual and expected trade shares are both below 0.005: the observation has rightly been excluded from the estimation;

* Opt. cit., p.63. As was mentioned before, our empirical work did not reach a level such that we could apply the full procedure described here.

(iii) actual trade share is above, but explained trade share is below 0.005: the observation has been wrongly included;

(iv) actual trade share is below, but calculated share is above 0.005: the observation has been wrongly excluded.

The results of the first correlations – if there are any – should provide for a correction of basic data before a second estimation, taking into account the classes (iii) and (iv) above. Then one should decide what arbitrary value is to be assigned to these flows.

The Resistance and the Attraction Variables

Traditional economic gravity theory distinguishes between two types of resisting forces, namely *natural* and *artificial* trade impediments. We focused only on the former one, since data on artificial trade obstacles - tariffs, taxes, duties, exchange controls, quantity restrictions, or a combination of these - can hardly be obtained on the regional level in the available length of time for this work . Therefore, *we assume, that these effects are equally distributed all over the world* .

The natural trade barriers are closely related to transportation. The resistance between regions varies with the geographical distance, the kind of commodity to be traded, the mode and speed of transport, the number of trans-shipping operations, etc. The *transportation costs* of the different commodities combine all of these effects into one value. In theory, these values could be derived from the difference between *c.i.f.* and *f.o.b.* statistics, and thus could serve as proxies for the actual impediments. Since our data does not allow for such a treatment*, we quantified our resistance variable on the following practical grounds.

The overwhelming majority of transportations of forest products take place on sea. Direct overland transportation – by rail – are competing with this. If we assume that the conveyance costs of any specific commodity depend on the distance only, *geographic distances* between the main sea-ports should represent the resistance factors well.

However, it is not so obvious which harbors we should refer to as the ports of *regions*. The sea-port statistics available to us are not specific enough about the goods loaded and unloaded in international sea-borne shipping. We have selected some main ports rather arbitrarily, and took the distances between them from a publication of the U.S. Defense Mapping Agency (1971)**. For lack of better information we have used these distances (given in nautical miles) as an explanatory variable, irrespective of the fact that in the case of some products different ports might have been picked.

Considering the *attraction* variables, we used the most simple approach available. Partly for political reasons, partly due to traditional trade connections some directions of trade are very much favored by both the exporter and importer regions. We assume, that these flows are

* See Appendix I. for details.

** Ports selected and their distances assumed are listed in Appendix IV.

the ones above 1%. Therefore, in addition to the constant variable, a *0- 1 dummy variable* was used to represent these phenomena. In this way, our second "constant" term should reflect the concentration of trade as well.

It is obvious of course that our assumptions are to be revised and corrected in the course of further research on this matter.

How to Represent Potential Trade?

Potential export supply is defined to be that part of production which exceeds domestic needs. In traditional economic gravitational theory*, supply partly depends on the level of *domestic production* and partly on the ratio between production for the home market and for foreign demand. It is assumed, that this ratio depends on the *"absorption capacity"* of the domestic market.

The size of domestic production has a *positive* effect on international trade, because as a result of the economies of scale, there is a minimum output below which production is inefficient. On the other hand given a higher "absorption capacity" for the domestic market, more branches of the economy will exceed the limits of efficient production, and thus the smaller will be the potential export supply and demand for imports. Thus, this factor acts *negatively* on both sides of foreign trade.

Domestic production is expressed (obviously) in terms of GDP, the "absorption capacity" of the home market is represented by the *population size* in traditional gravity models.**

Although forestry represents only a very small part of total world production and trade, we may test whether or not trade flows of *forest products between regions* are also explained by these factors.

Data for GDP and population of the FSP regions were collected for years 1962-1981 from United Nations, International Monetary Fund and World Bank sources***. The time-series were aggregated on the same principles as the trade flow data****.

An initial set (which we shall call *Set /1/*) of the explanatory variables to be supplied for the regression was constructed, consisting of:

a) a CONSTANT term, C
b) the "ATTRACTION" dummy variable A_{ij}
c) the DISTANCE variable D_{ij}
d) the POPULATION of the exporting region P_i
e) the POPULATION of the importing region P_j

* See Nagy (1979), p. 45.
** C.f. Linnemann (1966)
*** Statistical Yearbooks by the UN, International Financial Statistics by the IMF, World Tables and Atlases by the World Bank were used for compilation of the data.
**** See section on the Dependent Variable.

f) the GDP of the exporting region G_i

g) the GDP of the importing region G_j

The equation

$$Z_{ij} = \beta_0 C \frac{(G_i)^{\beta_1}(G_j)^{\beta_2}(A_{ij})^{\beta_3}}{(P_i)^{\beta_4}(P_j)^{\beta_5}(D_{ij})^{\beta_6}} \qquad /3.2/$$

was estimated. The results are presented in Table 18 overleaf; they are not at all satisfactory. Either the signs of the estimated coefficients are against economic expectations, or their level of significance is low, or both are outside the acceptable range. From the *economic* point of view, none of the equations seem to be proper: moreover, the explanatory variables that are of an "economic nature" (i.e. GDP and POPULATION) cannot be considered as they are linked systematically to trade flows. From the *econometric* point of view, even if the estimated functions have a definitely positive correlation coefficient, there is still a relatively low degree of determination: the R^2 of PULPWOOD still indicates that over 25 % of the variance in the trade flows remains unexplained by the given set of explanatory variables.* Thus, neither the economic, nor the econometric aspects allow for any serious conclusions.

However, there are some good signs, too. First of all, the *attraction effects* - represented by our dummy explanatory variables for the large flows are significant for all of the 12 cases studied. The *resistance effects* - represented by our series on geographical distances - are all negative, although their level of significance rather disappointing. In general, one may say, that natural impediments do play an important role in determining world trade, even if we cannot consider the numerical values of the estimated elasticities correct yet.

Another "result" is, that in spite of the overall insignificance, the economic *"push"* and *"pull"* factors incorporated into the potential trade variables seem to influence the trade flows. It is of course obvious, that we should look for a new set of variables, in order to express interrelations between actual and potential trade much better than GDP and population do.

Therefore a second set of explanatory variables was constructed (Set */2/*) including data on regional *forest areas* instead of GDP. The parameters obtained from the estimation did not show any improvement, neither in the fit, nor in their significance**; again the overwhelming majority of explanation of the trade flows was due to the CONSTANT , ATTRACTION and DISTANCE terms. Moreover, in the equations for commodities not so closely related to wood resources (i.e. NEWSPRINT, PRINTING & WRITTING, PAPER & BOARDS), the fit has become even worse.

The next step was to look for more *product- specific* explanatory variables, such as production and consumption series of products.*** Since only the time-series for Coniferous Sawnwood production and

* This "result" was not unexpected. See Nagy (1983a).

** That is why no more results are to be shown in this section.

*** As suggested by Nagy (1983a).

Table 18: Summary of regression estimation using *set /1/* explanatory variables.

CONSTANT	ATTRAC-TION	DISTANCE	POPULATION of the exporter	POPULATION of the importer	GDP of the exporter	GDP of the importer	R2 [R]
			1. CONIFEROUS LOGS, observations: 48				
6.579	3.652	-0.263	0.045	-0.056	-0.077	0.061	0.643
(3.63)	(7.34)	(-1.17)	(0.28)	(-0.32)	(-0.38)	(0.34)	[0.80]
			2. NON-CONIFEROUS LOGS, observations: 70				
5.890	3.456	-0.229	0.210	0.148	0.055	-0.192	0.585
(3.59)	(7.17)	(-1.18)	(1.67)	(1.06)	(0.32)	(-1.27)	[0.77]
			3. PULPWOOD, observations: 41				
9.953	3.407	-0.728	0.109	0.023	-0.100	0.207	0.741
(3.99)	(4.65)	(-2.40)	(0.61)	(0.12)	(-0.41)	(0.97)	[0.86]
			4. FUELWOOD, observations: 61				
4.472	3.506	-0.206	0.054	0.247	0.425	0.085	0.663
(2.43)	(7.61)	(-0.93)	(0.42)	(1.71)	(2.67)	(0.57)	[0.81]
			5. CONIFEROUS SAWNWOOD, observations: 56				
6.749	3.866	-0.455	0.402	-0.286	-0.064	0.540	0.717
(3.87)	(7.24)	(-2.28)	(3.05)	(-2.01)	(-0.34)	(2.91)	[0.85]
			6. NON-CONIFEROUS SAWNWOOD, observations: 80				
6.537	2.834	-0.258	-0.062	0.185	0.112	0.079	0.551
(4.22)	(7.50)	(-1.47)	(-0.57)	(1.53)	(0.74)	(0.57)	[0.74]
			7. PANELS, observations: 89				
6.823	2.890	-0.370	0.078	0.068	0.303	0.099	0.579
(4.60)	(6.84)	(-2.18)	(0.70)	(0.62)	(2.00)	(0.74)	[0.76]
			8. PULP, observations: 75				
4.498	3.383	-0.048	0.022	-0.697	0.294	0.440	0.665
(3.25)	(6.73)	(-0.30)	(0.19)	(-5.47)	(1.96)	(2.90)	[0.82]
			9. NEWSPRINT, observations: 55				
3.315	3.217	-0.003	0.425	-0.648	-0.030	0.647	0.652
(1.88)	(6.00)	(-0.01)	(2.75)	(-3.96)	(-0.15)	(3.39)	[0.81]
			10. OTHER PRINTING & WRITING, observations: 73				
6.265	2.593	-0.279	0.243	-0.453	-0.054	0.589	0.638
(4.40)	(6.80)	(-1.72)	(2.06)	(-3.39)	(-0.36)	(3.65)	[0.80]
			11. OTHER PAPER & BOARD, observations: 75				
5.447	2.550	-0.226	0.057	-0.318	0.113	0.674	0.580
(3.31)	(5.38)	(-1.19)	(0.43)	(-2.29)	(0.72)	(3.70)	[0.76]
			12. ALL PRODUCTS, observations: 91				
5.970	2.731	-0.240	0.123	-0.173	0.203	0.380	0.530
(3.99)	(6.13)	(-1.41)	(1.15)	(-1.57)	(1.48)	(2.84)	[0.73]

Note: Numbers in parenthesis are Student t-statistics.

consumption could be constructed satisfactorily on the regional level within the given time, this *Set /3/* of explanatory variables was used for the estimation of that single equation alone.

The parameters for the CONSTANT , ATTRACTION and the DISTANCE remained more or less the same, as in the case of the estimation on *Set /1/*, but determination has turned out to be even lower, than for *Set /2/*. Moreover, the signs for CONSUMPTION and PRODUCTION coefficients were just the opposite of those expected: the larger the regional sawnwood consumption, the higher the potential supply, and the higher the production of sawnwood is within the region, the lower the trade.

There can be several reasons for this phenomena; the poor data on trade flows, the wrong selection of explanatory variables, or both. For example, trade flows of the Eastern European region are only reported satisfactorily by Yugoslavia*, while production statistics are relatively good for the whole region. The same applies also for total trade data, and thus for *apparent consumption* too. Regressing low trade flow values with high production observations should only yield negative coefficients. Probably, the same is true for most flows of the developing regions.

Suggestions for Further Experiments

It is obvious from the above tests, that the construction of a more satisfactory trade flow data base should follow first. Explanatory variables should then be constructed on the commodity level, to express potential trade effects more precisely. The collection of data for the variables might be easier and quicker if we define a new approach for gravity modeling e.g. if instead of computing averages over 20 years, we may use a sequence of five year periods and regress the equations for each period separately. As an alternative to the above, trade flows of the FAO statistics can be tested for gravity assumptions.

All ideas on variables, observations, statistics and other issues mentioned in this section are welcome.

* For details see Appendix I.

APPENDIX I: THE DATA FOR THE TRADE FLOWS

As has been mentioned in the Introduction, the historical analysis of international trade in forest products comprises three rather different approaches. However, these methods utilize the same kind of statistical information, namely the data expressing trade flows between given exporters and importers. For reasons of compatibility, our analysis should be based on exactly the same set of numerical data which, in principle, allows a maximum geographical coverage of world trade in all possible forestry products over the longest available time-period. Considering that there are over 150 countries participating in international trade today, for each year and for each product we may well have more than 20 thousand individual statistical observations of trade flows. It is obvious that this huge number should be reduced drastically to constitute a feasible and manageable database.

Therefore, firstly, individual countries were grouped into 10 geographic regions. Secondly, 11 commodity classes of forestry products were formed according to the 3 and 4 digit level categories of the Standard International Trade Classification (SITC) and bearing in mind the FAO product classification. Appendix II gives a detailed description of these regions and commodities. The database thus arrived at consists merely of 1100 observations per year, while the maximum geographical and commodity coverage of world trade remains unchanged.

The data on regional trade flows cannot be directly obtained, since statistics are available only on a country-by-country basis. There are two possible sources of trade-flow data: different "direction of trade" tables are published both by the FAO and the Statistical Office of the UN. Some important features of these sources are shown in Table 19.

Table 19. Some features of UNSO and FAO trade flow statistics.

	UNSO	FAO
Years covered	1962-1981 (20)	exporters' reports: 1966-1981 (16) importers' reports: 1966-1975 (10)
Countries covered	all reporters	1966-1977: "major" reporters 1978-1981: reporters with trade ≥ 1% of world exports
Products covered*	all (11)	5 + some "subproducts"
Measurement units	value in US$ volume in cum or mt (different countries use varying units for a given product)	volume in cum or mt (all countries use the same for a given product)
Primary source of data	government reports	reports of forestry officials and/or FAO estimates

* Note: for FSP commodities, see Appendix II.

It seems to be rather obvious from Table 19 that for our purposes UNSO data is somewhat superior to those of FAO, since it covers more years, and all FSP regions and products can be obtained from it. Apart from these considerations, there seems to be a number of problems with the quality of the data. Table 20 illustrates this statement. We picked the product Coniferous Sawlogs as an example, since it is given by both sources. The year 1975 was chosen because FAO still published data on imports together with exports in that year. The four individual flows appearing in Table 20 were selected at random from the group of highly developed industrial nations which are believed to have reasonably good foreign trade statistics.

Although Table 20 speaks for itself, the following comments may help the reader:

Direction 1:

- Canada reports a volume of imports from the USA which are 20 to 30 % higher than the same flow reported by the USA.
- The exporter (USA) reports in free-on-board (f.o.b.) prices, which are somewhat higher than the cost-insurance-freight (c.i.f.) prices given by the importer (Canada).
- The volume to weight ratio (i.e. the conversion factor shown) is different for the two reporters.

Direction 2:

- The f.o.b. price paid by Japan for Coniferous Sawlogs and Veneer Logs appears to be 4 to 5 times the price paid by other countries.

Table 20. Direction of trade in Coniferous Sawlogs and Veneer logs, 1975 (selected flows).

Direction 1: Exports of USA to Canada.

For	Reported by USA	Canada	Unit	USA/Canada
FAO	1112	1417	1000CUM	0.785
UNSO	742	1040	1000MT	0.713
UNSO	30.492	29.096	1000US$	1.048
Conversion factor	1.50	1.36	CUM/MT	
UNSO Unit Value	41.1	28.0	$/MT	

Direction 2: Exports of USA to Japan.

For	Reported by USA	Japan	Unit	USA/Japan
FAO	10230	9297	1000CUM	1.100
UNSO	6759	6043	1000MT	1.118
UNSO	626.693	919.641	1000US$	0.681
Conversion factor	1.51	1.54	CUM/MT	
UNSO Unit Value	92.7	152.2	$/MT	

Direction 3: Exports of FRG to Sweden.

For	Reported by FRG	Sweden	Unit	FRG/Sweden
FAO	92	1	1000CUM	92.000
UNSO	65.6	0.9	1000MT	72.889
UNSO	1.871	36	1000US$	51.970
Conversion factor	1.40	1.11	CUM/MT	
UNSO Unit Value	28.5	40.0	$/MT	

Direction 4: Exports of Sweden to Norway.

For	Reported by Sweden	Norway	Unit	Sweden/Norway
FAO	155	25.4	1000CUM	0.610
UNSO	131	203	1000MT	0.645
UNSO	5221	9392	1000US$	0.556
Conversion factor	1.18	1.25	CUM/MT	
UNSO Unit Value	39.9	46.3	$/MT	

Direction 3:

— While in the case of Directions 1 and 2, it seems likely that the same product in traded (i.e. Coniferous Sawlogs), in *Direction 3* the large discrepancies in the reports suggest that the data refer to some very non-homogeneous commodities.

Direction 4:

— As in *Direction 1* there is a 35 to 40 % discrepancy between the volume reported by the exporter and the importer.

— There is a surprisingly large deviation in the f.o.b. and c.i.f. values, considering the proximity of Sweden and Norway.

What are the lessons from the above "observations"?

(1) Neither of the statistical sources can be considered as really superior to the other, concerning the quality of data presented.

(2) Quantity reports are more unreliable than value data, since volumes are measured in different units even when they bear the same name (e.g., a cubic meter can refer to a stacked or solid wood measure). Proper re-conversion of different units is very difficult..

(3) The valuation in f.o.b. and c.i.f. prices may differ due to the time- consuming transportation process as well (e.g., the USA may have exported and thus reported a freight of logs just before the end of the year, while Canada receives it only the year after; exchange rates may also modify the value, etc.)

(4) Even the highly developed countries may improperly report their trading partners, data on the trade flows, or both. UNSO does not take any responsibility, however, to reconcile false or misleading reports; while FAO attempts to do so — at least for exporters' statistics in the years 1976-1981. Moreover, the time-consuming reconciliation of the data could not be done at IIASA given the available time and current resources.

Apart from the above considerations, since computerization of the FAO statistics could not be completed in time, we used the ***value reports of UNSO*** for further processing.

We still had the choice of two data sets to select from, namely the importers' and the exporters' reports*. A decision had to be made on whether to use either of the two, or to merge the information from both and build our own database. Each solution may turn out to be rather risky; using the importers' data we may lose some of the information obtainable only from the exporters' reports and vice versa. In merging the two sources we have to find a justification for this.

* Data on re-exports is also available, but since there is no indication of the original exporter, it is useless for us.

A series of computations has helped us to answer the above question. Each individual cell of our "theoretical" trade flow value matrix should correspond to one of the following "quality" cases:

(a) flow reported by both trading partners and the data is similar (both values are within the same range *and* f.o.b. data is somewhat smaller than c.i.f. data)

(b) flow reported by both trading partners and there is a small difference (both values are within the same range, but f.o.b. data is somewhat higher than c.i.f. data – a difference due to the time lag in transportation)

(c) flow reported by both trading partners, the data is obviously different

(d) imports are reported only

(e) exports are reported only

(f) no trade was reported by both partners

The region-by-region summary of the above cases is given in Table 21 for year 1980, using the criteria f.o.b. $\leq$ cif $\leq$ 1.3 f.o.b., for cases (a) and (b). For case (a), cells of flow matrix data may be obtained from any of the two sources without any further consideration. The same applies to cells in case (f), where no data is given, since the probability of not reporting any flows by mistake is rather low. However, there are several countries not reporting anything. Among these, we think, the most important non-reporters are the Socialist countries.

Table 21. Frequency of Trade Flow Reports by Quality Cases (a) to (f), 1981.

Product		Quality Case: (a)	(b)	(c)	(d)	(e)	(f)	total
1	Logs (O)	2	2	27	11	18	40	100
2	Logs (NO)	6	3	49	11	16	15	100
3	Pulpwood	1	2	14	7	21	55	100
4	Fuelwood	1	2	49	7	11	30	100
5	Sawn (C)	11	4	47	6	17	15	100
6	Sawn (NC)	10	2	63	10	8	7	100
7	Panels	13	6	63	3	10	5	100
8	Pulp	16	9	38	5	19	13	100
9	Newsprint	6	8	27	3	21	35	100
10	PR & WR	8	5	58	4	12	13	100
11	PA & BO	12	9	59	3	11	6	100

Cases (b), (c), (d), and (e) are similar since we do not know whether these data are correct or not. It is obvious, however, that where a trade flow is reported by at least one of the parties -- in cases (d) and (e) -- there is actually a trade flow. Taking into account the huge frequency of reports in classes (b) to (e), we decided to risk merging source-statistics, at least on the region-to-region level*. We applied the following rather arbitrary principle: *for each individual region- to- region flow the higher value of the two sources was accepted.*

This way we could utilize the information in the "mirror" statistics for bad reporters and non-reporting countries (e.g., Bulgaria does not report trade with Finland, but Finland may give data on trade with Bulgaria). However, we can not obtain data on intra-regional trade of the Socialist countries. Tests have shown, that the UN statistics cover only the flows between Yugoslavia and the CMEA countries, as reported by Yugoslavia. To illustrate how poorly intra-Eastern-European trade is represented, we checked the foreign trade statistics of the USSR – see Tables 22 and 23 below.

Although SITC and USSR classifications are not comparable, it is obvious that the intra-Eastern European trade can be even ten times higher than is represented in our data.

Table 22. USSR exports of Roundwood, in 1000 cum (USSR commodity classification code: 500)

To	1979	1980
Total world	15225	13933
Japan	7949	6090
European Socialist Countries	2485	2853
Yugoslavia	371	416

Source: Foreign trade of the USSR in 1980, p.69.

Table 23. USSR Imports of Sawntimber, in cum (USSR commodity classification code: 50102).

From	1979	1980
Rumania	219254	206115
Yugoslavia	9260	25891

Source: Foreign trade of the USSR in 1980, p.89.

* "Real" merging would mean a country-level reconciliation, but since this has turned out to be too intensive for the IIASA-VAX computer, we had to give up this idea.

The data base we thus arrived at is far from perfect. The "thumb rule" mix up c.i.f. and f.o.b. price structures, which should be taken into account when economic conclusions are drawn. It is clear that the reconciliation of the database should follow, but this work is left to a later stage.

During the compilation of the database, a computer program was made at FSP for easy handling of trade flow data. (For a detailed description, see Appendix III.)

APPENDIX II: FOREST SECTOR PROJECT CLASSIFICATION OF REGIONS AND COMMODITIES

Detailed Regions

1. NAM North America
2. JAP Japan
3. NEU Northern Europe (Finland, Norway, and Sweden)
4. WEU Western Europe
5. EEU Eastern Europe (including USSR and Yugoslavia)
6. OCE Oceania
7. AFR Africa
8. LAM Latin America
9. ASE ASEAN countries (Indonesia, Malaysia, Philippines, Singapore, and Thailand)
10. ASI Other Asian countries

Summary Regions

1. TDD total developed (non-socialist) regions
2. TSC total socialist regions
3. TNG total developing regions
4. TWO total world

Product Classification

	IIASA AGGREGATED PRODUCTS	4 DIGIT SITC REV1	
1.	CONIFEROUS LOGS	242.2	Sawlogs + Veneer logs - conifer
2.	NONCONIFEROUS LOGS	242.3	Sawlogs + Veneer logs (NC)
		242.4	Pitprops (C + NC)
		242.9	Other industrial roundwood (C + NC)
3.	PULPWOOD	242.1	Pulpwood (C + NC)
4.	FUELWOOD	241.1	Fuelwood+Wood residues
		241.2	Wood Charcoal
5.	CONIFEROUS SAWNWOOD	243.2	
6.	NON-CONIF. SAWNWOOD	243.3	
		243.1	Sleepers
7.	PANELS	631.1	Veneer sheets
		631.2	Plywood
		631.42	Particle boards
		641.6	fibreboards+other build boards
8.	PULP	251.2	Mechanical
		251.9	Semi-chemical
		251.7	Sulphate
		251.8	Sulphite
		251.6	Dissolving grades
		251.5	other wood pulp
9.	NEWSPRINT	641.1	
10.	OTHER PRINTING & WRITING	641.2	
11.	OTHER PAPER & BOARD	641.3	Kraft paper & paperboard
		641.4	Cigarette paper
		641.5	Machine-made paper
		641.7	Hand-made paper
		641.9	Rolls/sheets

APPENDIX III: COMPUTER PROGRAM FOR HANDLING TRADE FLOW DATA

Introduction

A data bank (DB) was constructed to store statistical information to be used for the historical analysis of international trade in forest products. This DB consists of the data described in Appendix I, namely

- value data in current 1000 US dollars
- for years 1962-1981
- for 11 FSP products plus total of forest products (See Appendix II for product classification)
- for 10 FSP regions and summary totals for 3 economic classes (developed non-socialist, socialist, and developing) plus world total (See Appendix II for region classification).

From the computational point of view a DB of the above type constitutes an organizational framework for a given data retrieval procedure. Since this procedure is independent of the actual information the DB is filled with, one may create and use many DB files (e.g., a DB for volume data, a DB for the delta intensity indicators, a DB for importers' reports, etc.) So far only one additional DB of the delta indicators is available, which was derived from the above basic DB file. As research on international trade proceeds, new DB files will appear.

A very simple-to-use interactive computer program was compiled at IIASA/FSP to help even the most inexperienced computer users to carry out research on the trade flow data. The primary aim of this program is to produce the listings and tables which are most frequently used for analytical purposes. There are two FORMATS in which the statistical

information is retrievable:

- FLOW TABLE format (for any given cross-section of the three-dimensional data-cube of a given observation year)
- TIME-SERIES format (for any given time range of observations for any given element of the data-cubes of successive years)

The following OPTIONS of actual or derived data-cube elements are available within any of the above formats:

- Actual (observed) data of the trade flow
- Percentage share as represented by the observed data in imports, exports, or total trade
- Balance of trade in absolute numbers or as exports in percent of imports

Within the above options several MODEs are available to specify any or some of the three dimensions necessary to define a given section or element of the data cubes: any importer and/or exporter region and any product can be selected.

There are two types of table SIZEs, the above formats, options and modes may refer to:

- summary tables (i.e., data of the 3 economic classes plus world total)
- detailed tables (i.e., data of the 10 FSP regions plus world total).

How to Get Started

(Please read this section carefully before running the program!)

The only thing one should be careful about when using the computer program is the "login" procedure:

(1) Decide whether graphing (plotting) of data is needed or not. If not, then refer to (4); if yes, then go on to (2).

(2) Decide whether displayed or hard-copy graphs are needed. If you need hard-copies only (i.e., ink on paper), refer to (4); if you need plots on the terminal screen as well, go on to (3).

(3) Login to a graphic terminal (with big green, square screens in brown cases):

  (i) Hit *MODE* while *CNTL* is pressed. ">>" appears.

  (ii) Hit "l", and then *RETURN*. "Wait for connection" appears first. After a while the message

  "Berkeley VAX/UNIX
  login:"

  appears.

  (iii) Type in "kornai", and hit *RETURN*. Several messages may come to the screen. Wait until "%" appears.

  (iv) Type in "tty" and hit *RETURN*. "...ttyC#" appears, where # is a number. Make a note of it. Wait for "%".

(v) Type "edx myplot" and hit *RETURN*. Wait until the screen clears and file "myplot" appears.

(vi) If the number you received is equal to the number appearing in the rightmost character of the first line on screen go to step (xi). If not, then you should edit it:

(vii) Press *CNTL* and hit "n" meanwhile. The cursor (the white sign), jumps just after the "/dev/ttyc#" characters.

(viii) Press *CNTL* and hit "h" meanwhile. Holding *CNTL* pressed, each hit of "h" will tabulate the cursor left one character. Keep hitting "h" until the cursor covers the number following the "C".

(ix) Still holding down *CNTL* hit "f". The number disappears.

(x) Release *CNTL* and type the new number in.

(xi) Hit *ESC*. Hit "q". Wait until "*" appears.

(xii) Hit "w" and hit *RETURN*. A number, then a "*" appears.

(xiii) Hit "q". Wait until "%" appears. Editing is ready.

(xiv) Decide whether to use this graphic display only for graphs. If there is no other terminal free, you should refer to (5). Otherwise it is more convenient to move to a non-graphic terminal:

(4) Use the terminal on which the message:

"Berkeley VAX/UNIX
login:"

appears. Type in "kornai" and hit *RETURN* and wait for the "%" character.

(5) Type in "run" and hit *RETURN*. Now the program takes over. The only thing you should do is to read the messages carefully and give the correct answers. Following each answer, do not forget to hit the *RETURN* key. After proper completion of the run you will receive the printouts.

The DB program was entirely written in FORTRAN 77. It works in a stepwise graph-structure which might have improperly defined "routes" and "junctions". Even "loops" may appear (e.g., irrespective of your answer the same message keeps on coming to the screen). Then try to escape with "q". If it does not help, quit the run with *CNTL* "c". Please report these failures to Gabor Kornai, who is entirely responsible for all bugs which may occur.

APPENDIX IV: ASSUMED DISTANCES BETWEEN MAIN PORTS

Nautical miles	from and to		Port	/port	via
2100	NA	<-> NA	Char-LosAn	/Vanco-Quebec	:2
4254		-> Jp	Seattle	/Yokohama	
4840		-> NE	Charleston	/Stockholm	
3876		-> WE	Charleston	/Rotterdam	
4366		-> EE	Seattle	/Vladivostok	
6810		-> Oce	Seattle	/Sydney	
6830		-> Afr	Charleston	/Cape Twon	
4717		-> LatAm	Charleston	/Rio	
7062		-> ASEAN	Seattle	/Singapore	
5537		-> Asia rest	Charleston	/Port Said	
4839	Jp	-> NA	Yokohama	/Los Angenes	
1		<-> Jp			
13888		<-> NE	Yokohama	/Stockholm	
12924		<-> WE	Yokohama	/Rotterdam	
471		<-> EE	Higashi	/Vladivostok	
4330		<-> Oce	Yokohama	/Sydney	
11420		<-> Afr	Yokohama	/Dakar	Panama
9920		<-> LatAm	Yokohama	/Rio	C.Horn
2889		<-> ASEAN	Yokohama	/Singapore	
6805		<-> Asia rest	Yokohama	/Al Bashrah	
4257	NE	-> NA	Stockholm	/New York	
250		<-> NE	Stockholm	/Helsinki	
1015		<-> WE	Stockholm	/Rotterdam	
386		<-> EE	Stockholm	/Leningrad	
13480		<-> Oce	Stockholm	/Sydney	Panama
7146		-> Afr	Stockholm	/Cape Town	
6215		<-> LatAm	Stockholm	/Rio	
9279		<-> ASEAN	Stockholm	/Singapore	Suez
7632		<-> Asia rest	Stockholm	/Al Basrah	Suez
3473	WE	-> NA	Rotterdam	/New York	
400		<-> WE	Rotterdam	/Basel (river)	
1288		<-> EE	Rotterdam	/Leningrad	
12516		<-> Oce	Rotterdam	/Sydney	Panama
6187		-> Afr	Rotterdam	/Cape Town	
5259		<-> LatAm	Rotterdam	/Rio	
8323		<-> ASEAN	Rotterdam	/Singapore	Suez
7509		<-> Asia rest	Rotterdam	/Al Basrah	

Nautical miles	from and to		Port	/port	via
4981	EE	<-> NA	Vladivostok	/Los Angeles	
850		<-> EE	Leningrad	/Rostock	
5105		<-> Oce	Vladivostok	/Sydney	
5252		<-> Afr	Odessa	/Lagos	Gibraltar
6332		<-> LatAm	Odessa	/Rio	Gibraltar
3004		<-> ASEAN	Vladivostok	/Singapore	
4523		<-> Asia rest	Odessa	/Al Basrah	Suez
6511	Oce	-> NA	Sydney	/Los Angeles	
2000		<-> Oce	Sydney	/Auckland	
9677		-> Afr	Sydney	/Cape Town	
7636		<-> LatAm	Sydney	/Rio	
2403		<-> ASEAN	Freemantle	/Singapore	
5440		<-> Asia rest	Freemantle	/Al Basrah	
4883	Afr	-> NA	Lagos	/New York	
5146		-> NE	Lagos	/Stockholm	
4190		-> WE	Lagos	/Rotterdam	
10129		-> Oce	Freetown	/Sydney	
5600		<-> Afr	Freetown	/Djibouti	
2613		-> LatAm	Freetown	/Rio	
8769		-> ASEAN	Freetown	/Singapore	C.Horn
5267		-> Asia rest	Cape Town	/Al Basrah	
4762	Lat Am	-> NA	Rio	/New York	
1400		<-> LatAm	Rio	/La Plata	
8846		<-> ASEAN	Rio	/Singapore	C.Hope
8499		<-> Asia rest	Rio	/Al Basrah	C.Hope
7867	ASEAN	-> NA	Singapore	/Los Angeles	
5614		<-> Afr	Singapore	/Cape Town	C.Hope
1000		<-> ASEAN	Singapore	/Bangkok	
3916		<-> Asia rest	Singapore	/Al Basrah	
8505	Asia, rest	-> NA	Al Basrah	/New York	Suez
5500		<-> Asia rest	Al Basrah	/Hong Kong	

Source: Defense Mapping Agency 1971.

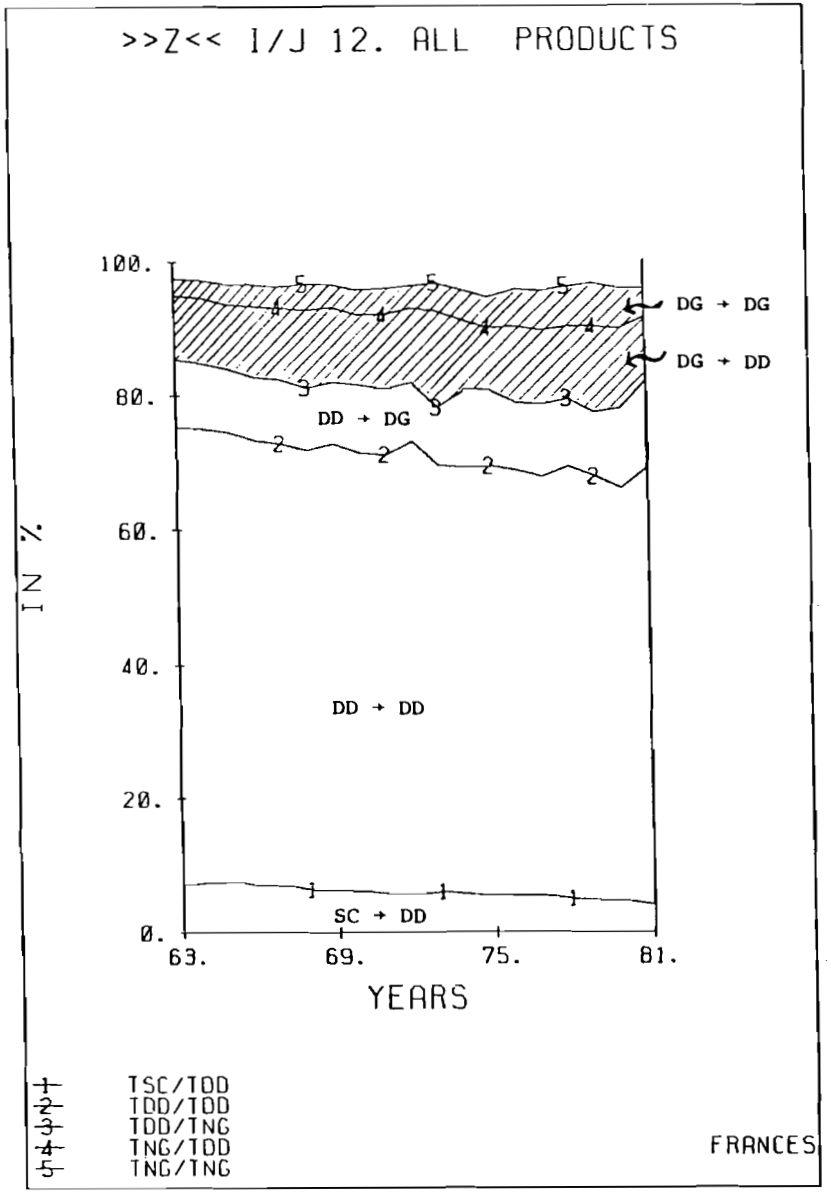

Figure 1. Cumulative share of world trade of flows of all forest products between socialist, developed (non-socialist) and developing regions.

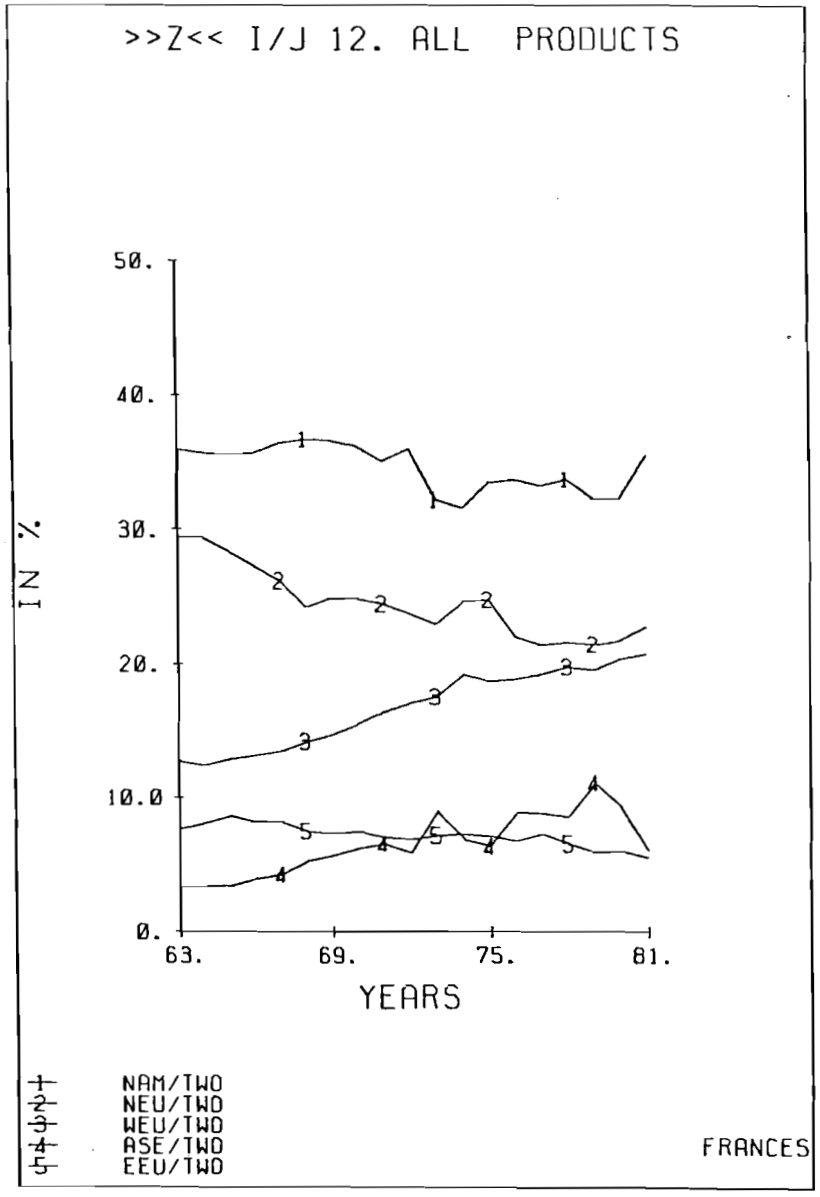

Figure 2. Share of world trade of major exporters of all forest products.

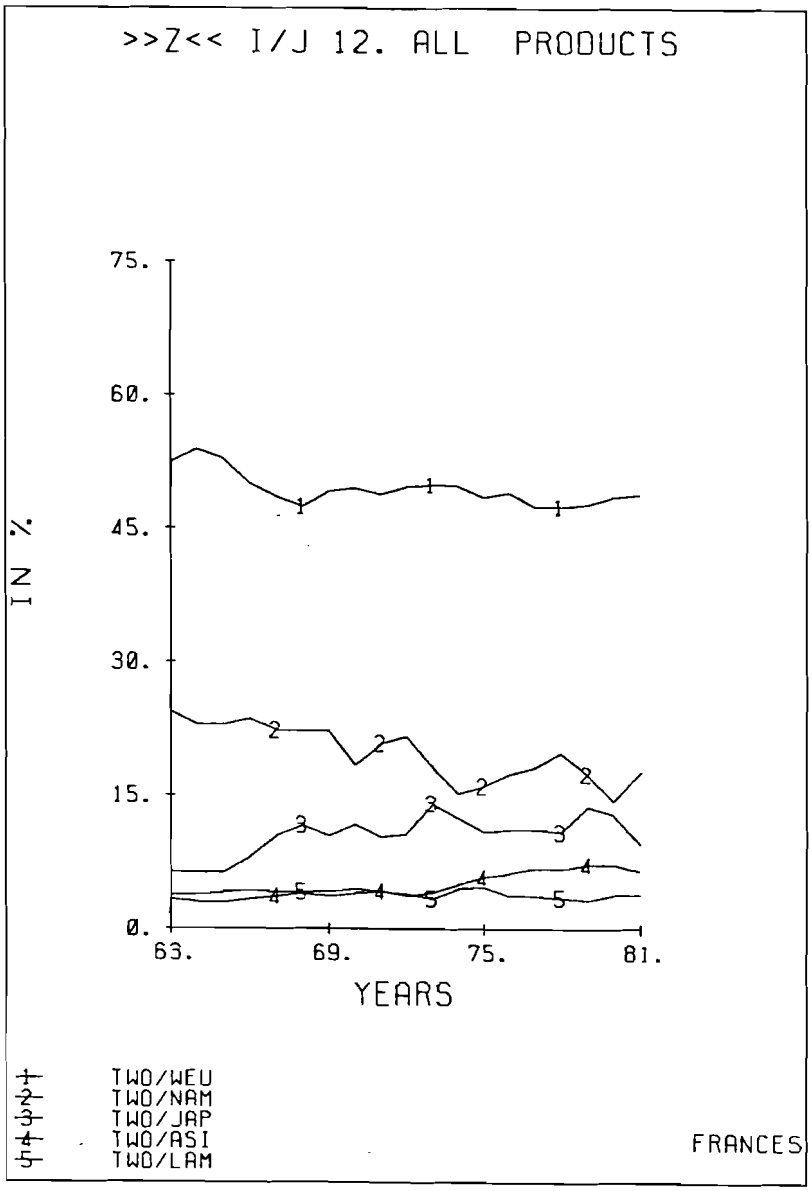

Figure 3. Share of world trade of major importers of all forest products.

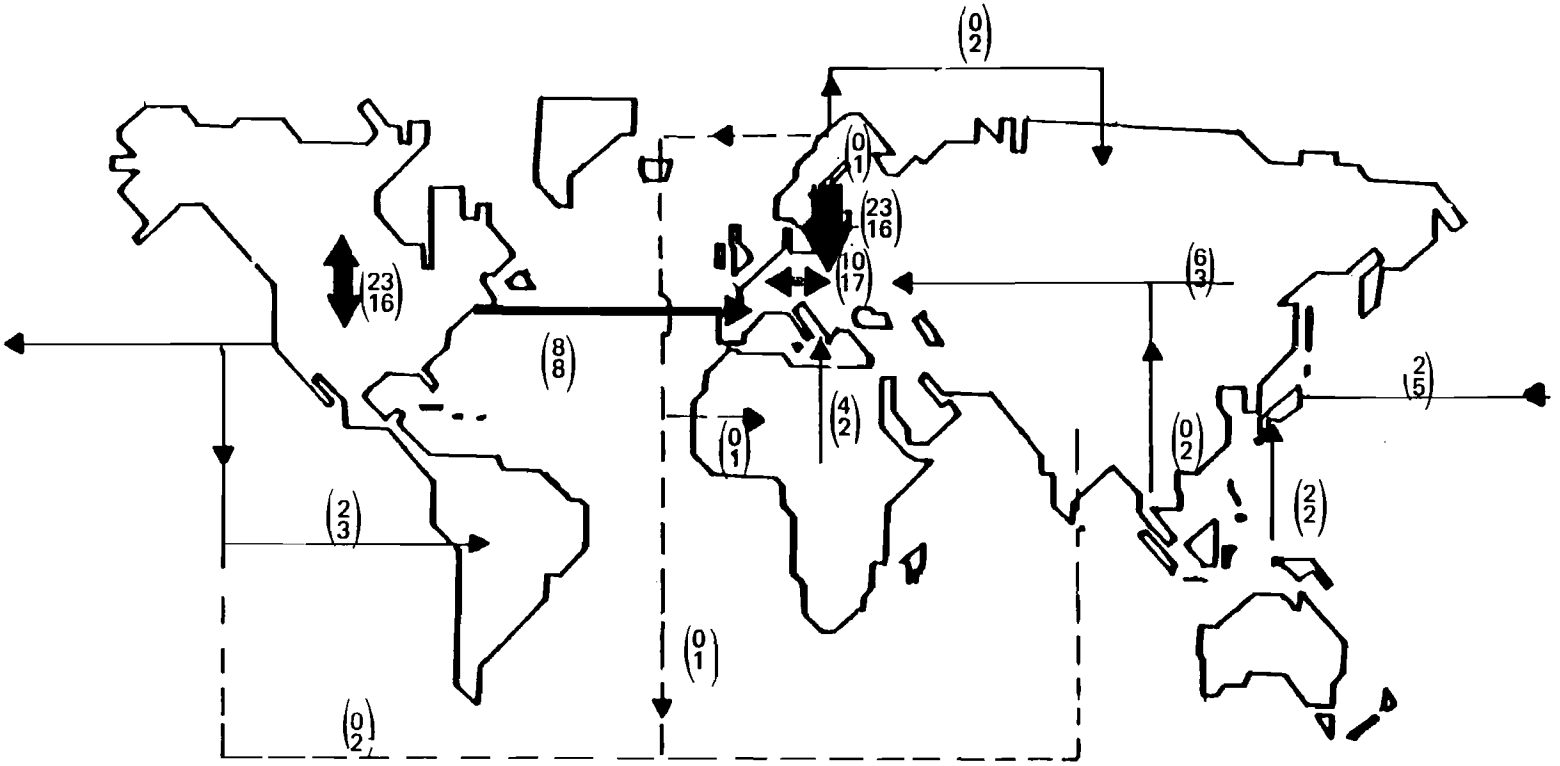

Figure 4. All forest products: bilateral trade flows ≥ 1 % of world trade in 1981.

$\binom{1962}{1982}$ shares given

----- flow ≥ 1% only since the late seventies

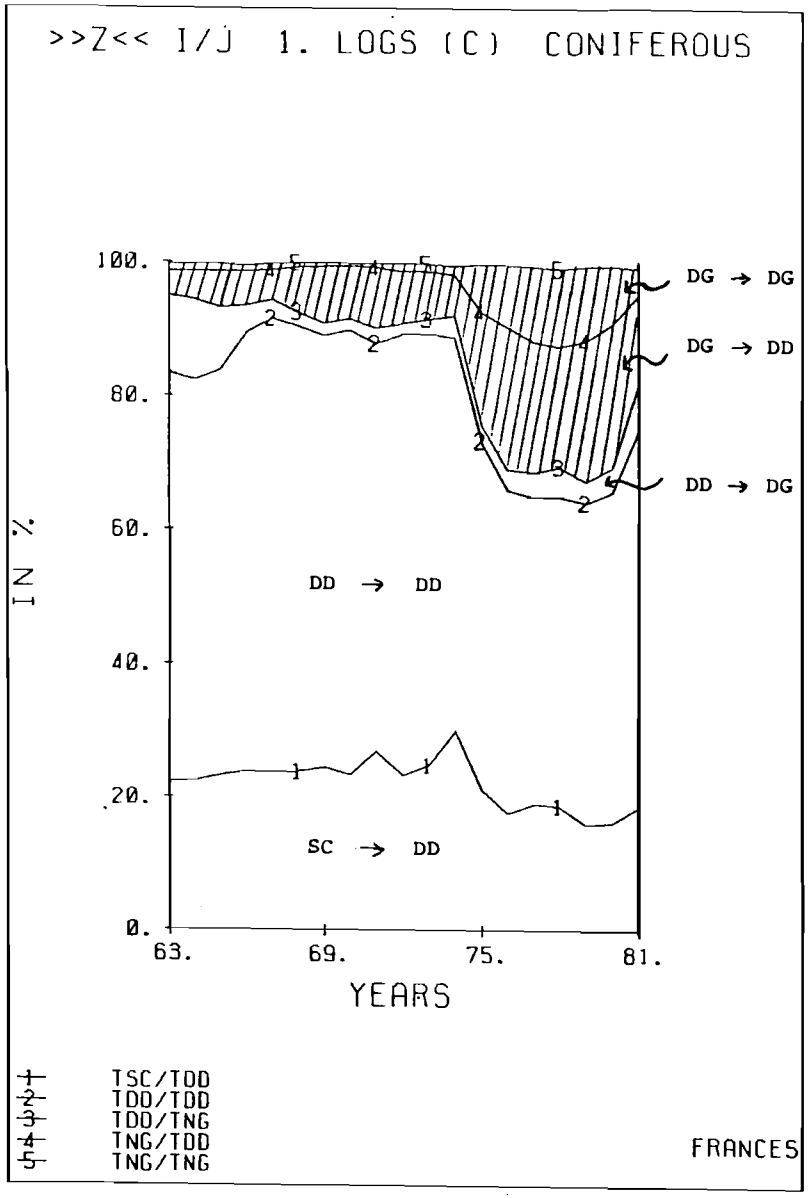

Figure 5. Cumulative share of world trade in Coniferous logs between developed non-socialist, socialist and developing regions.

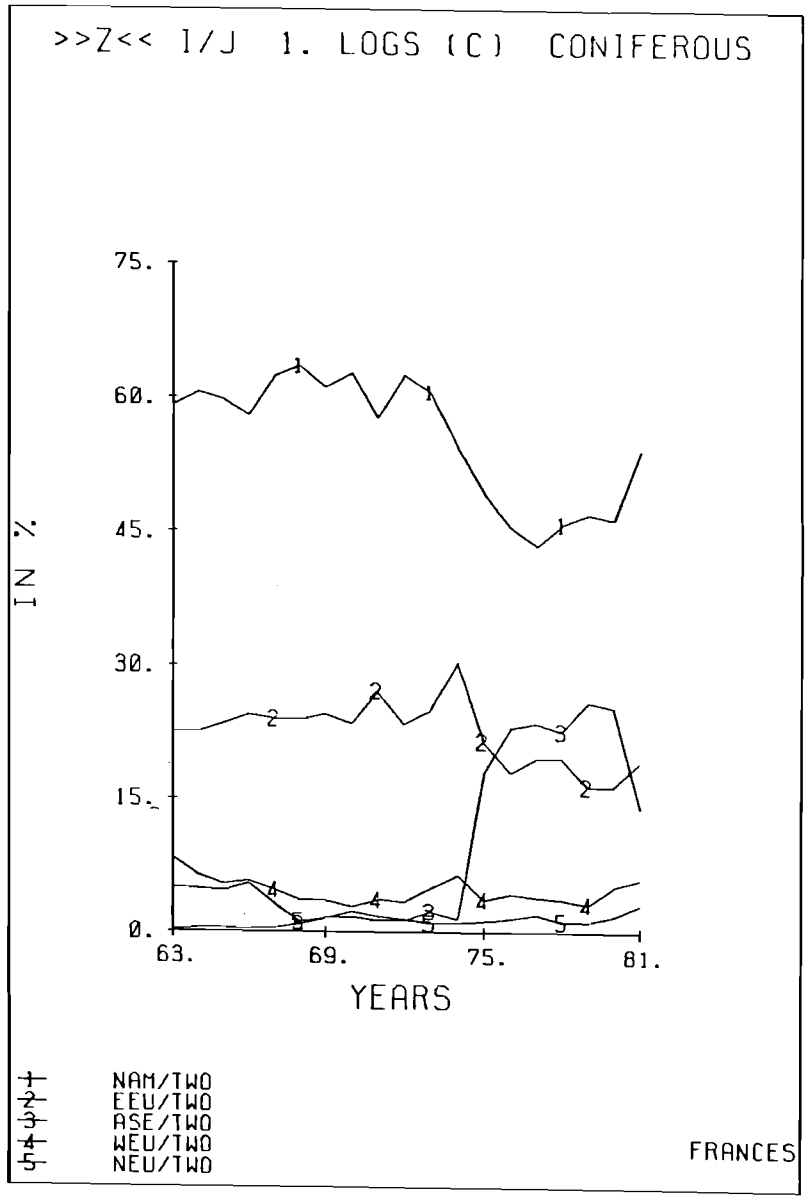

Figure 6. Shares of world trade of major exporters of Coniferous Logs.

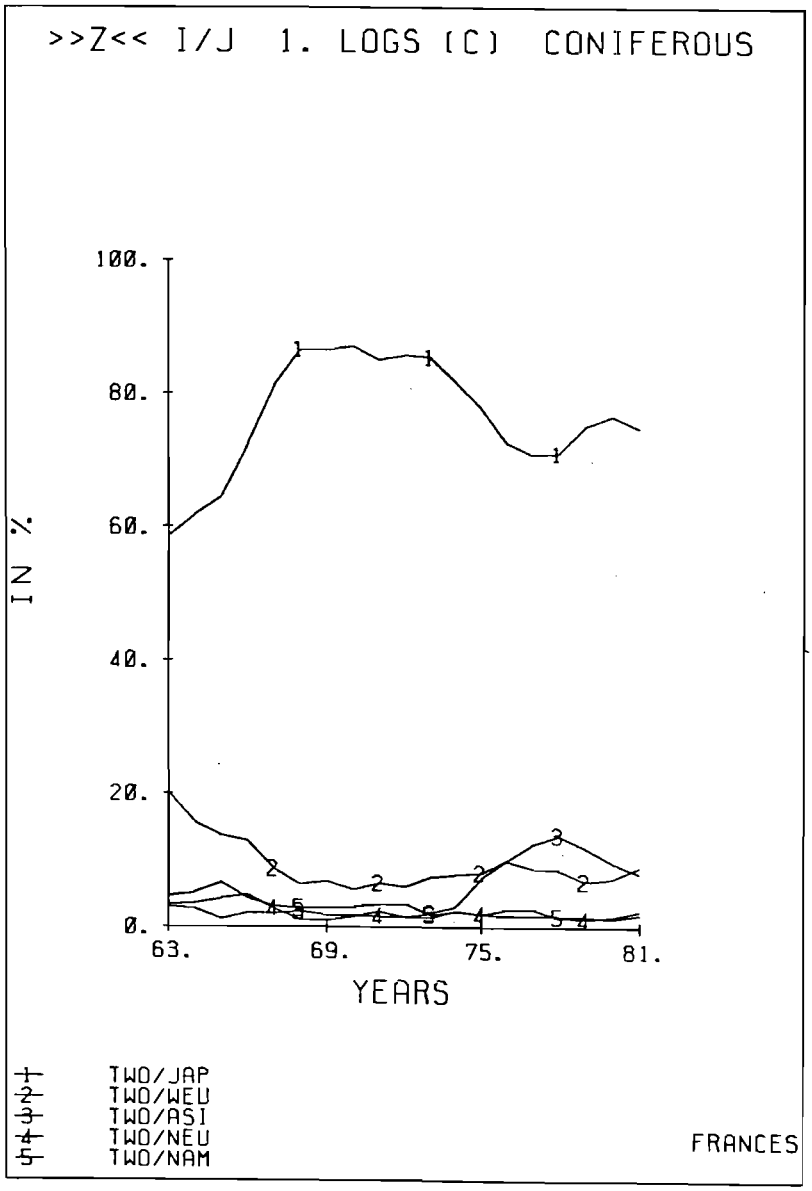

Figure 7. Shares of world trade of major importers of Coniferous Logs.

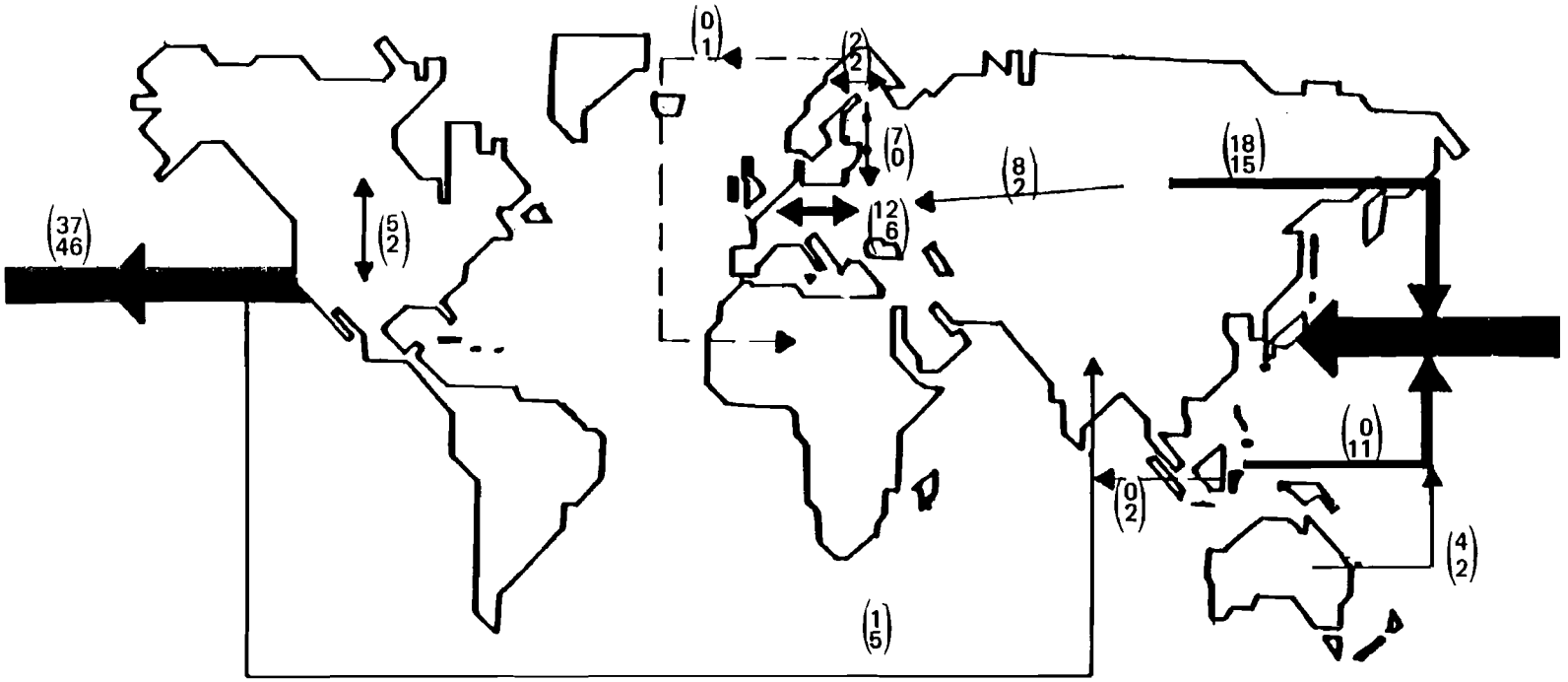

Figure 8. Coniferous Logs: bilateral trade flows ≥ 1% of world trade in 1981.

$\binom{1962}{1981}$ shares given

----- flow ≥ 1% only since the late seventies

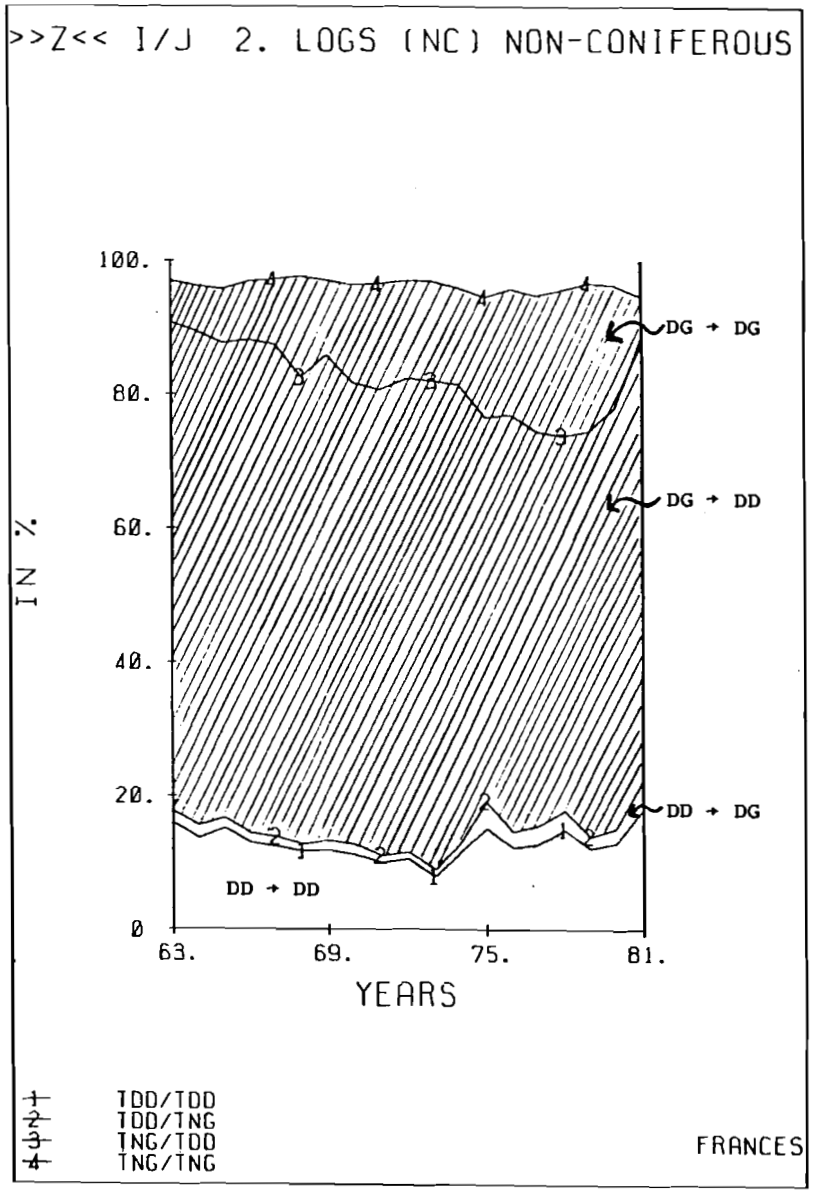

Figure 9. Cumulative share of world trade in Non-Coniferous Logs between developing and developed non socialist regions.

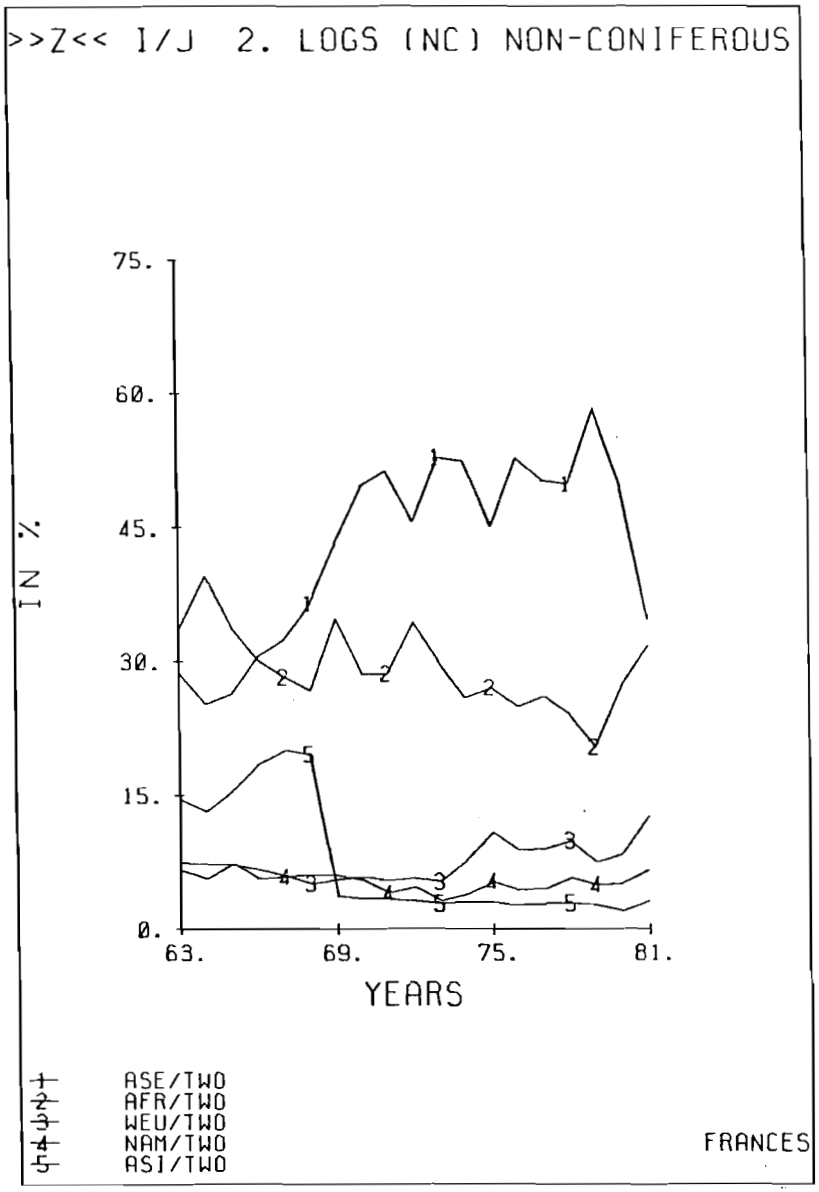

Figure 10. Shares of world trade of major exporters of Non-Coniferous Logs.

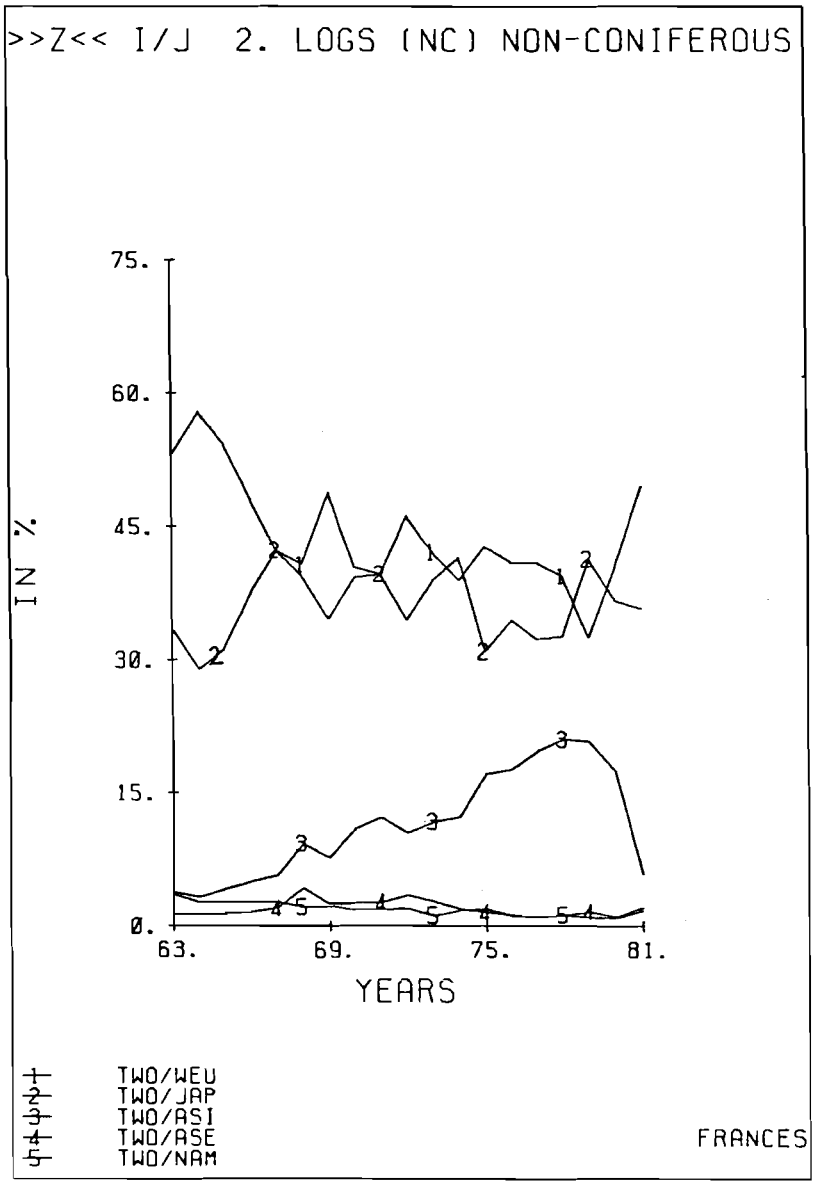

Figure 11. Shares of world trade of major importers of Non-Coniferous Logs.

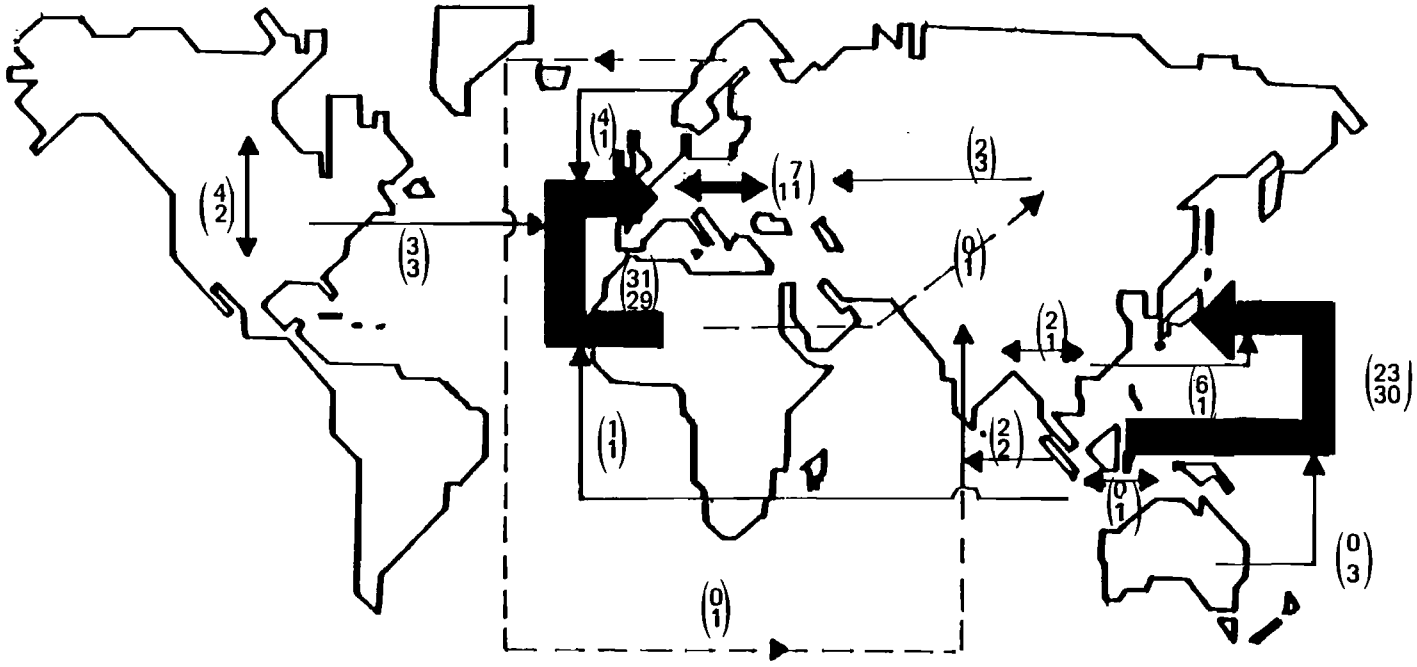

Figure 12. Non-Coniferous Logs: bilateral trade flows ≥ 1% of world trade in 1981.

$\binom{1962}{1982}$ shares given

----- flow ≥ 1% only since the late seventies

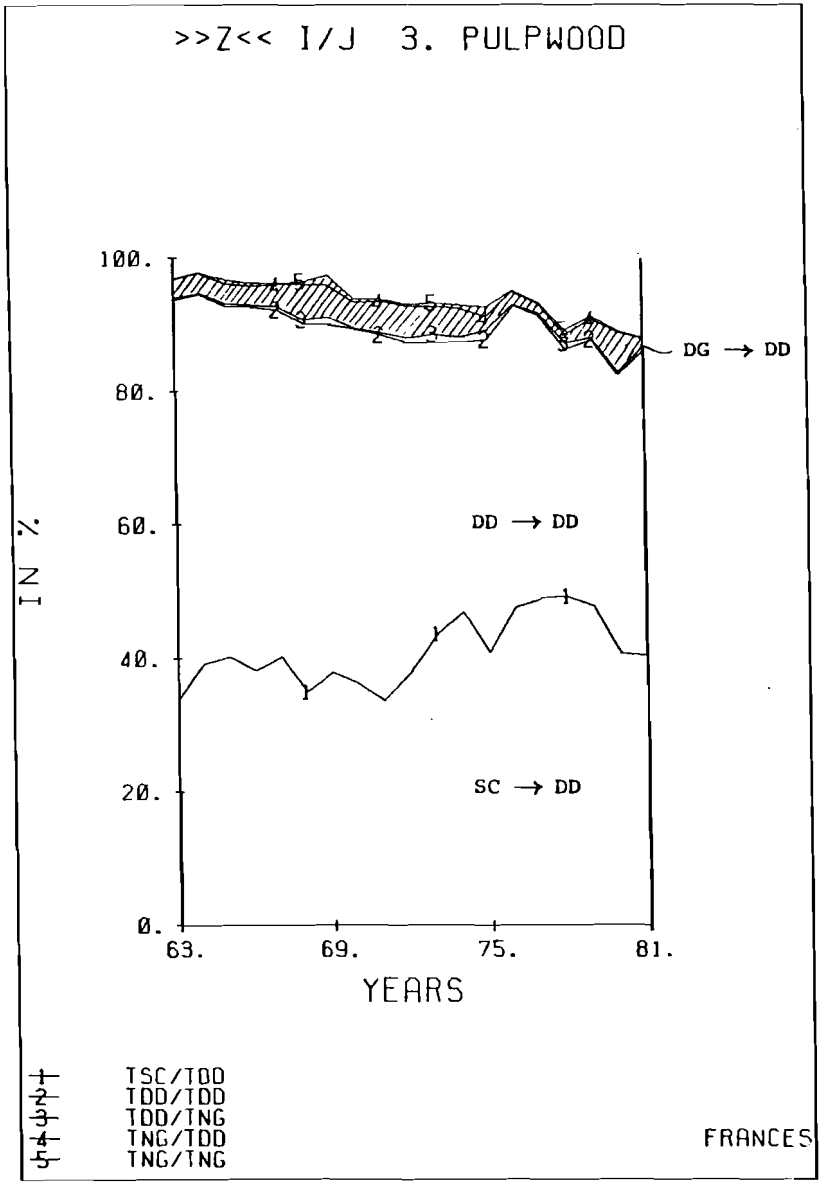

Figure 13. Cumulative shares of world trade of flows between socialist, developed non-socialist, and developing regions, for Pulpwood.

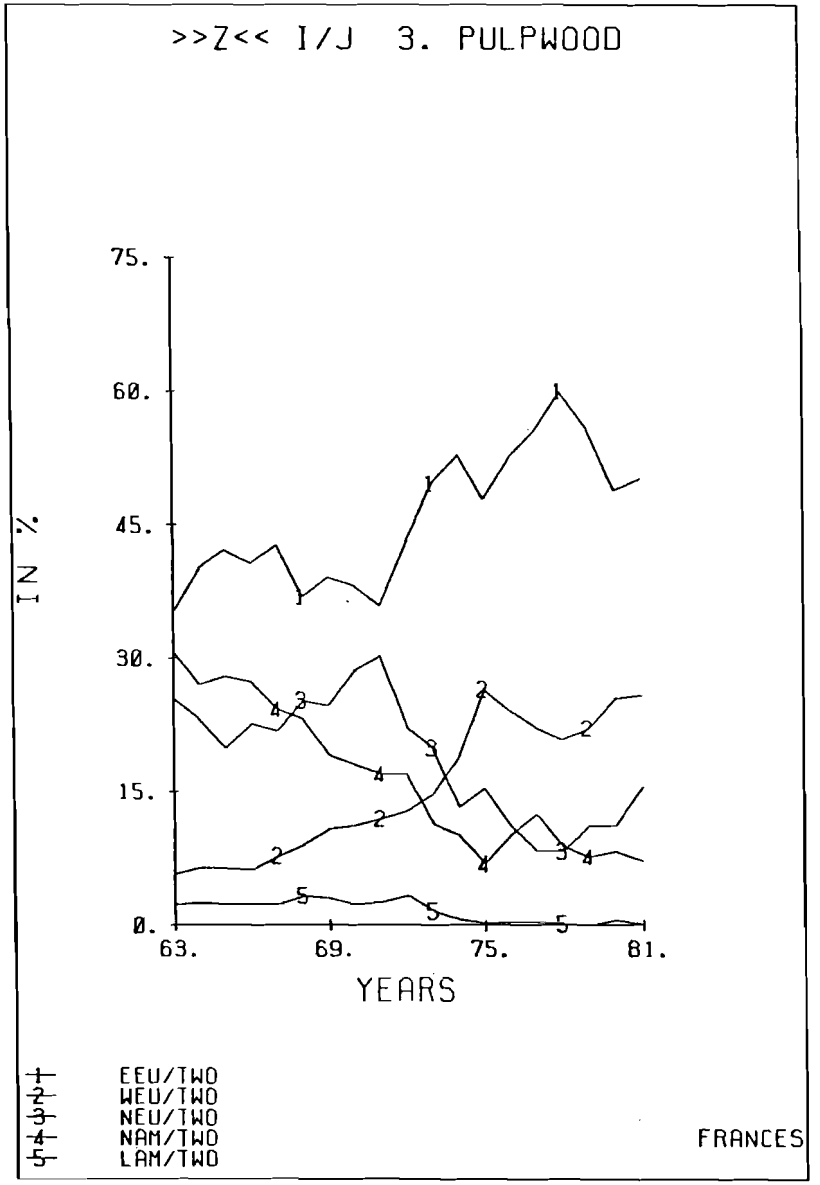

Figure 14. Shares of world trade of major exporters of Pulpwood.

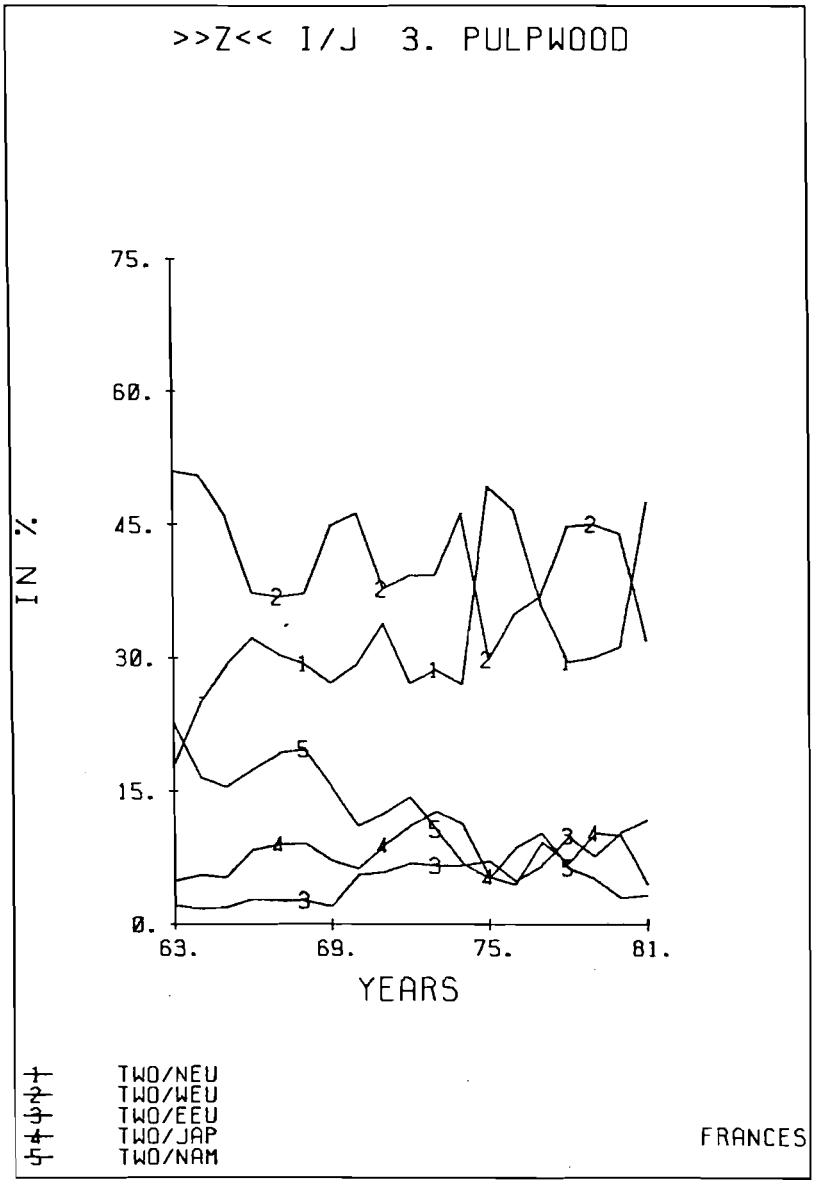

Figure 15. Shares of world trade of major importers of Pulpwood.

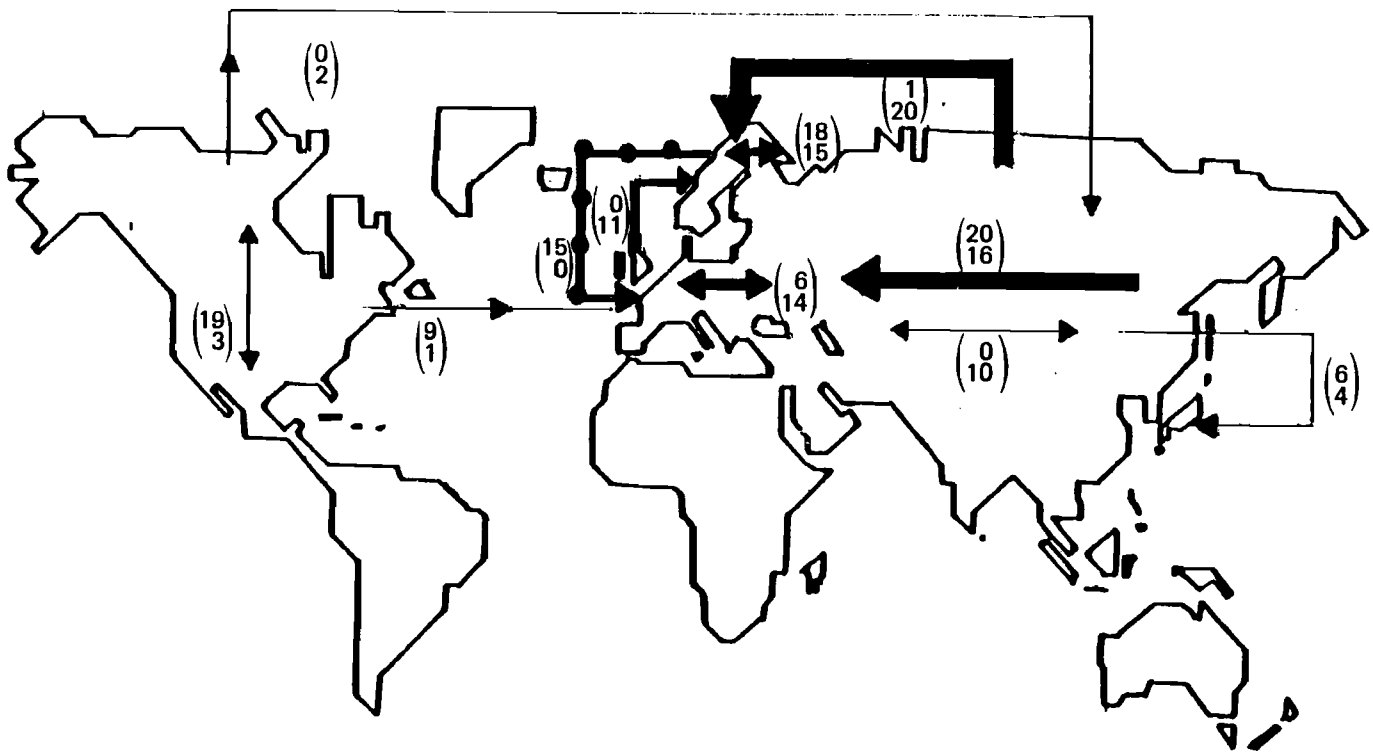

Figure 16. Pulpwood: bilateral trade flows ≥ 1% of world trade in 1981.

$\binom{1962}{1981}$ shares given

—●—●— flow ≥ 5% in 1962, but negligible by 1981

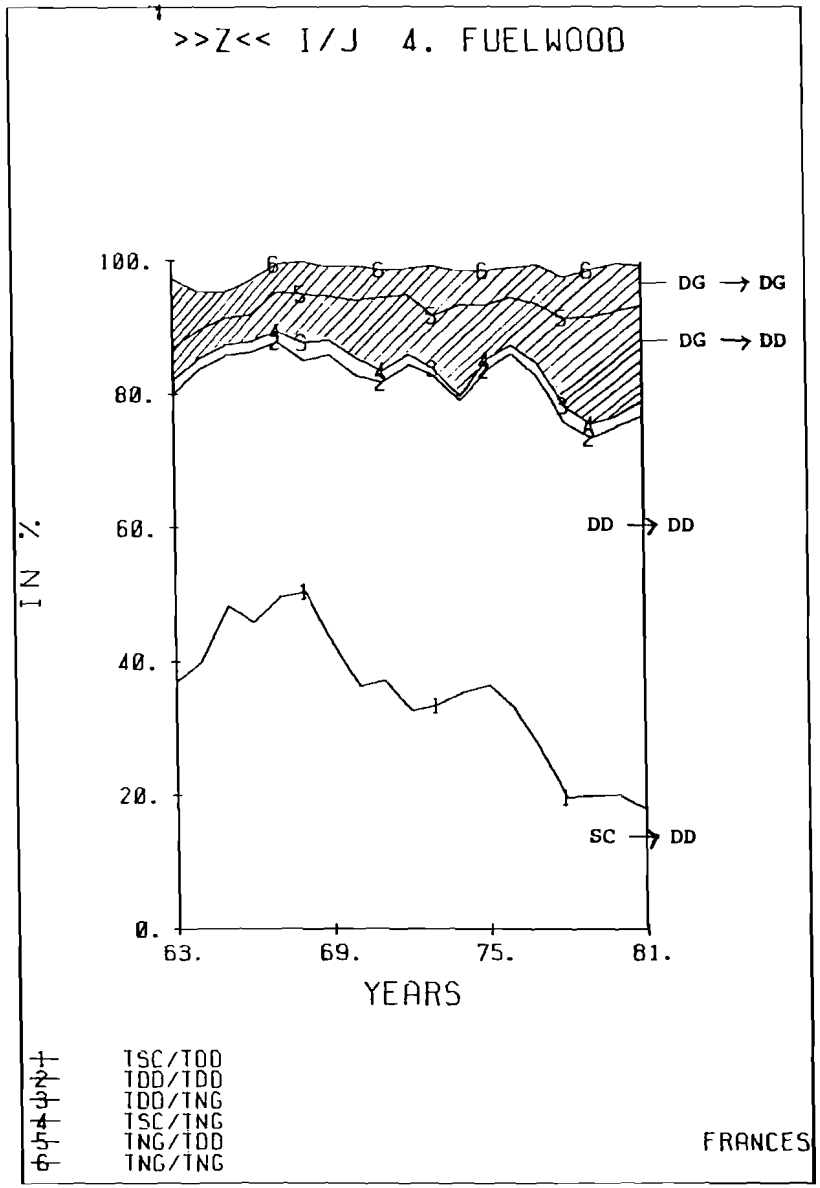

Figure 17. Cumulative share of world trade of flows between socialist, developed non-socialist, and developing regions, for Fuelwood.

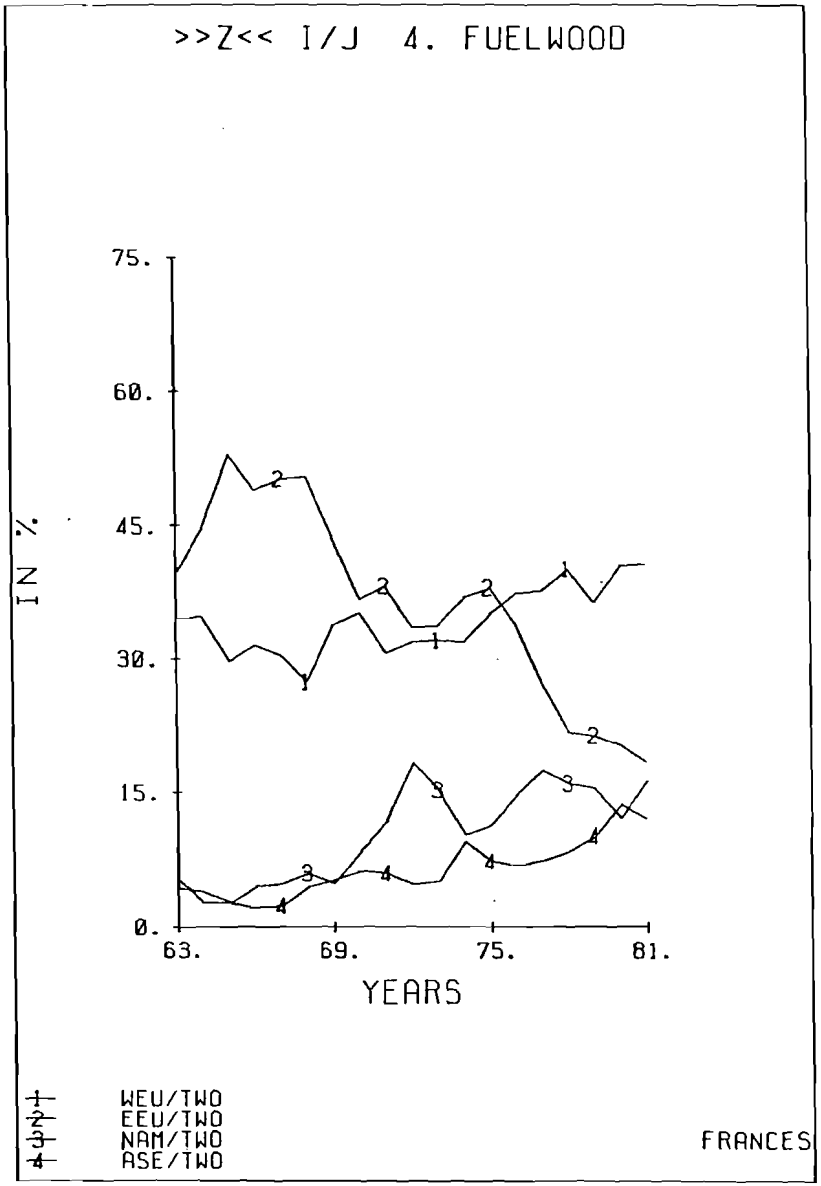

Figure 18. Shares of world trade of major exporters of Fuelwood.

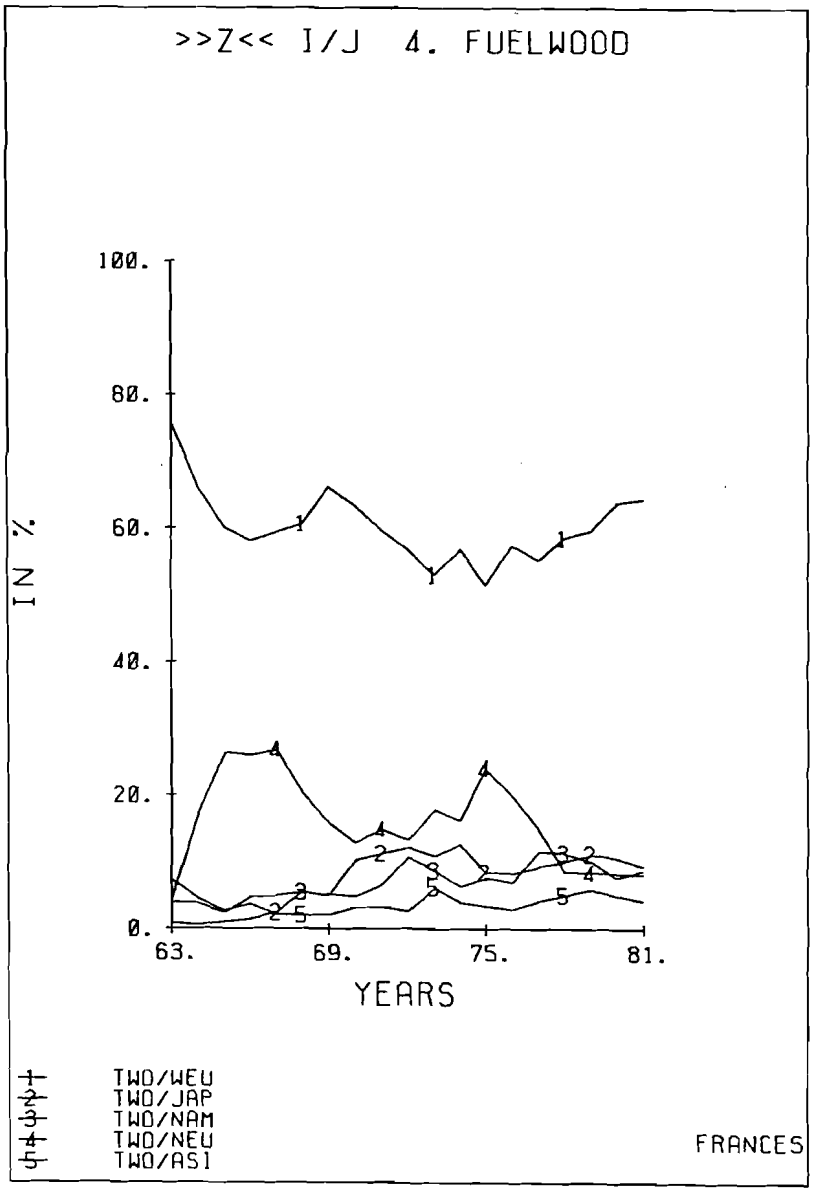

Figure 19. Shares of world trade of major importers of Fuelwood.

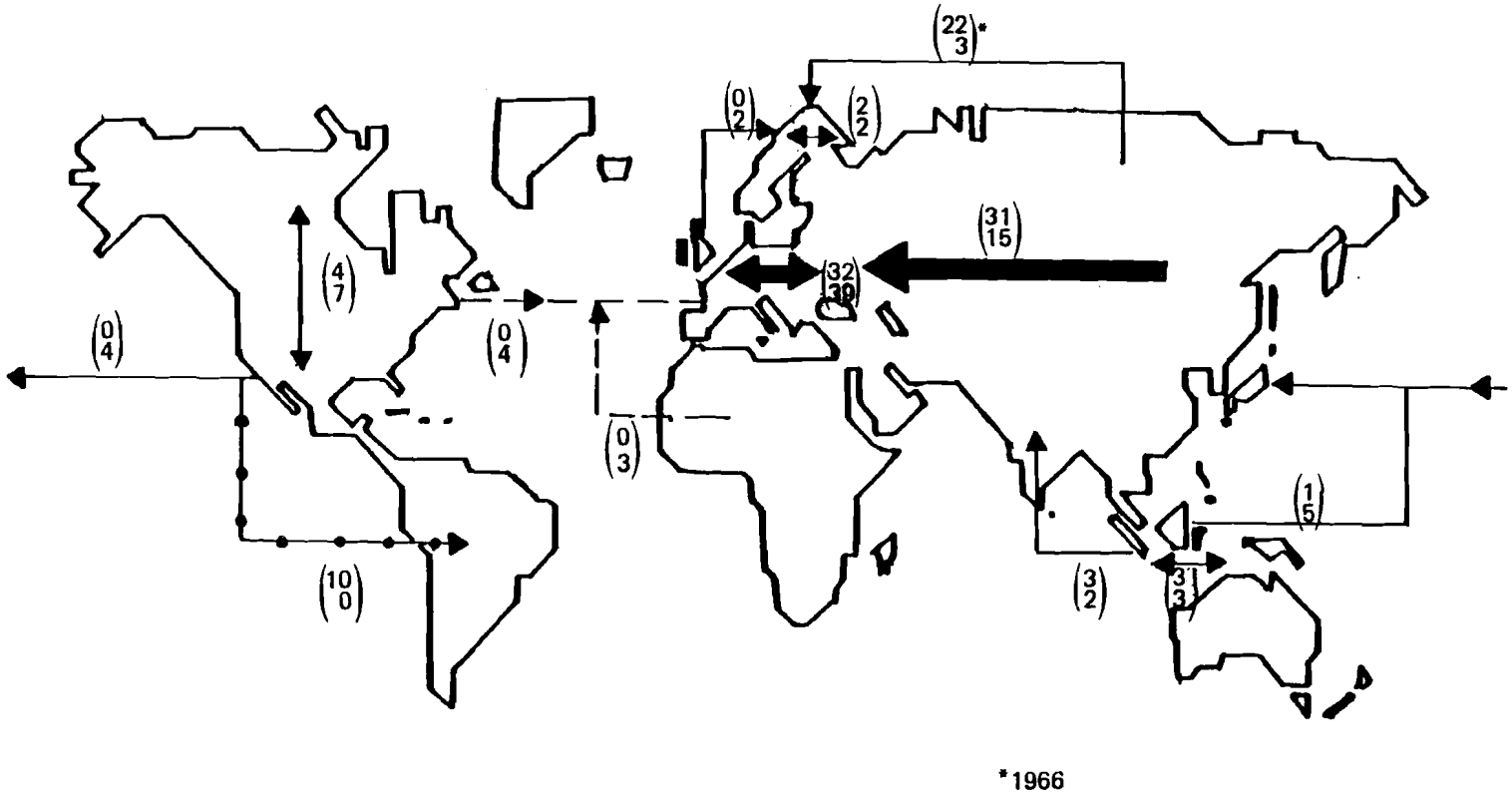

Figure 20. Fuelwood: bilateral trade flows ≥ 1.5% of world trade in 1981.

$\binom{1962}{1981}$ shares given, apart from * $\binom{1966}{1981}$

----- flow ≥ 1% only since the late seventies

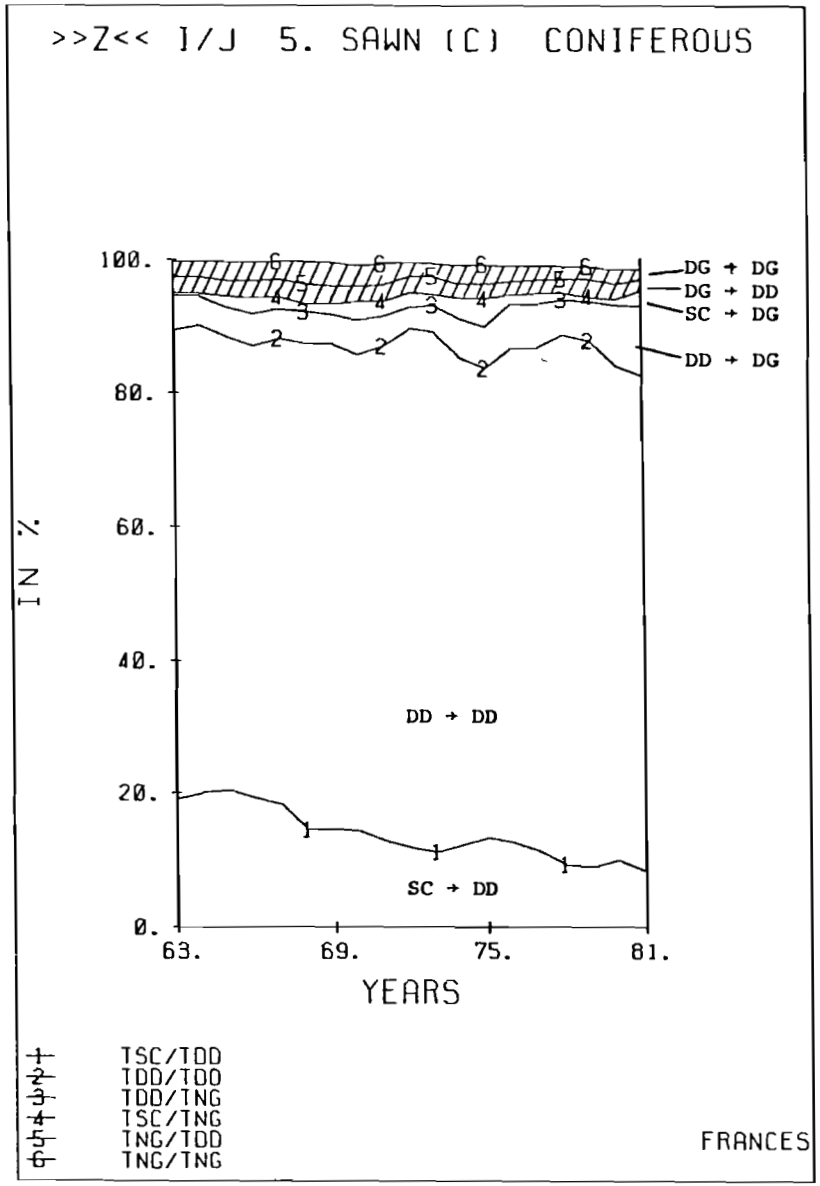

Figure 21. Cumulative shares of world trade of flows between socialist, developed non-socialist, and developing regions, for Coniferous Sawnwood.

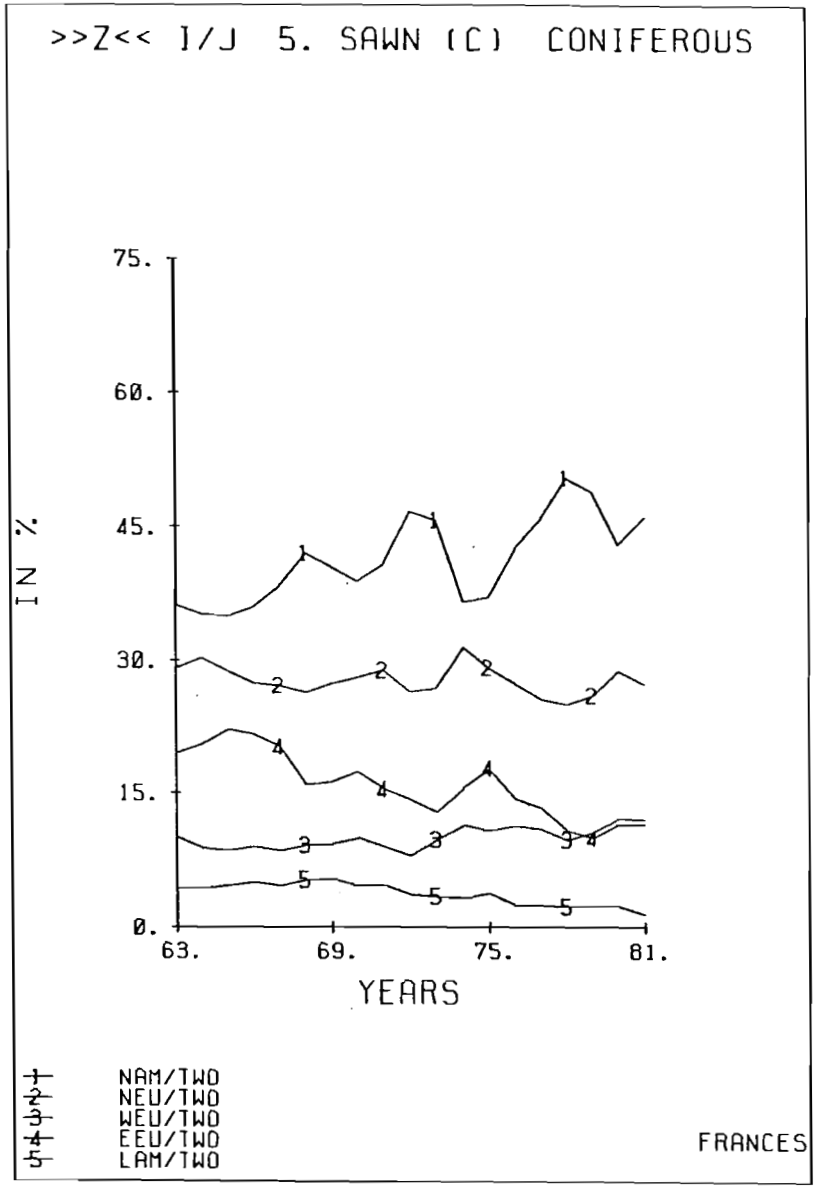

Figure 22. Shares of world trade of major exporters of Coniferous Sawnwood.

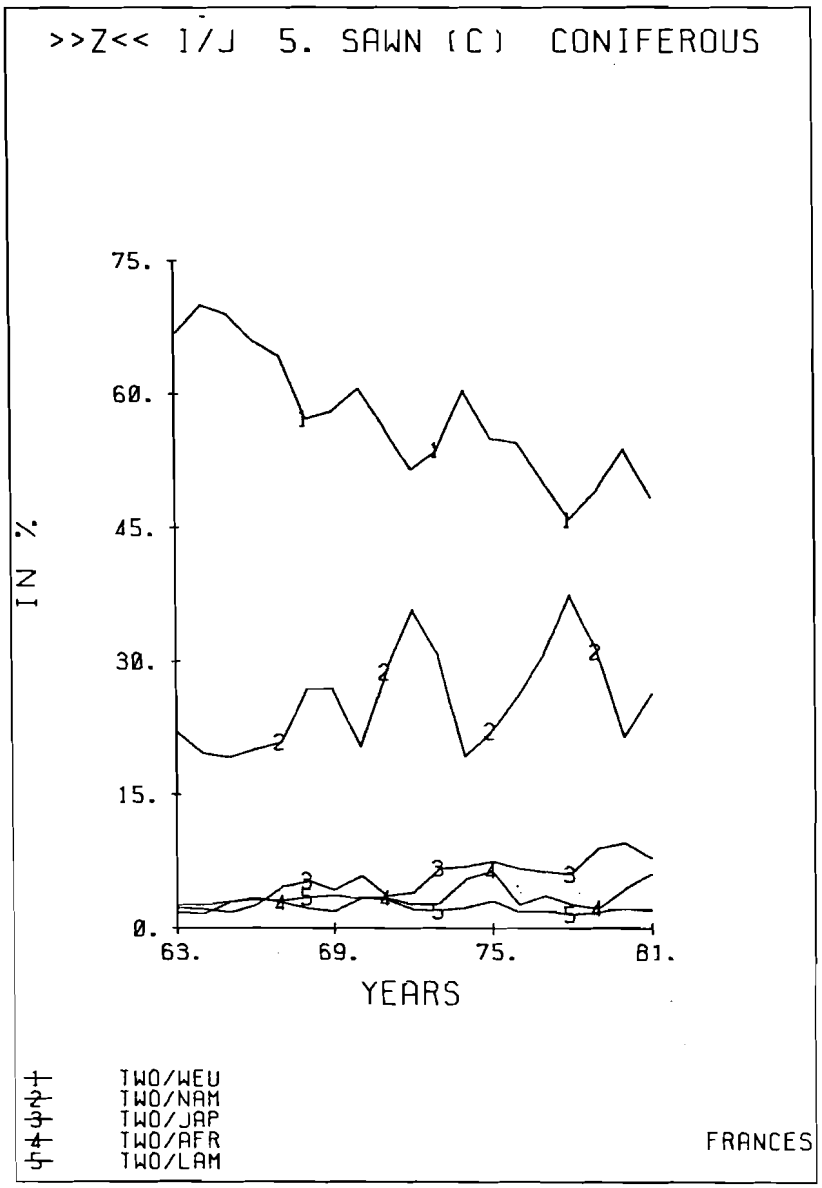

Figure 23. Shares of world trade of major importers of Coniferous Sawnwood.

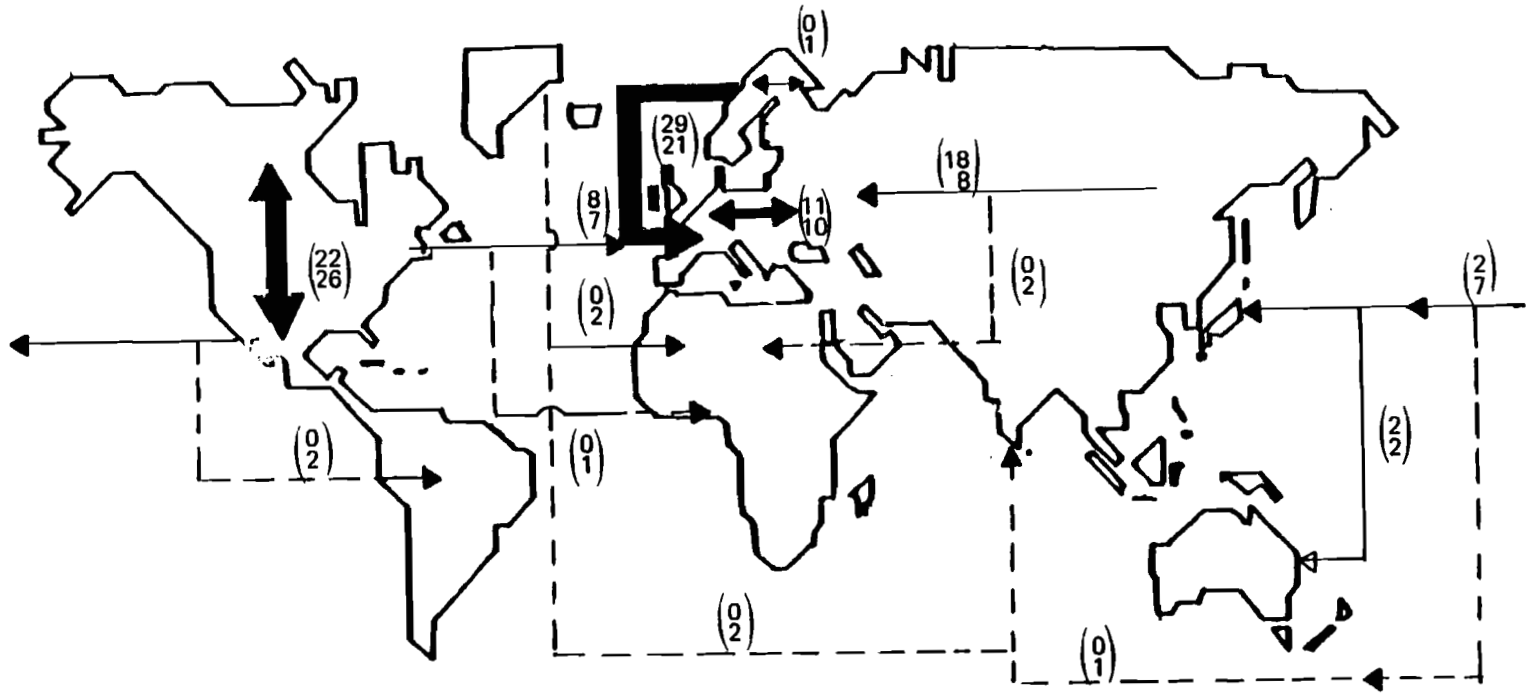

Figure 24. Coniferous Sawnwood: bilateral trade flows ≥ 1% of world trade in 1981.

$\binom{1962}{1981}$ shares given

----- flow ≥ 1% only since the late seventies

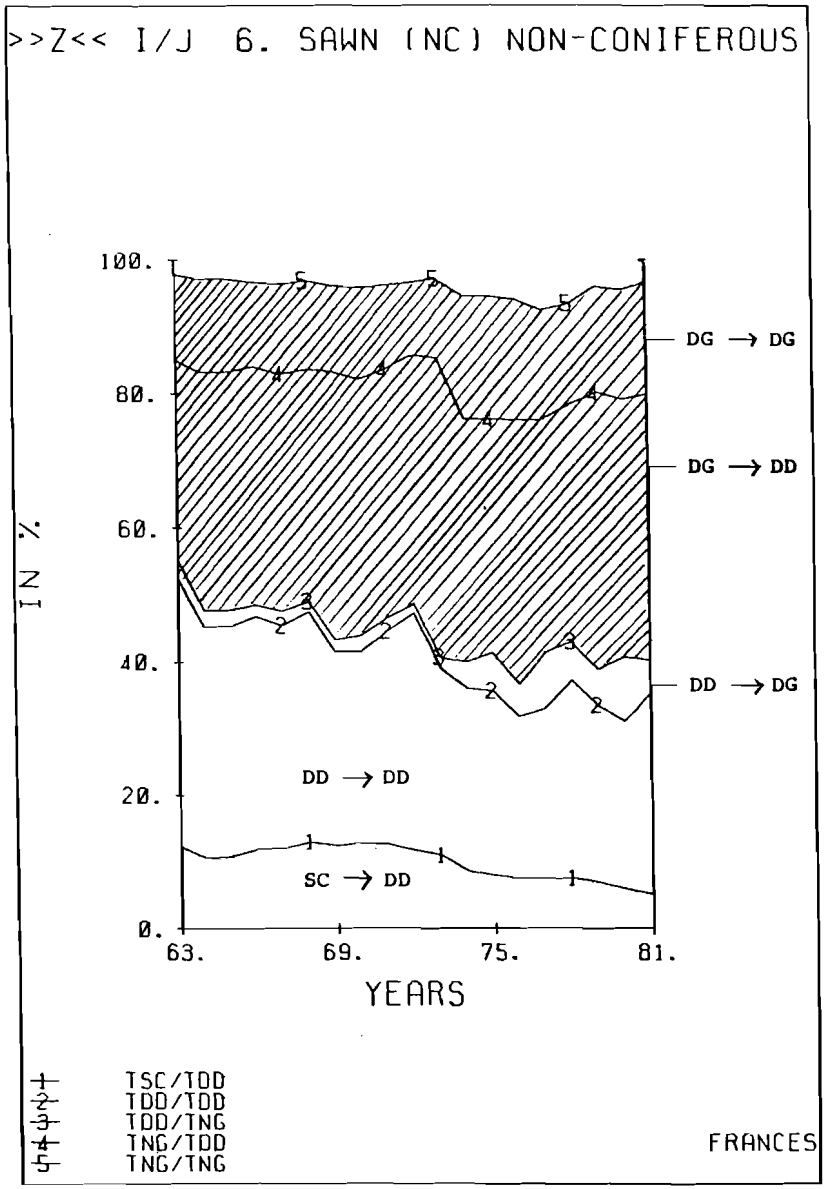

Figure 25. Cumulative share of world trade of flows of Non-Coniferous Sawnwood between socialist, developed non-socialist, and developing regions.

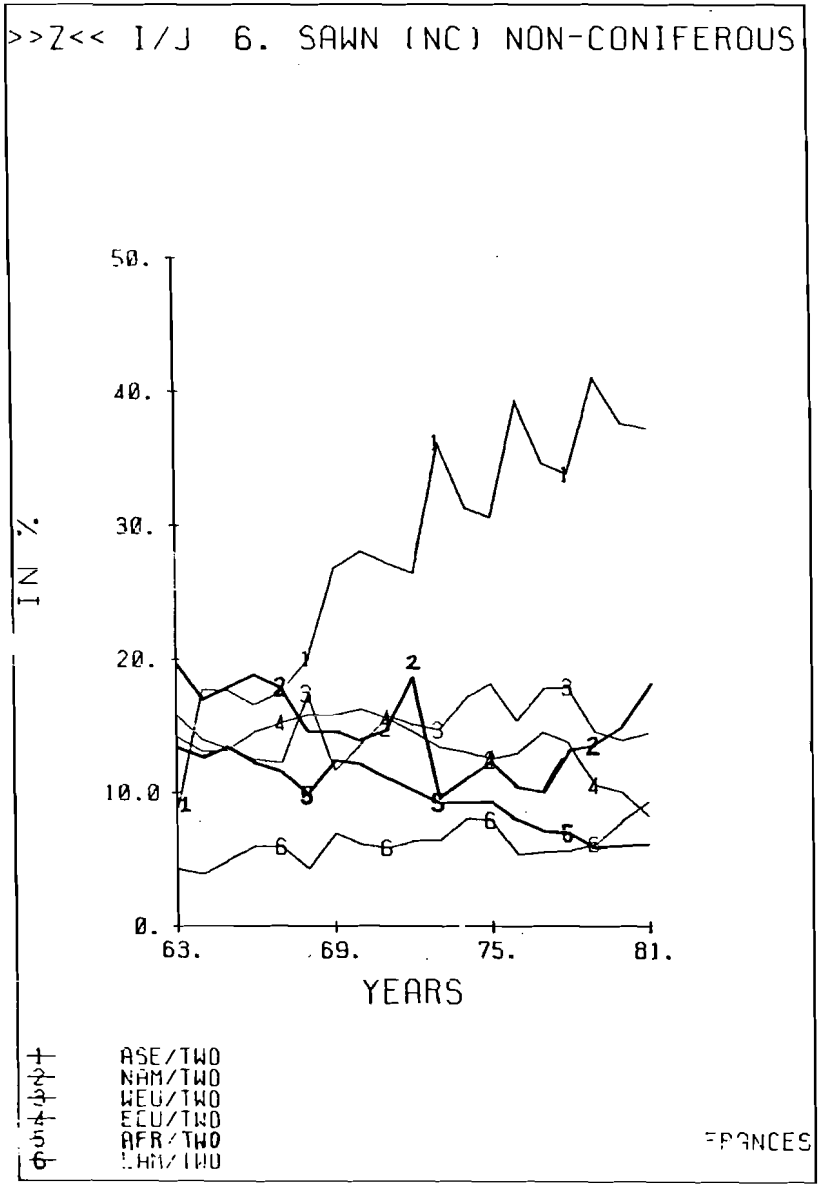

Figure 26. Share of world trade of major exporters of Non-Coniferous Sawnwood.

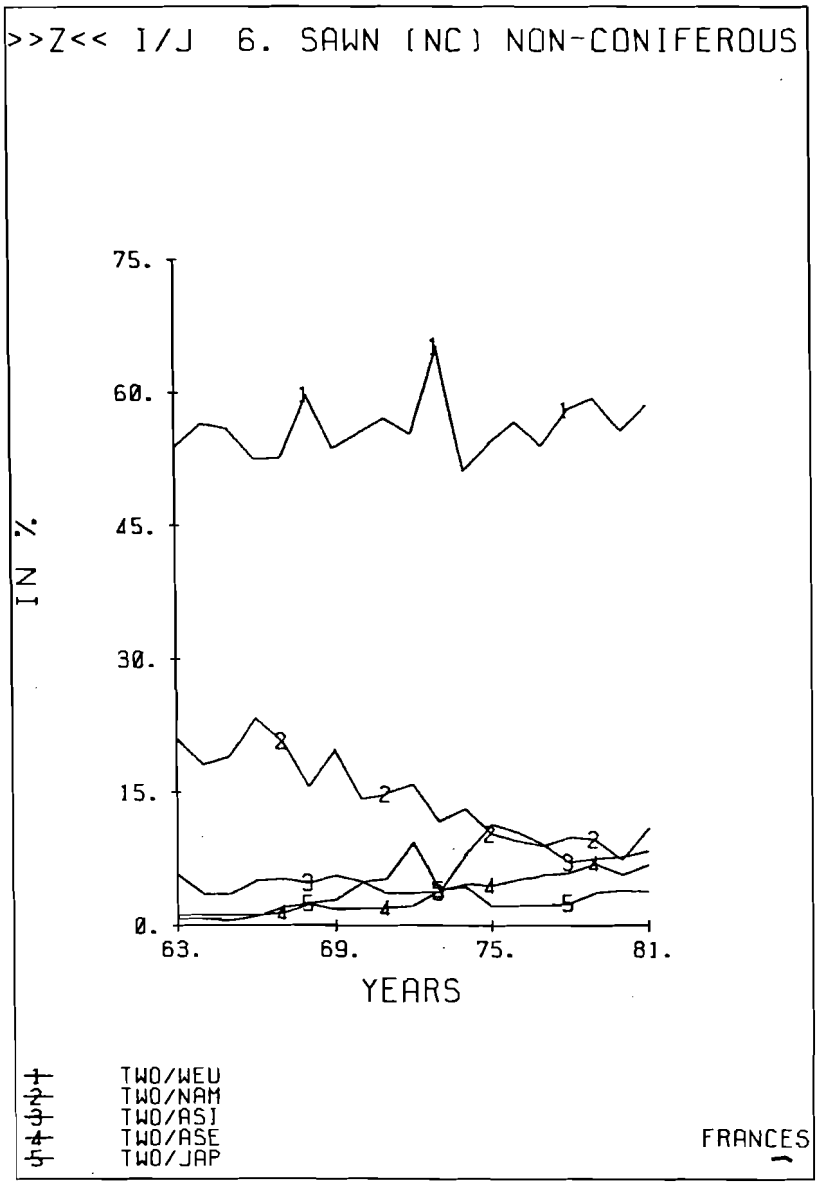

Figure 27. Share of world trade of major importers of Non-Coniferous Sawnwood.

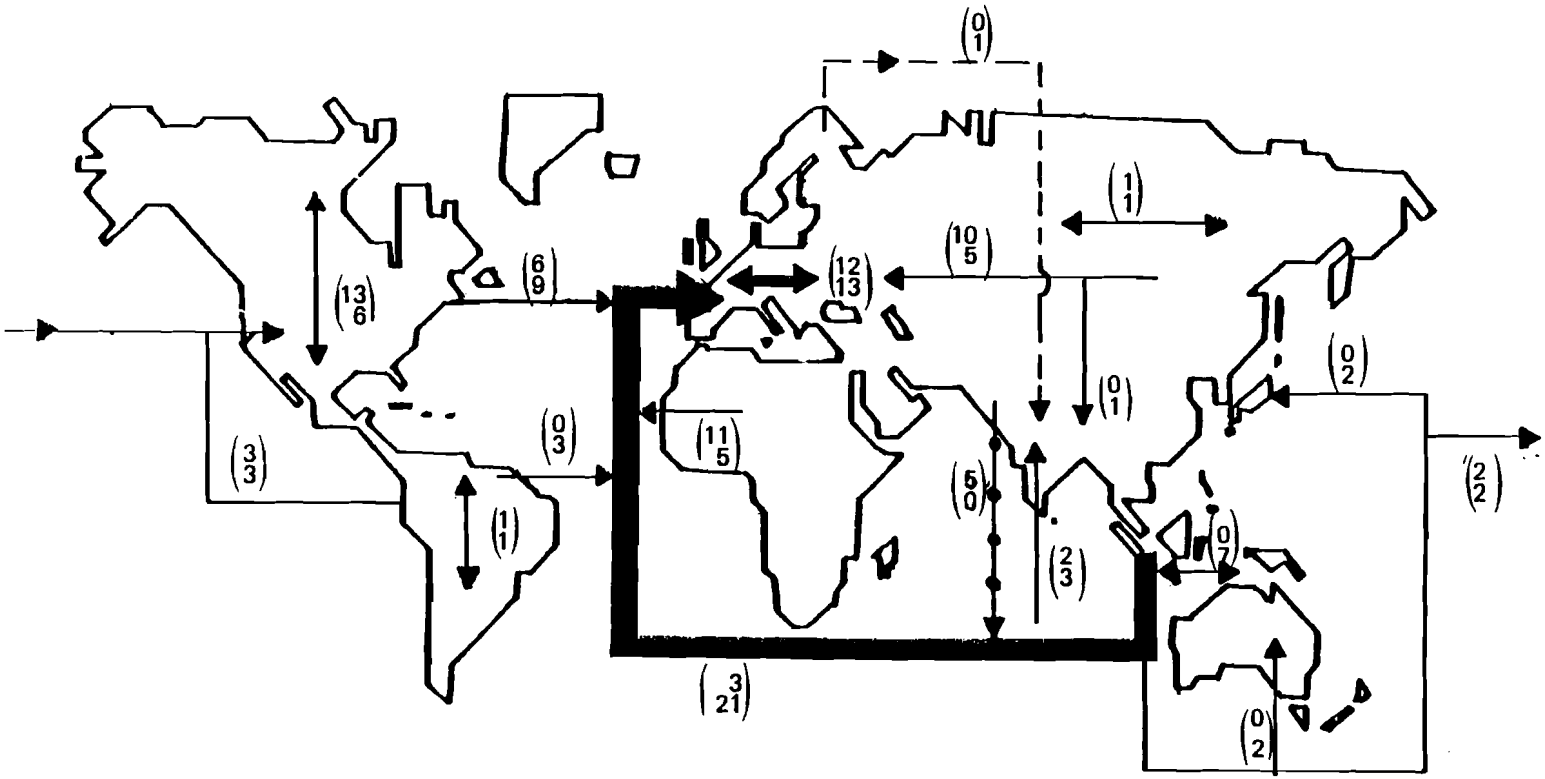

Figure 28. Non-Coniferous Sawnwood: bilateral trade flows ≥ 1% of world trade in 1981.

$\binom{1962}{1981}$ shares given

----- flow ≥ 1% only since the late seventies

—•—•— flow ≥ 5% in 1962, but negligible by 1981

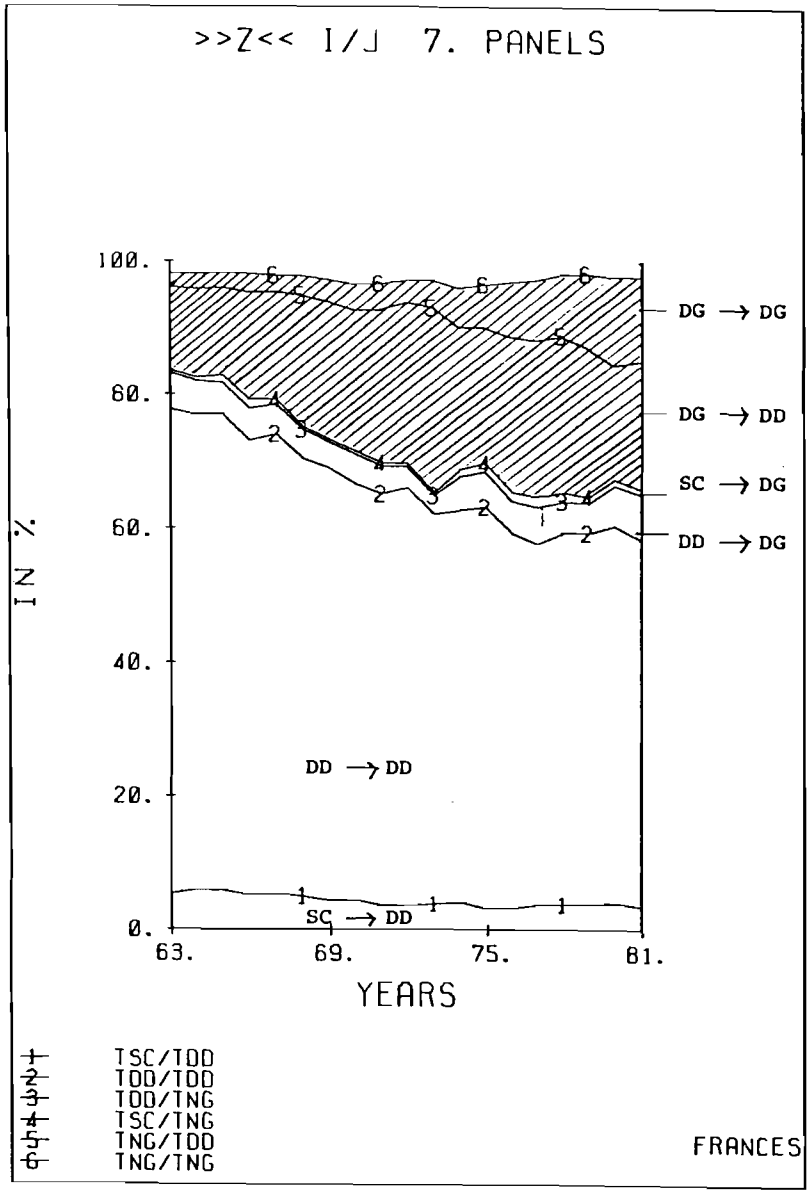

Figure 29. Cumulative share of world trade of flows of Panels between socialist, developed non-socialist and developing regions.

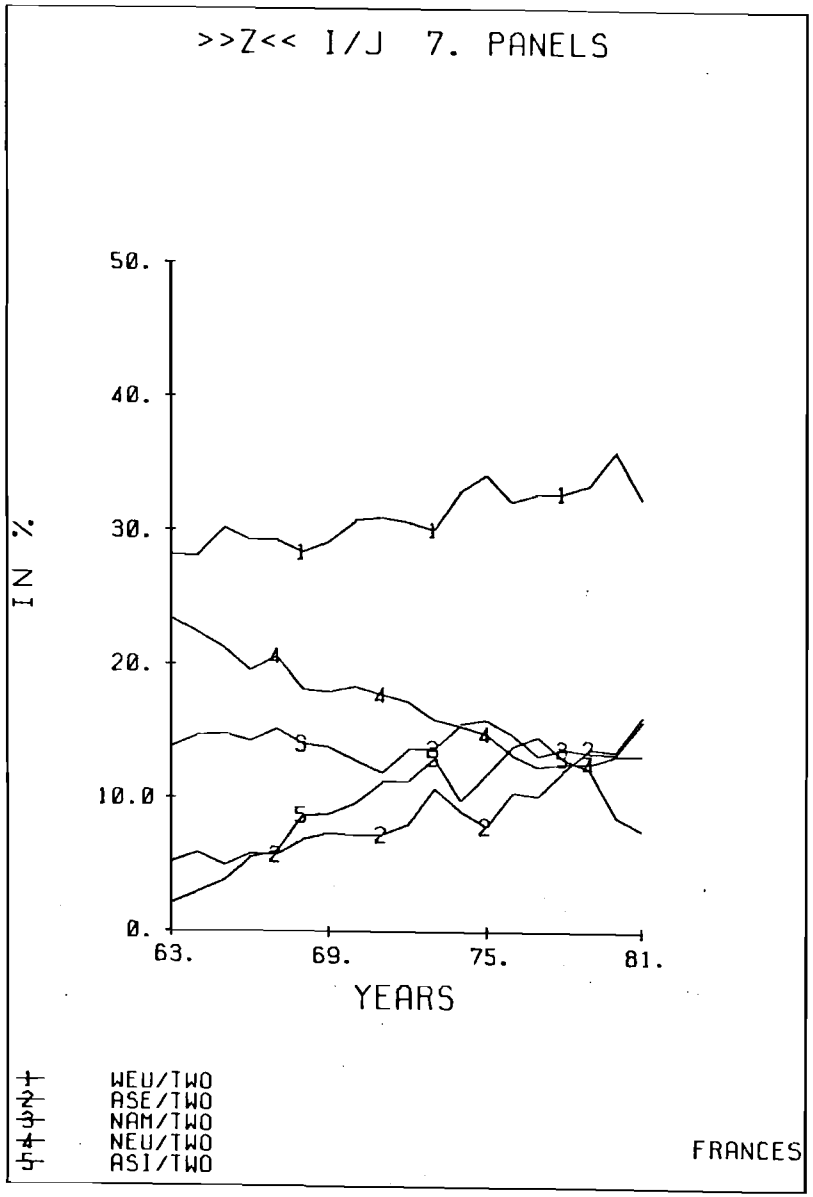

Figure 30. Share of world trade of major exporters of Panels.

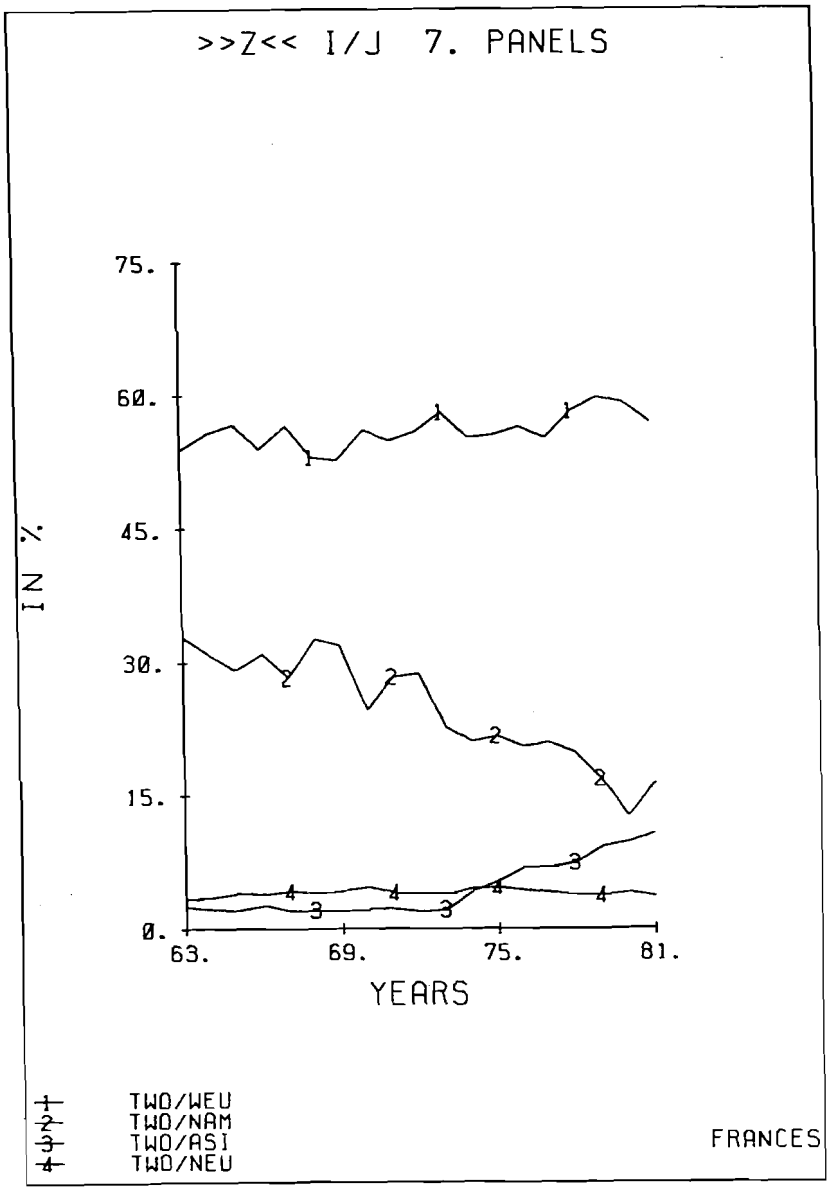

Figure 31. Share of world trade of major importers of Panels.

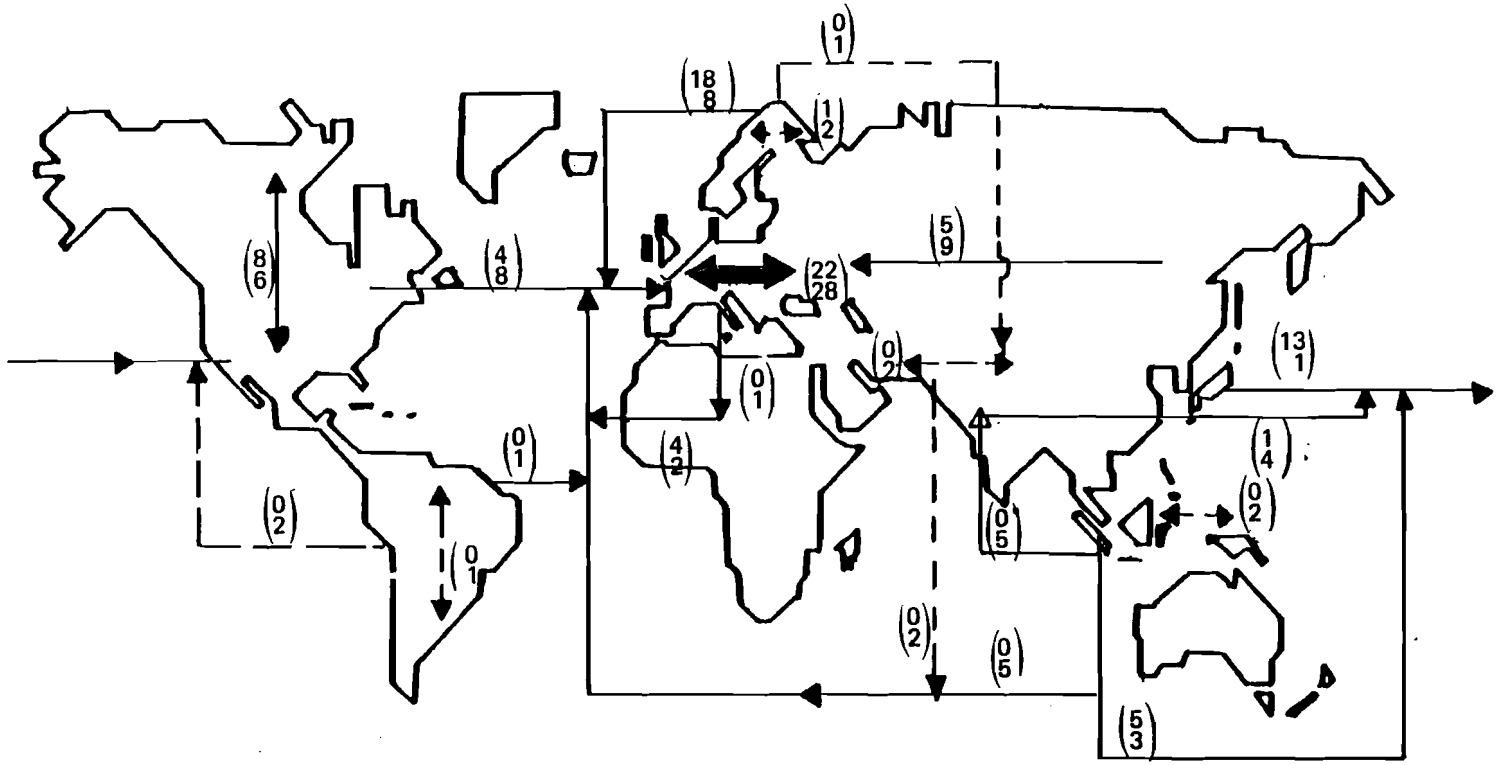

Figure 32. Panels: bilateral trade flows ≥ 1% of world trade in 1981.

$\binom{1962}{1981}$ shares given

----- flow ≥ 1% only since the late seventies

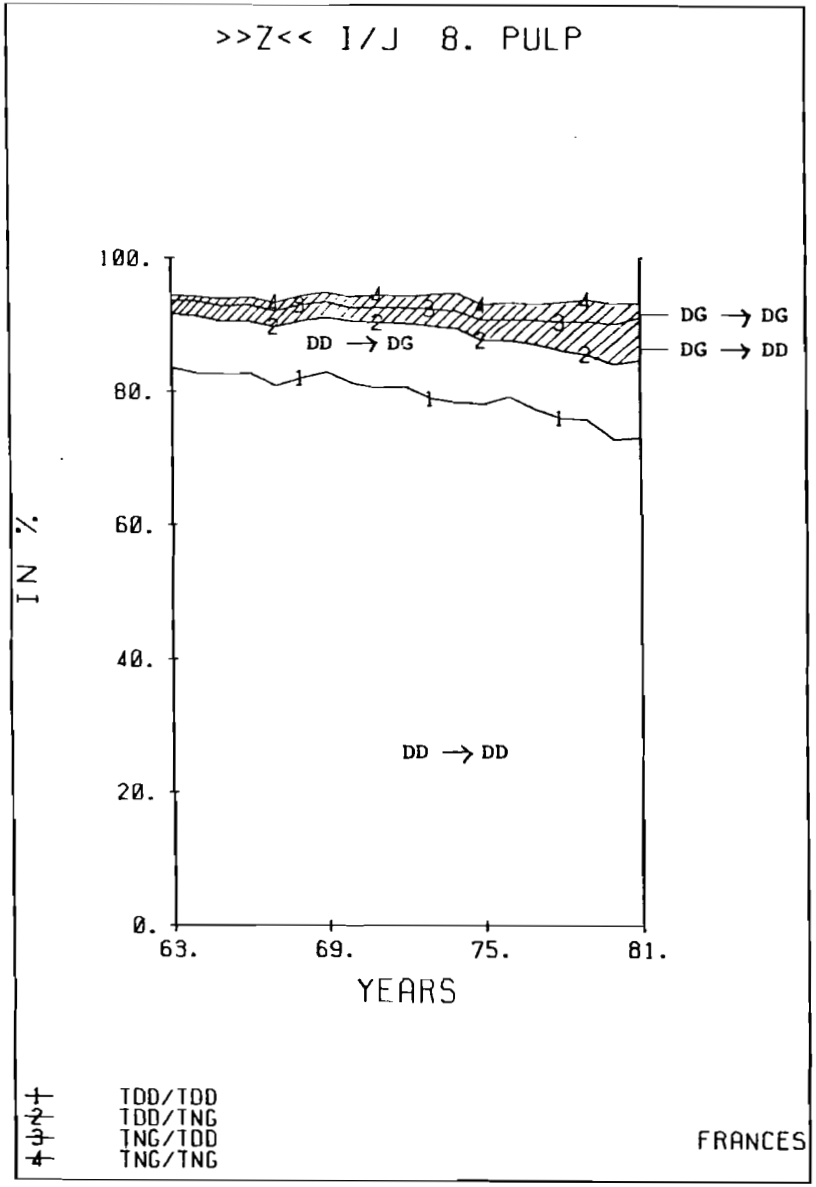

Figure 33. Cumulative share of world trade of flows of Pulp between developed non-socilaist, and developing regions.

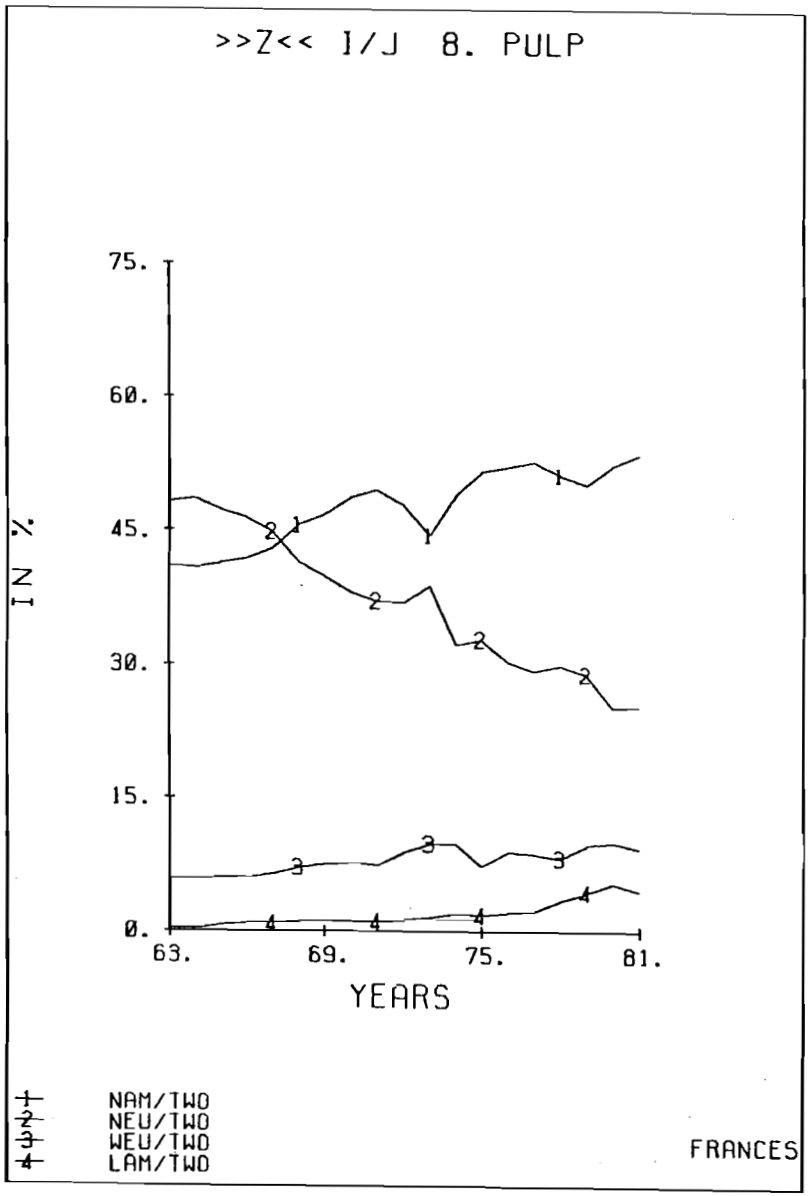

Figure 34. Shares of world trade of major exporters of Pulp.

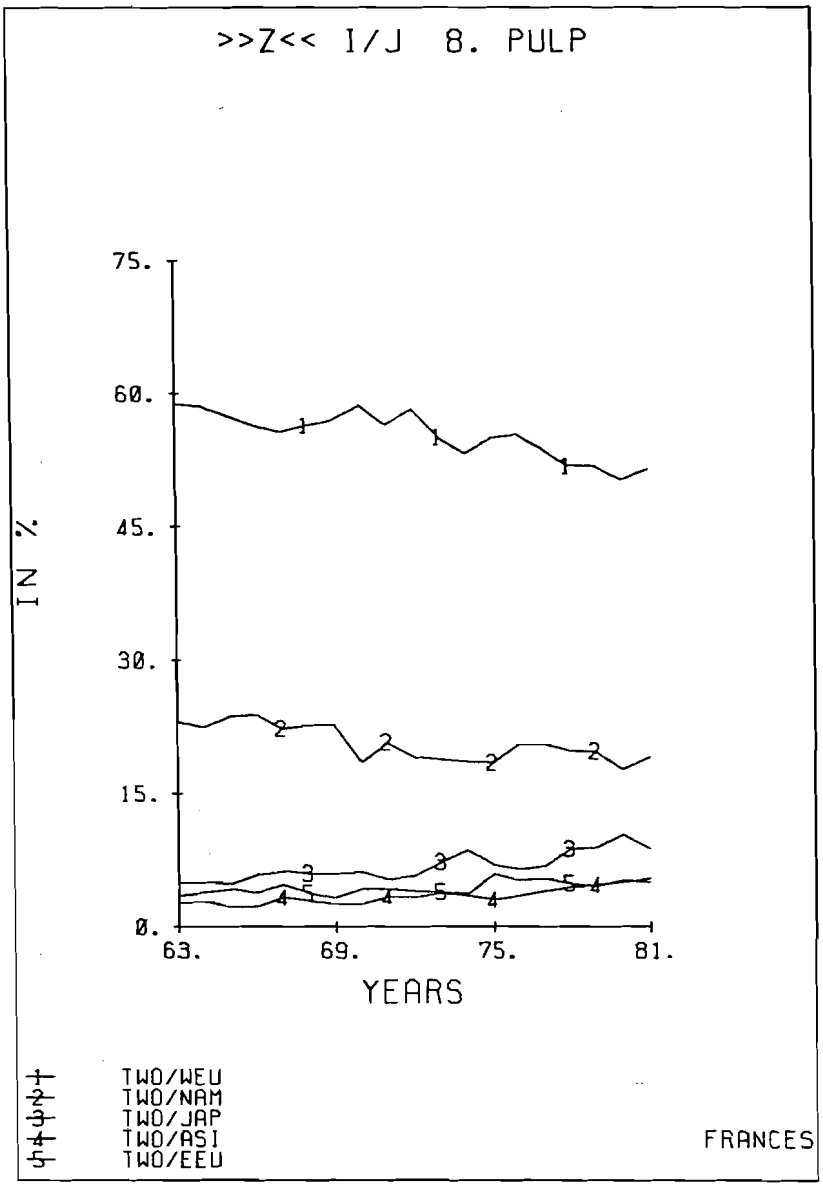

Figure 35. Shares of world trade of major importers of Pulp.

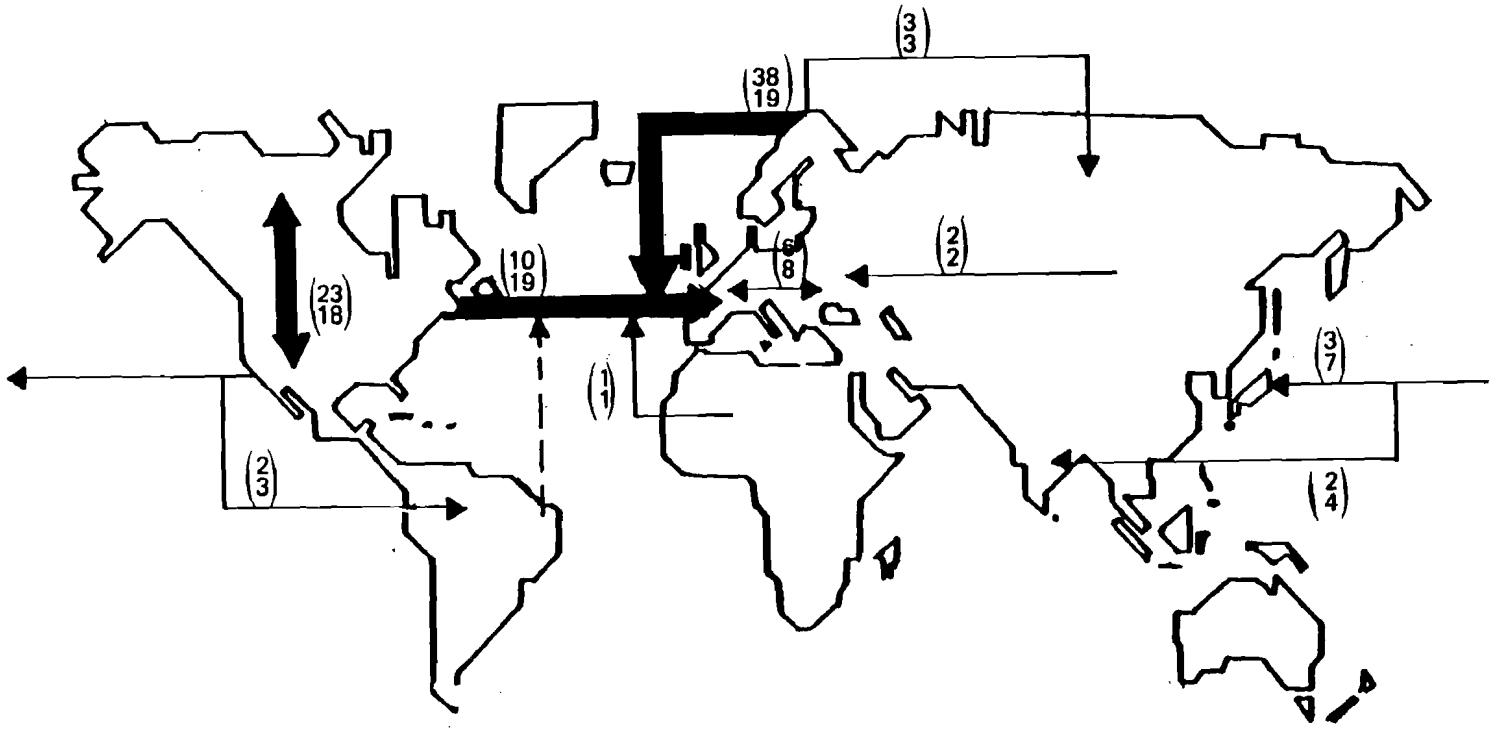

Figure 36. Pulp: bilateral trade flows ≥ 1% of world trade in 1981.

$\binom{1962}{1982}$ shares given

----- flow ≥ 1% only since the late seventies

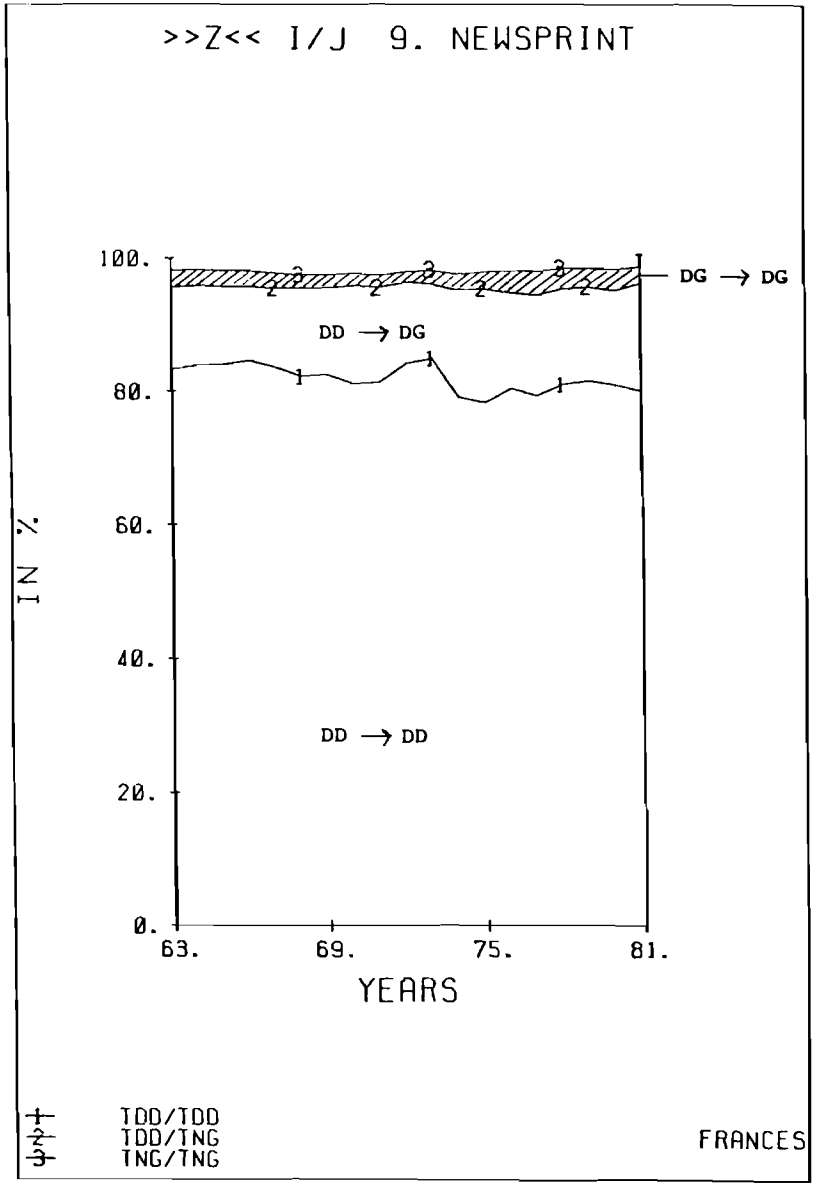

Figure 37. Cumulative share of world trade of flows of Newsprint between developed (non-socialist) and developing regions.

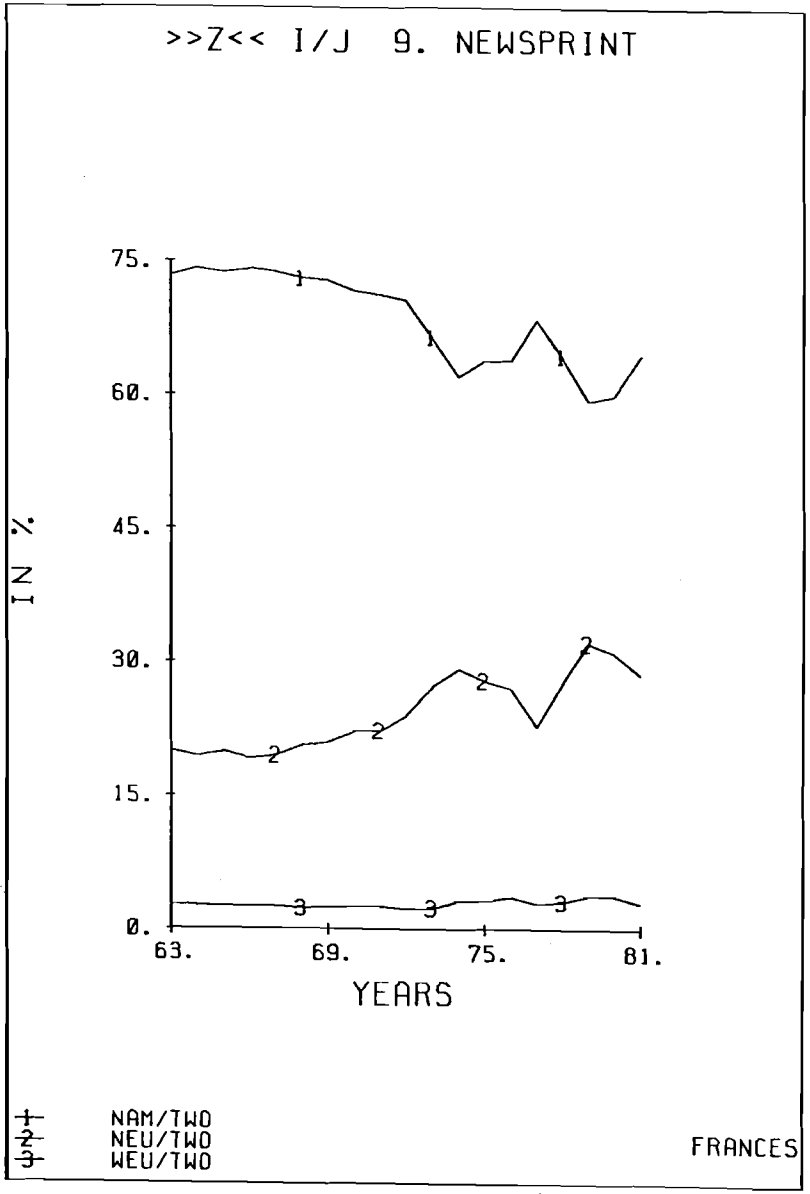

Figure 38. Share of world trade of major exporters of Newsprint.

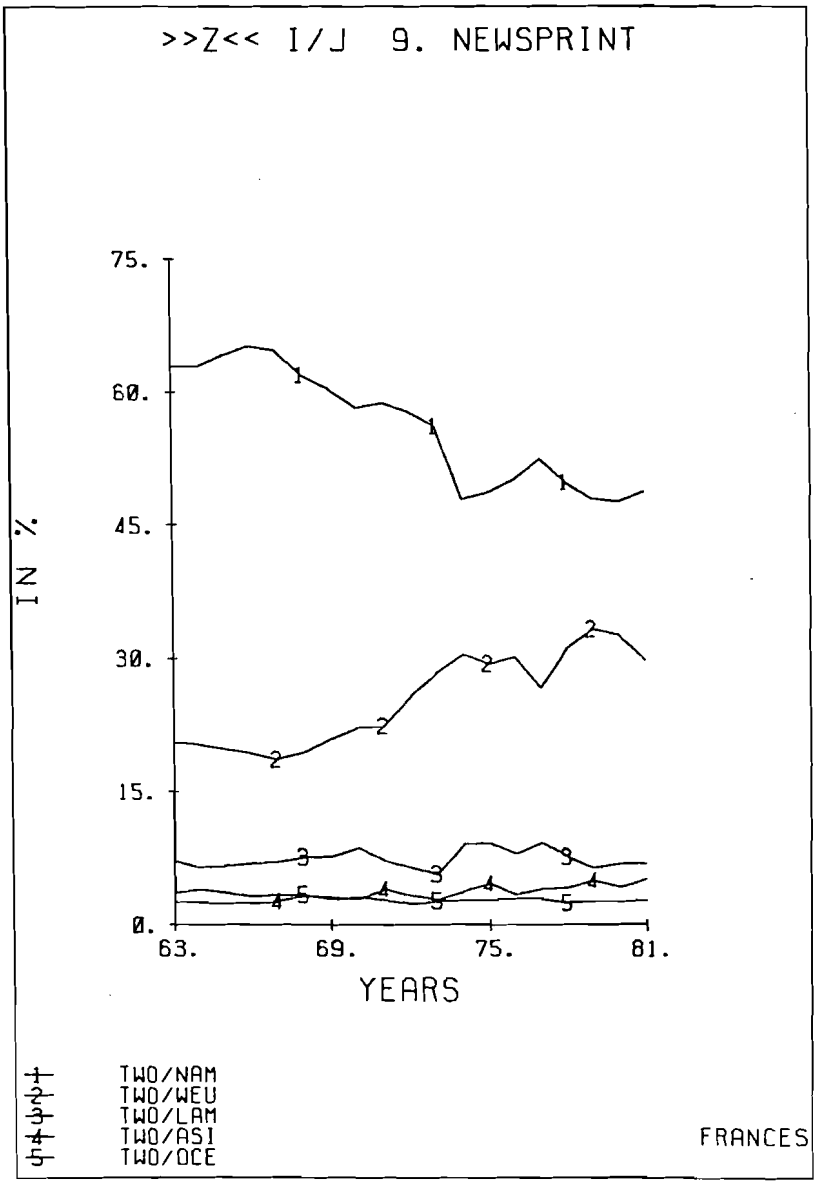

Figure 39. Share of world trade of major importers of Newsprint.

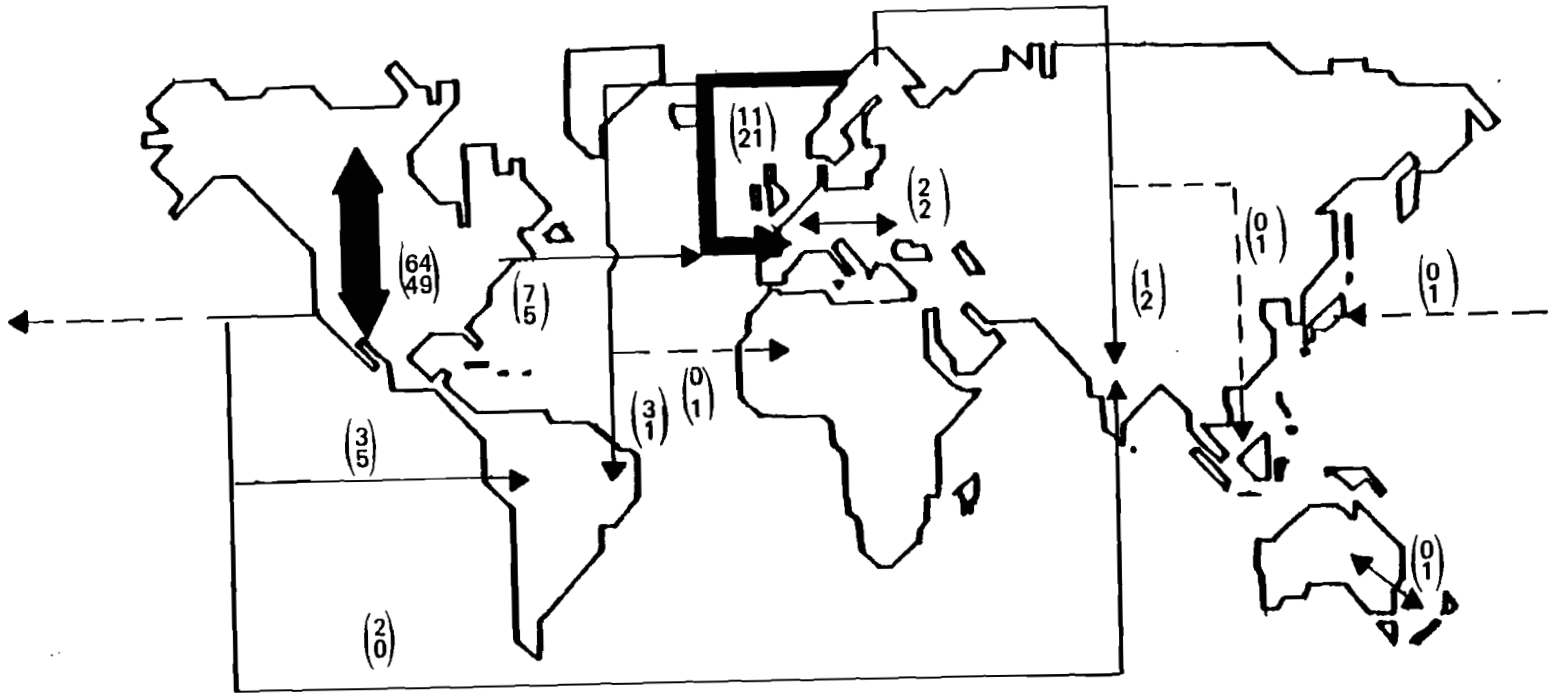

Figure 40. Newsprint: bilateral trade flows ≥ 1% of world trade in 1981.

$\binom{1962}{1981}$ shares given

----- flow ≥ 1% only since the late seventies

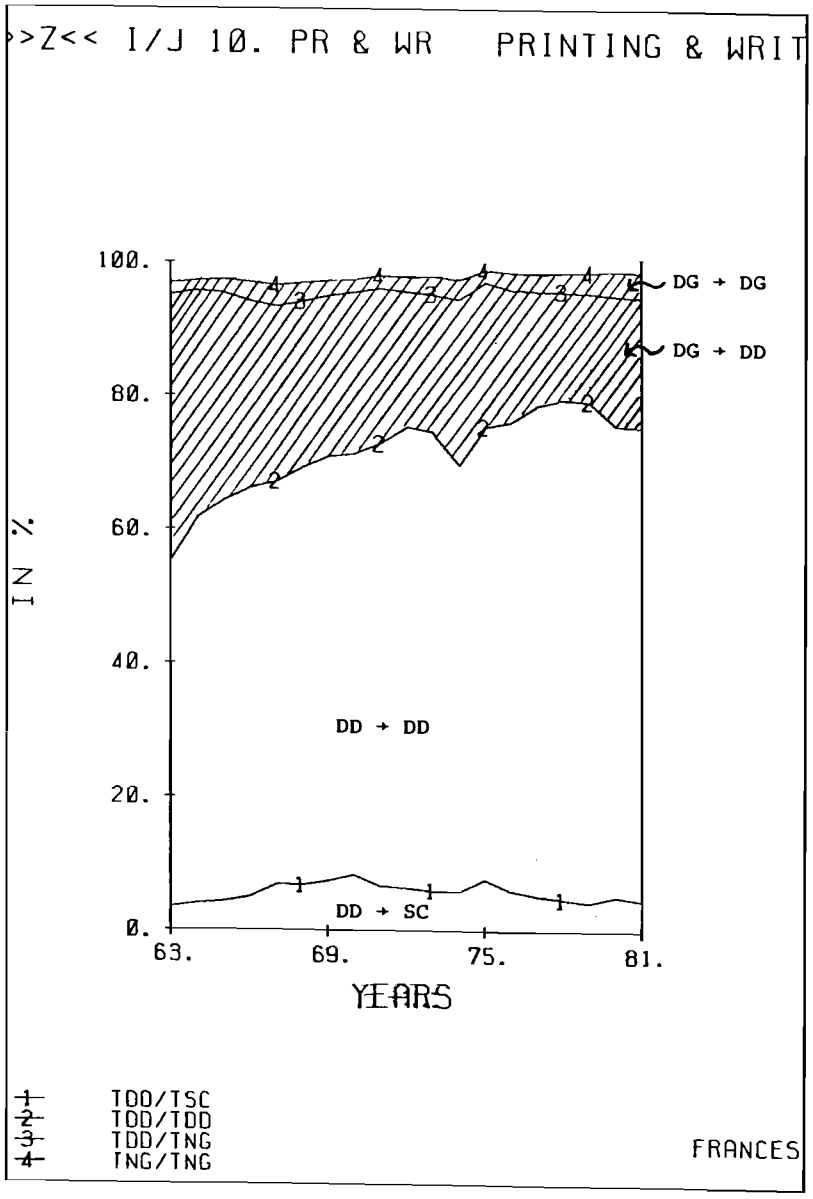

Figure 41. Cumulative share of world trade of "other printing and writing paper" flows between developed (non-socialist), socialist, and developing regions.

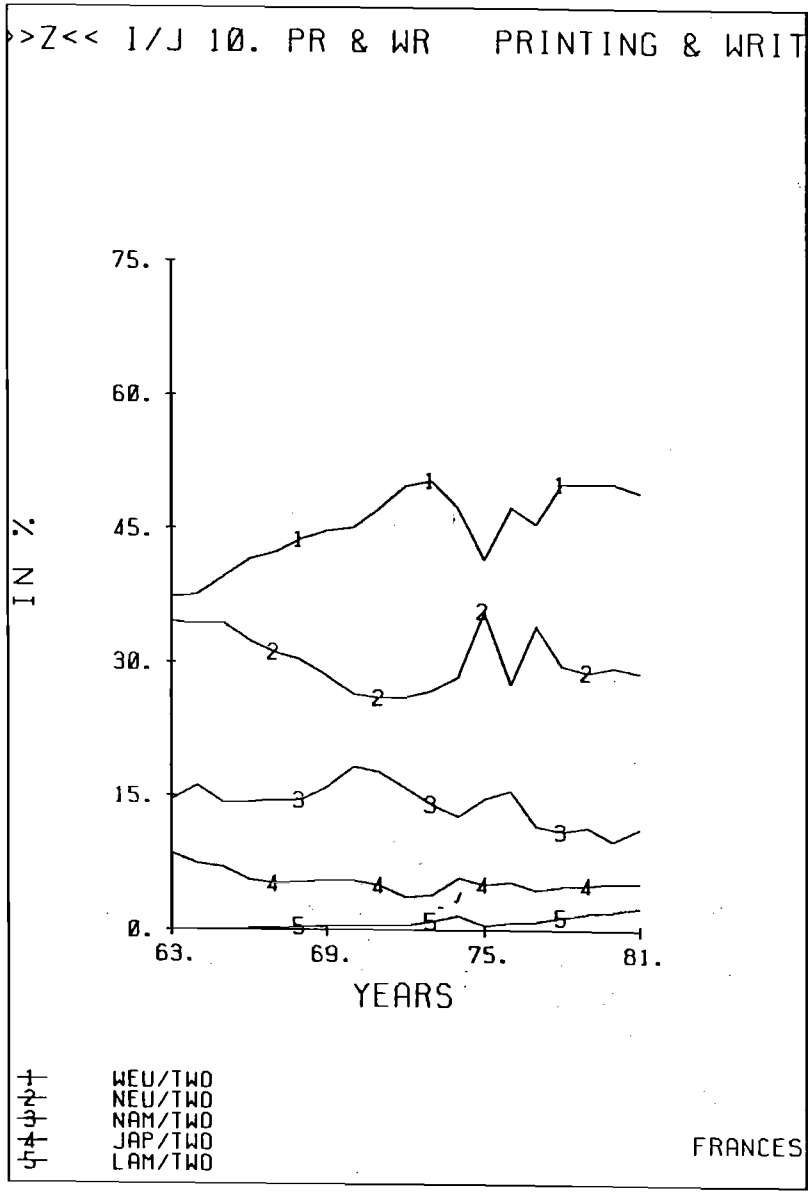

Figure 42. Share of world trade of major exporters of "other printing and writing paper".

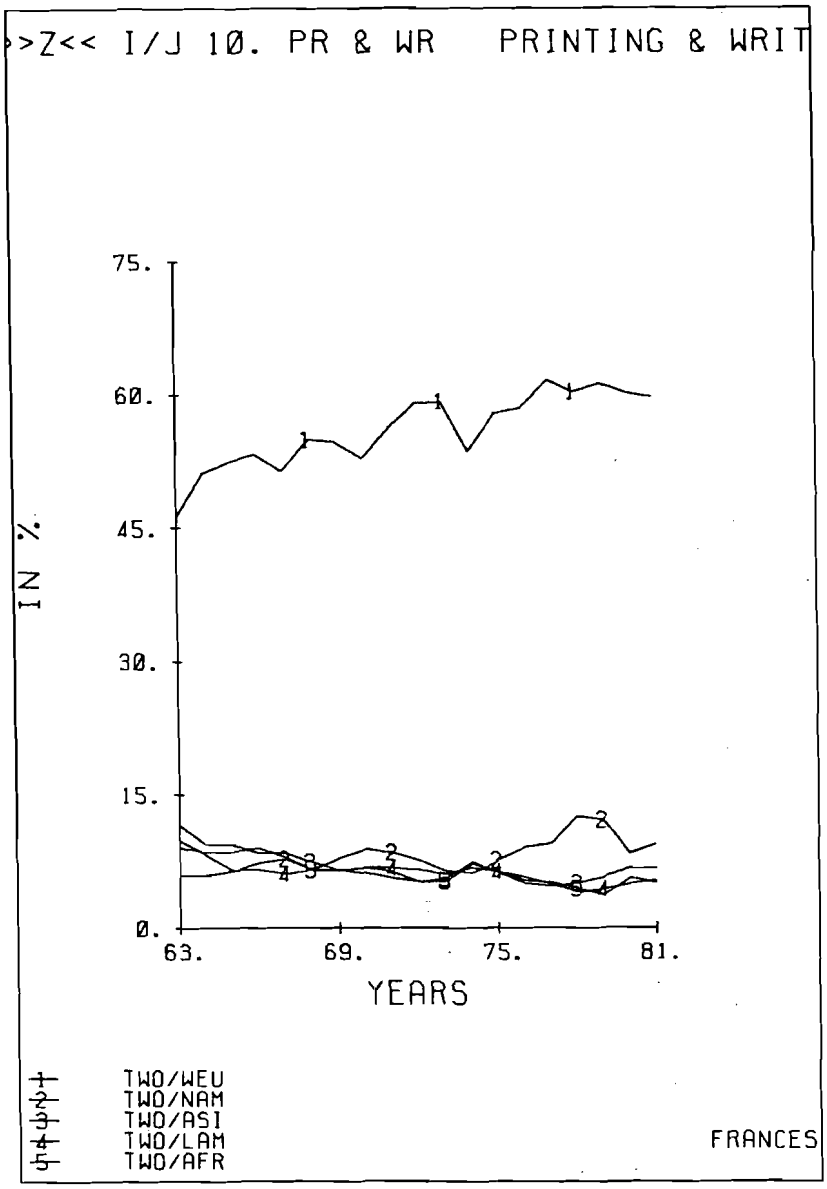

Figure 43. Share of world trade of major importers of "other printing and writing paper".

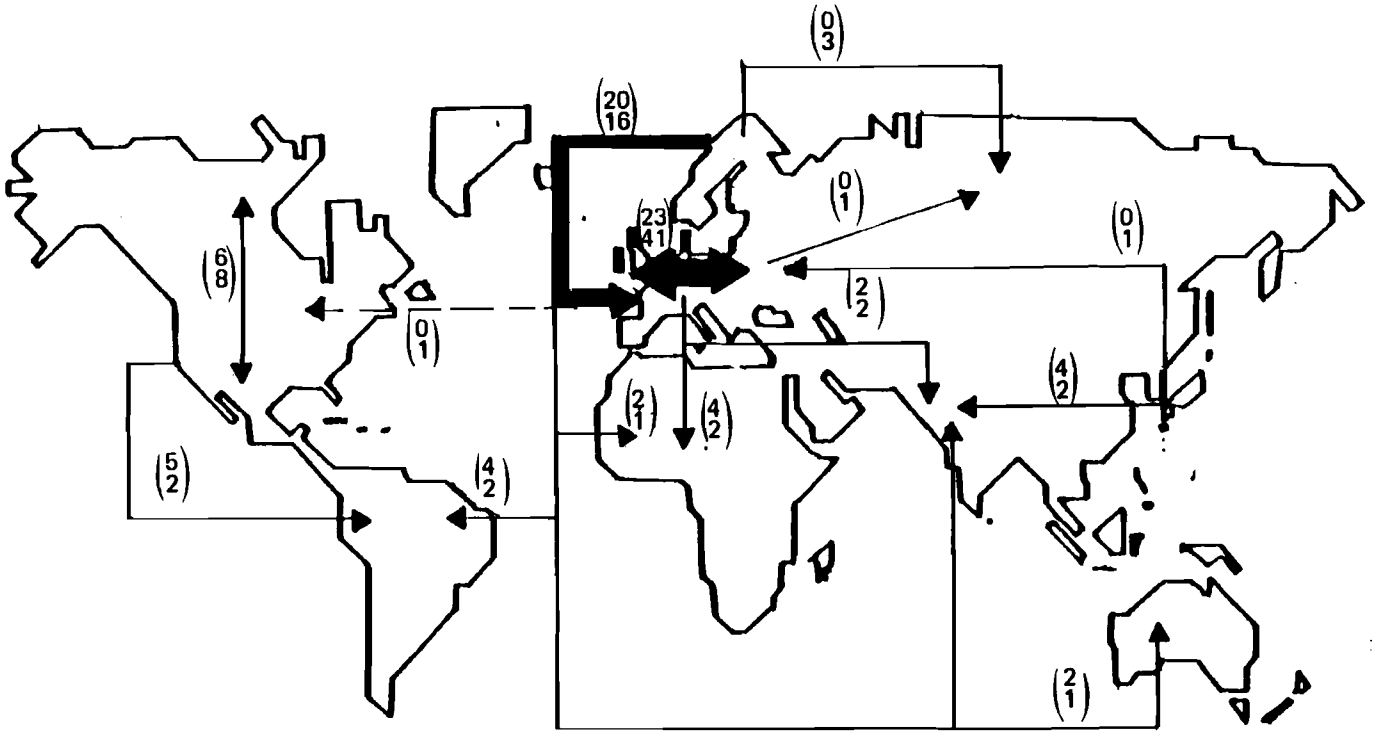

Figure 44. Other printing and writing paper: bilateral trade flows ≥ 1% of world trade in 1981.

$\binom{1962}{1982}$ shares given

----- flow ≥ 1% only since the late seventies

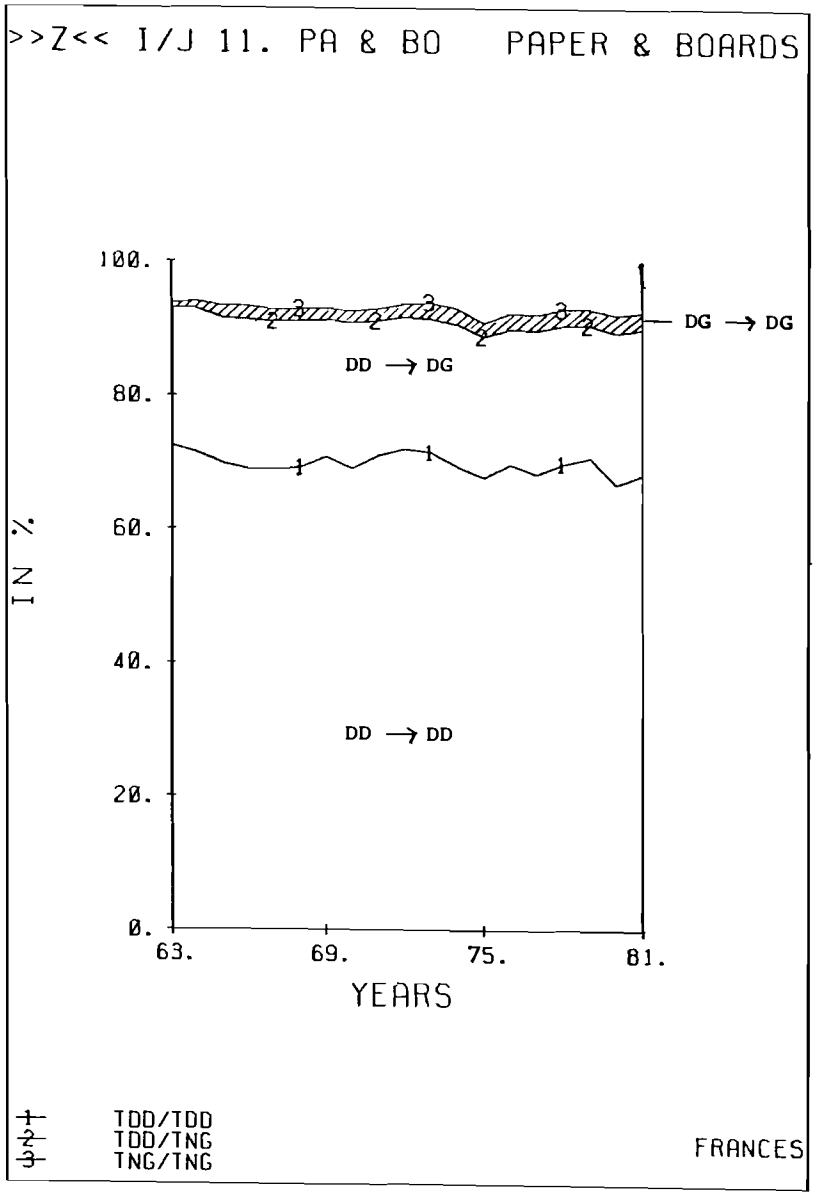

Figure 45. Cumulative share of world trade of "other paper and boards" flows between developed (non-socialist) and developing regions.

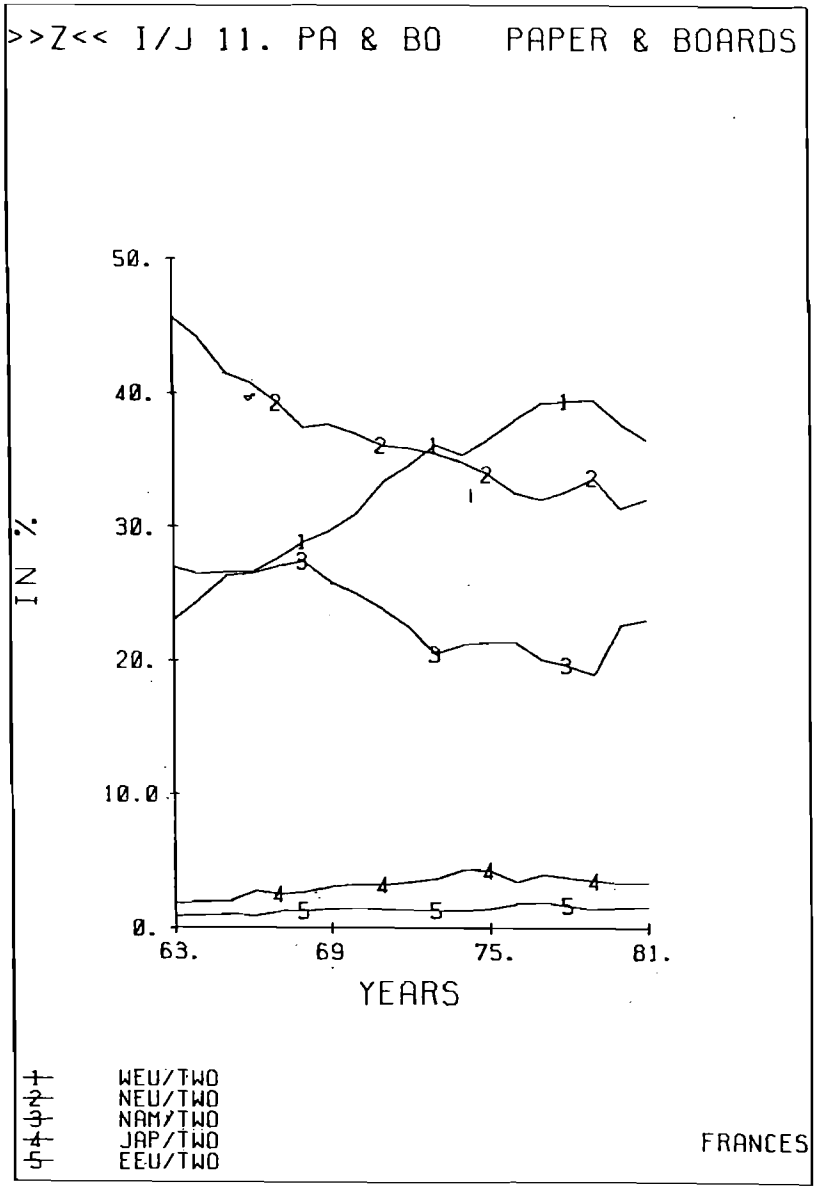

Figure 46. Share of world trade of major exporters of "other paper and boards".

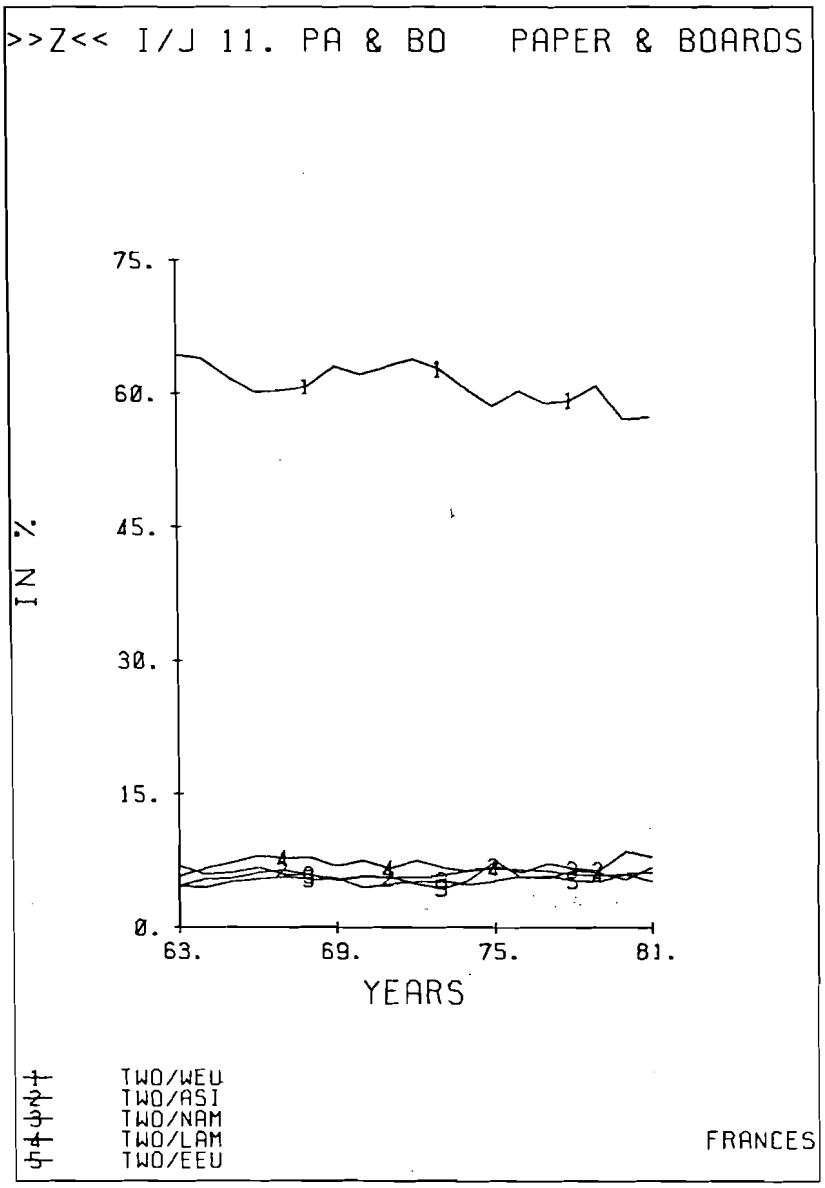

Figure 47. Share of world trade of major importers of "other paper and boards".

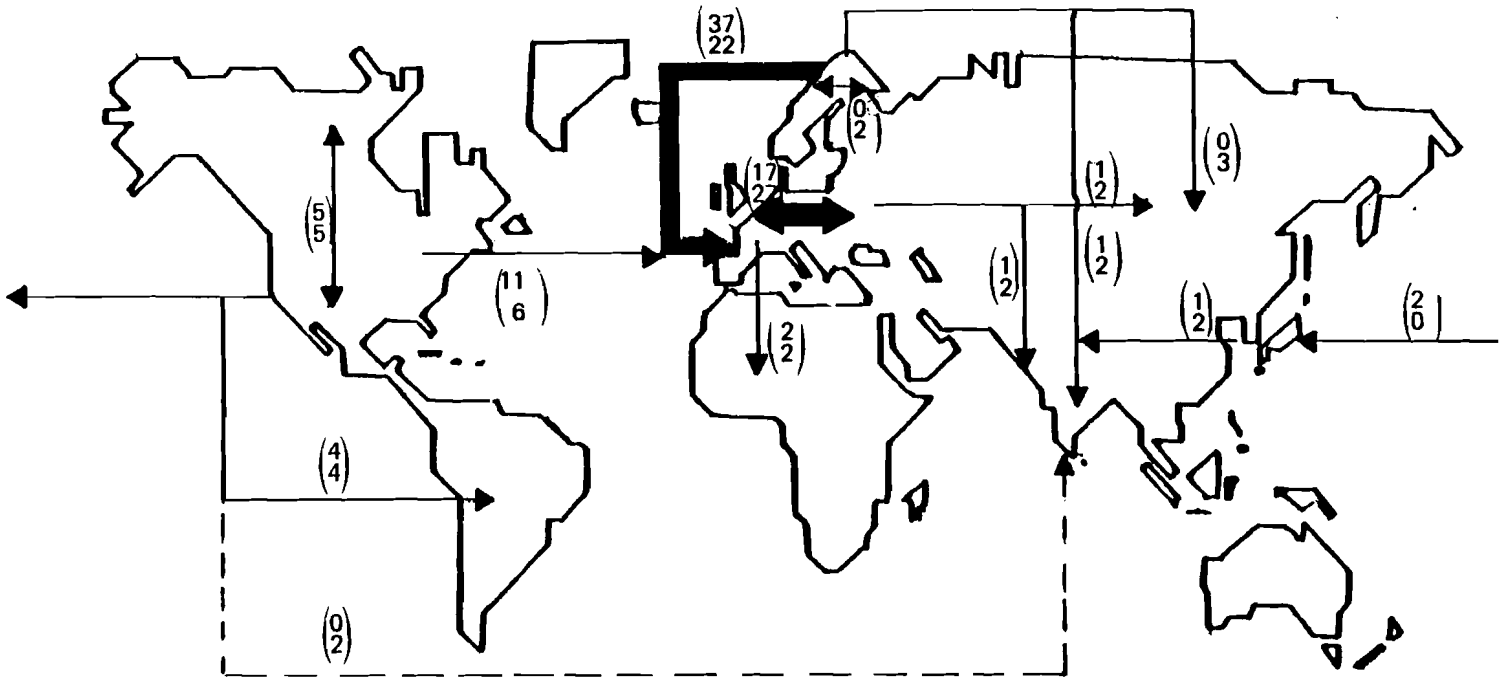

Figure 48. Other paper and board: bilateral trade flows ≥ 1.5% of world trade in 1981.

$\binom{1962}{1982}$ shares given

----- ≥ 1% only since the late seventies

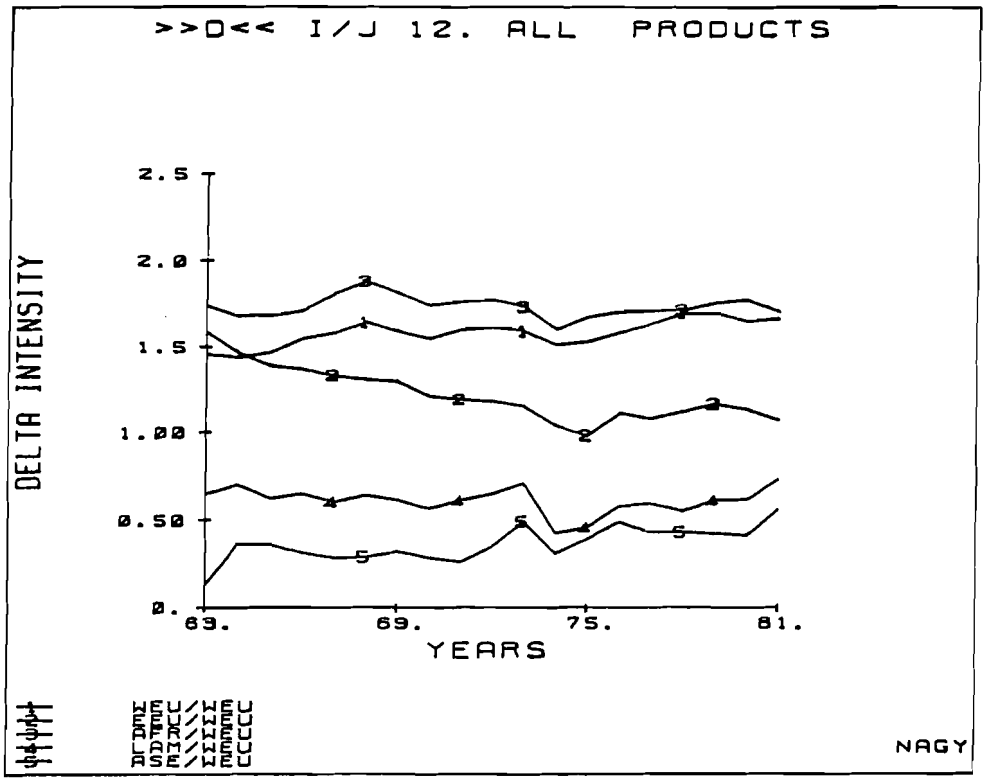

Figure 49. Trade intensities of Western European imports of forest products.

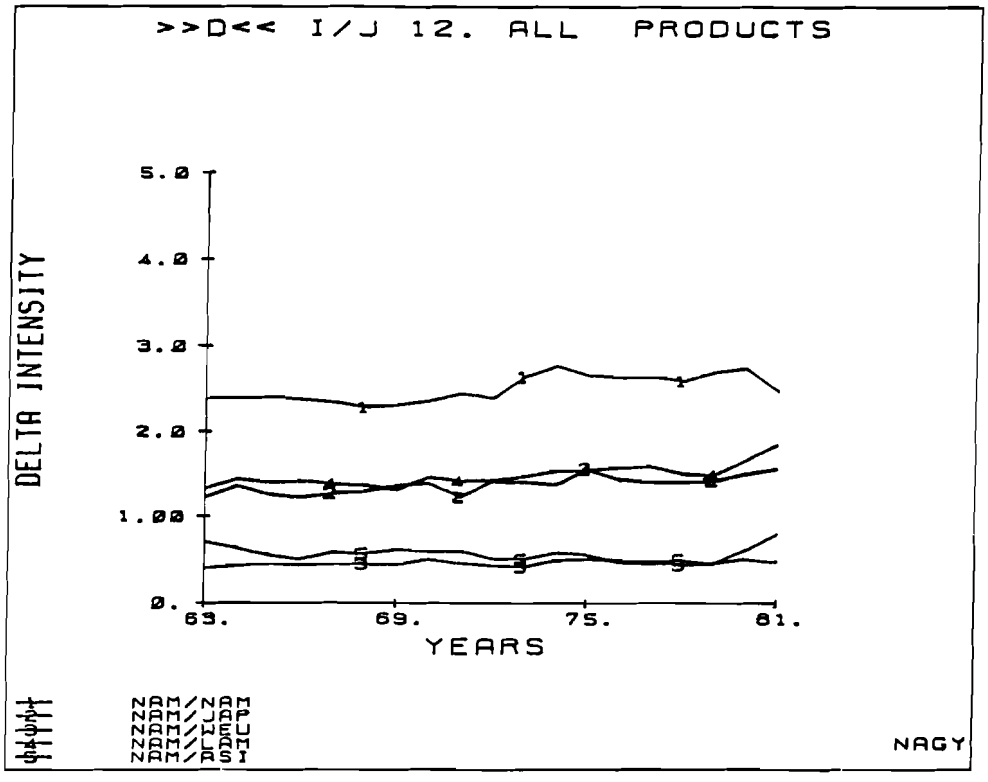

Figure 50. Trade intensities of North American exports of all forest products.

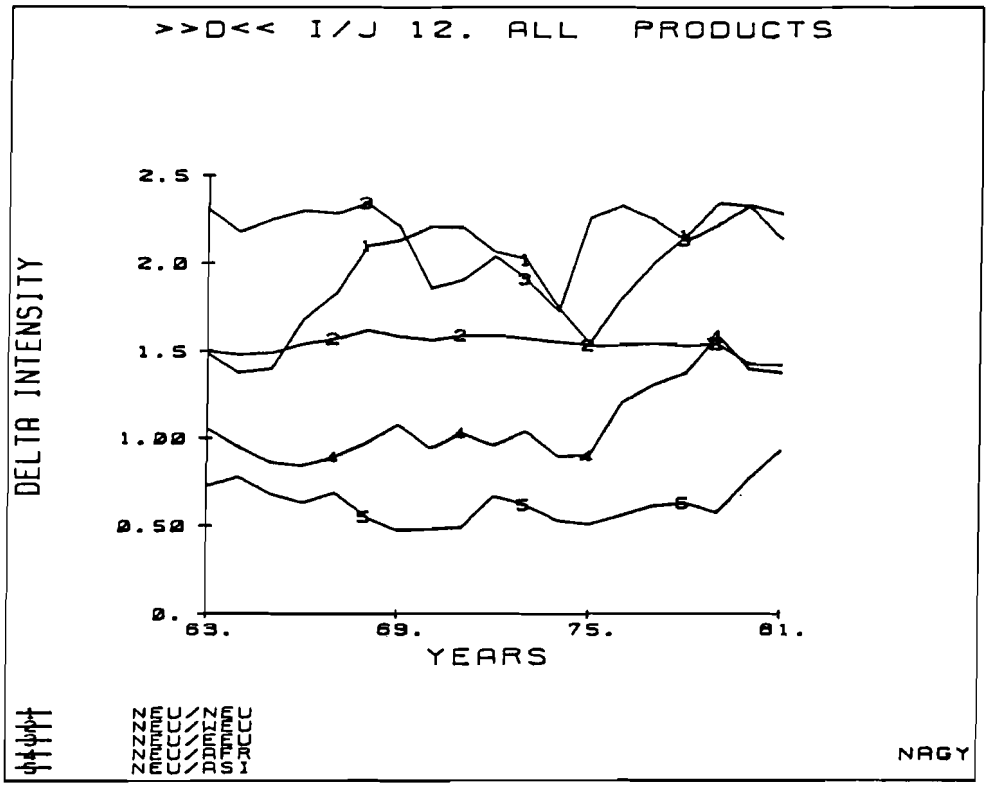

Figure 51. Trade intensities of North European exports of all forest products.

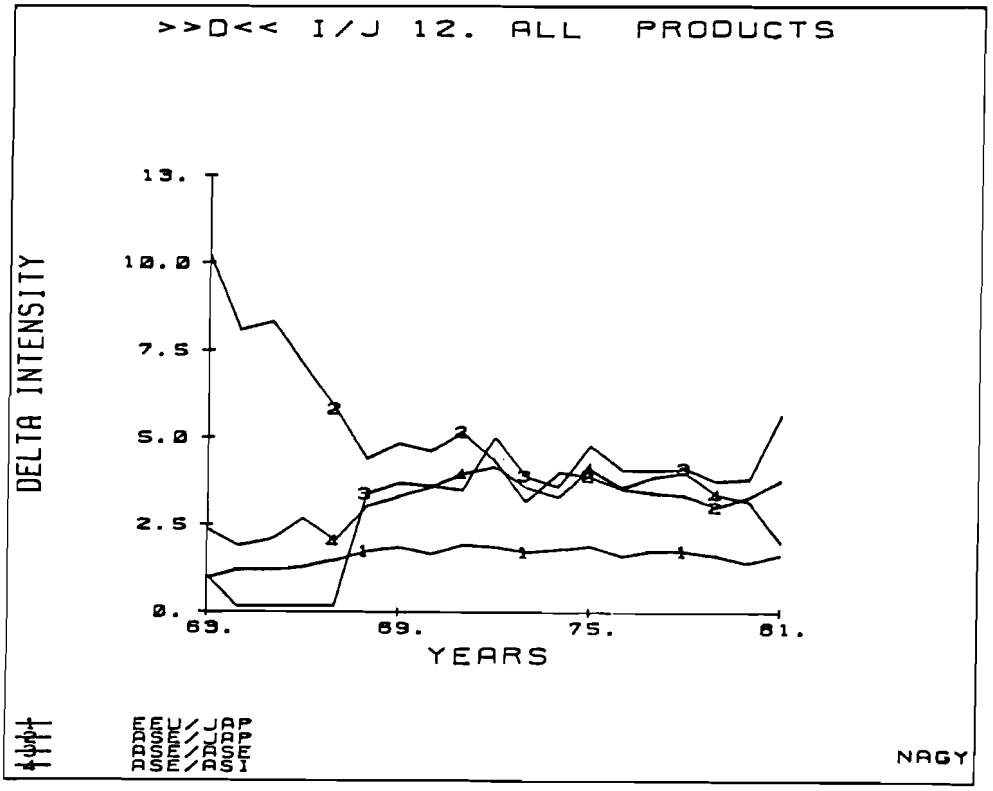

Figure 52. Trade intensities of selected flows of all forest products.

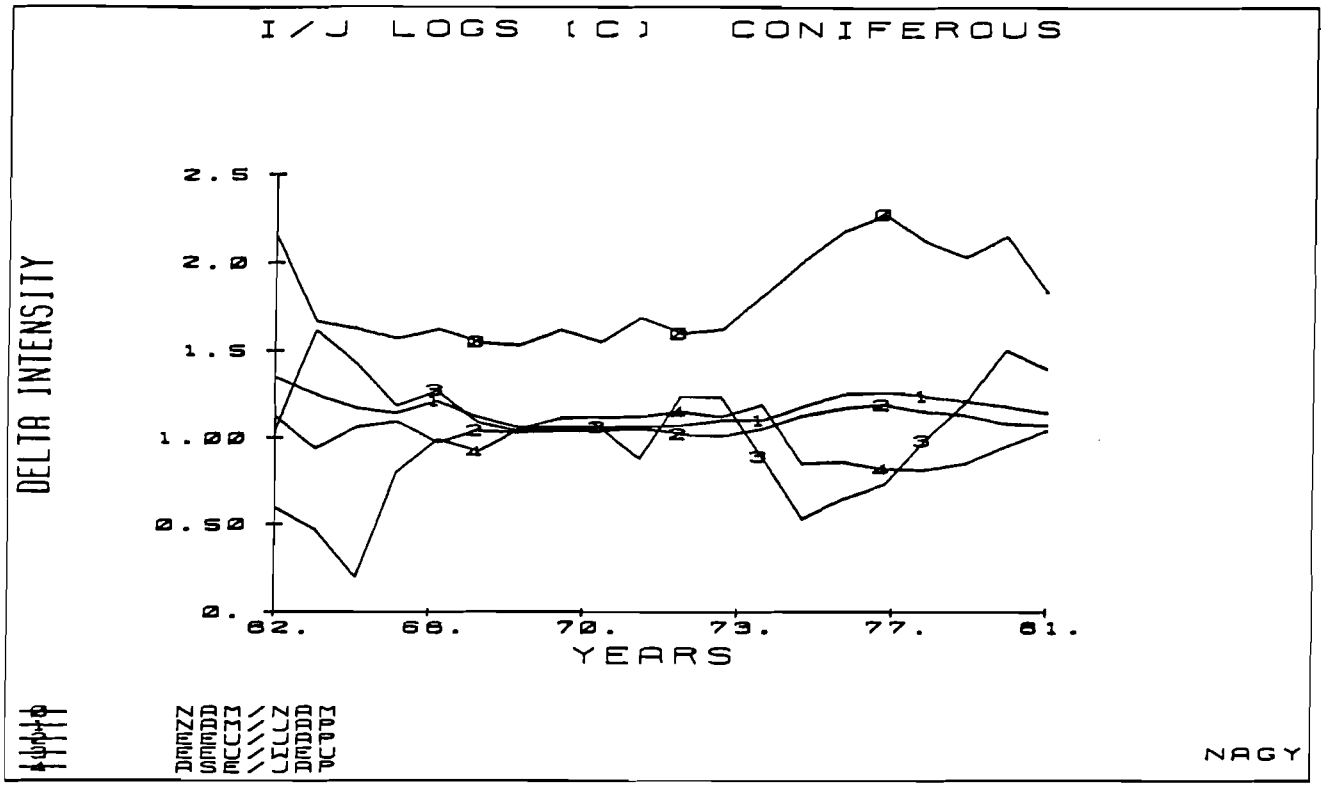

Figure 53. Trade intensities of major flows of Coniferous Logs.

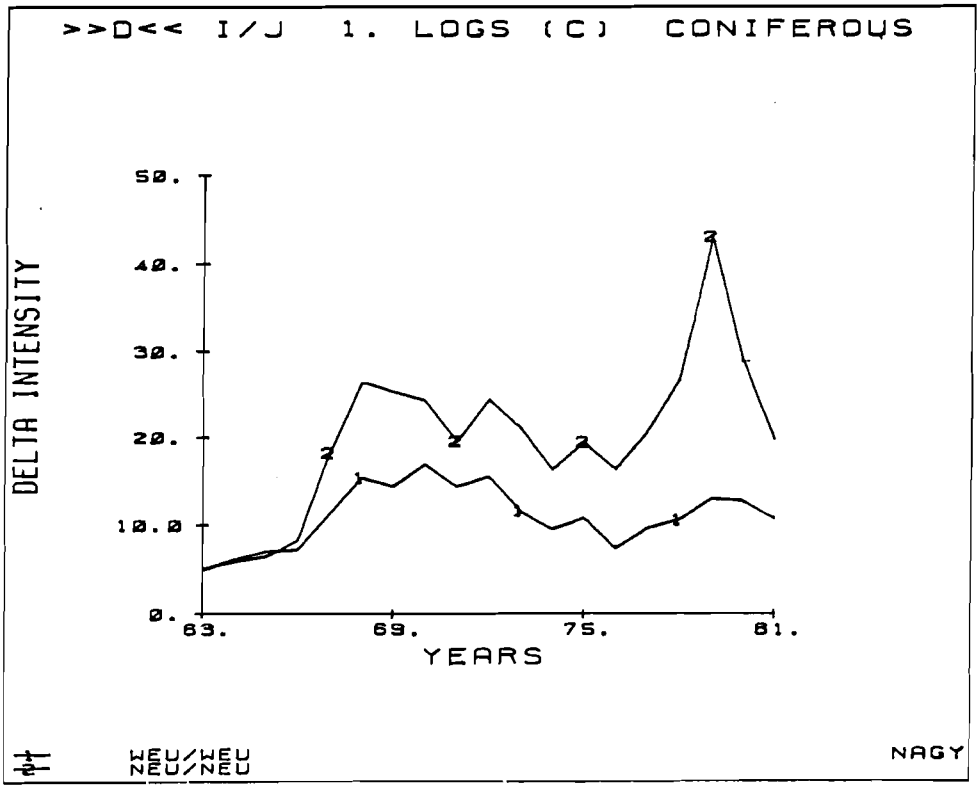

Figure 54. Trade intensities of intra-regional trade of Coniferous Logs in Northern and Western Europe.

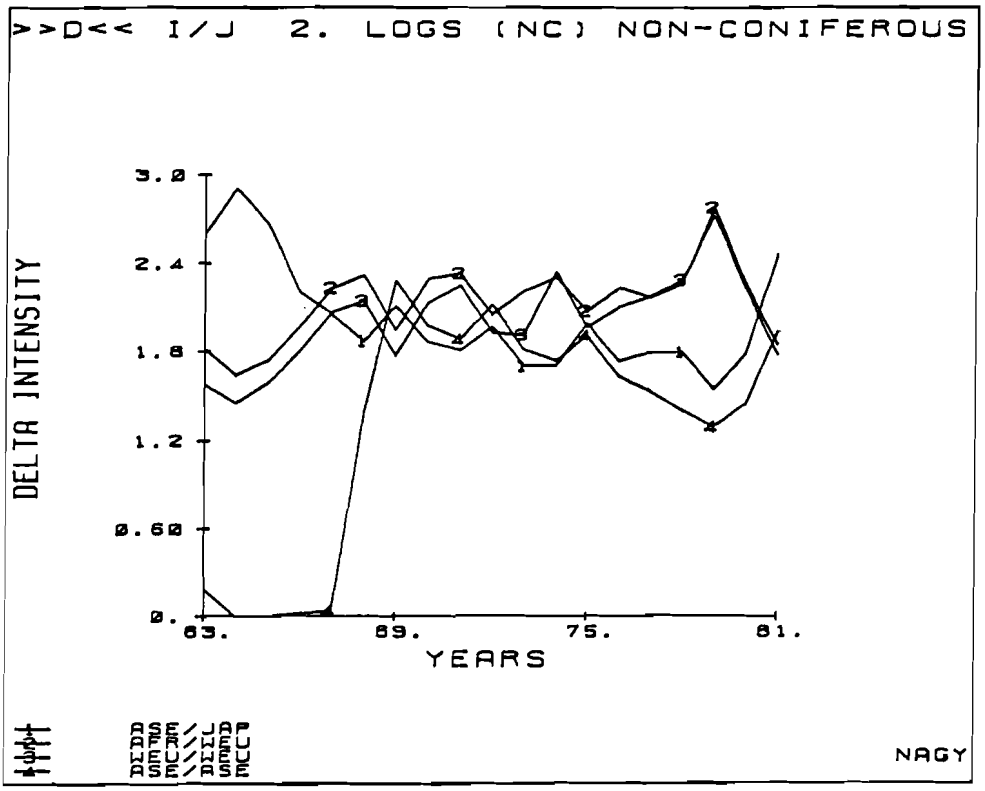

Figure 55. Trade intensities of major flows of Non-Coniferous Logs.

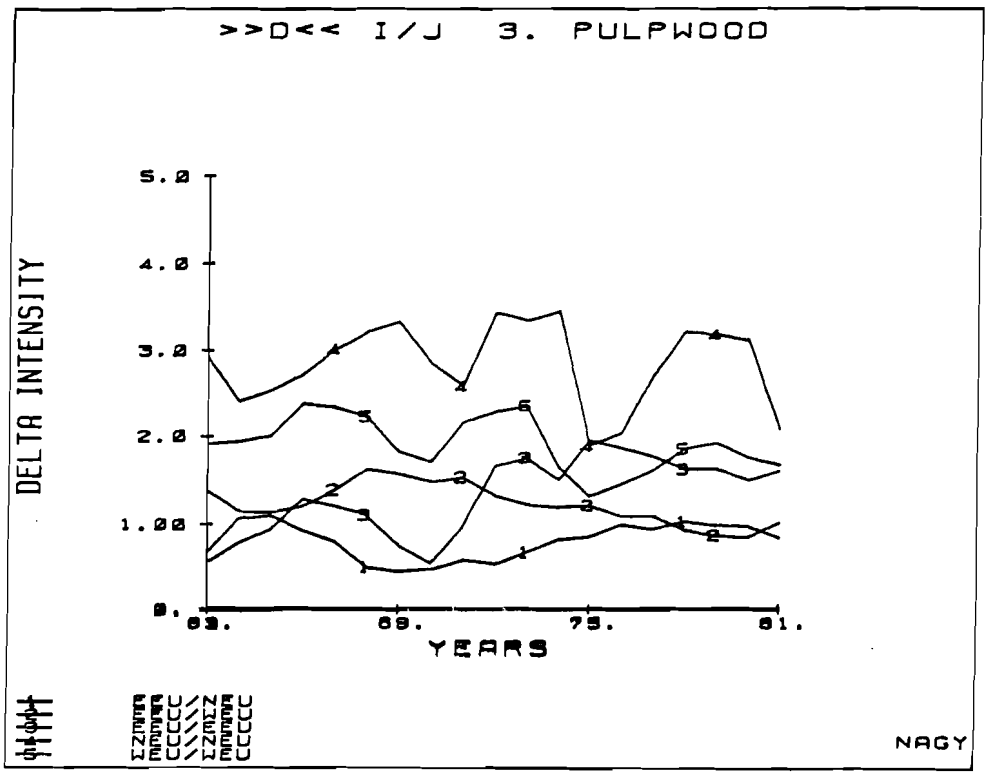

Figure 56. Trade intensities of major flows of Pulpwood.

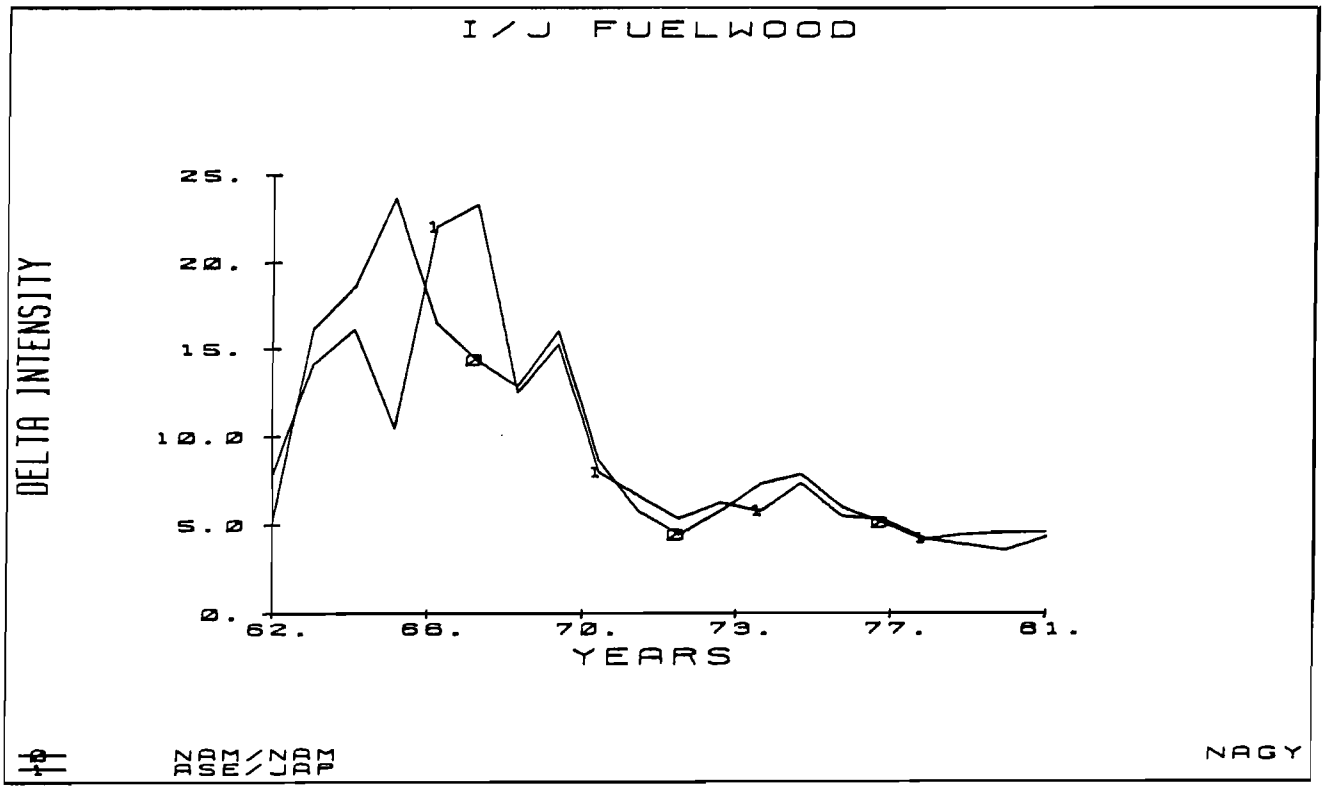

Figure 57. Trade intensities of major flows of Fuelwood.

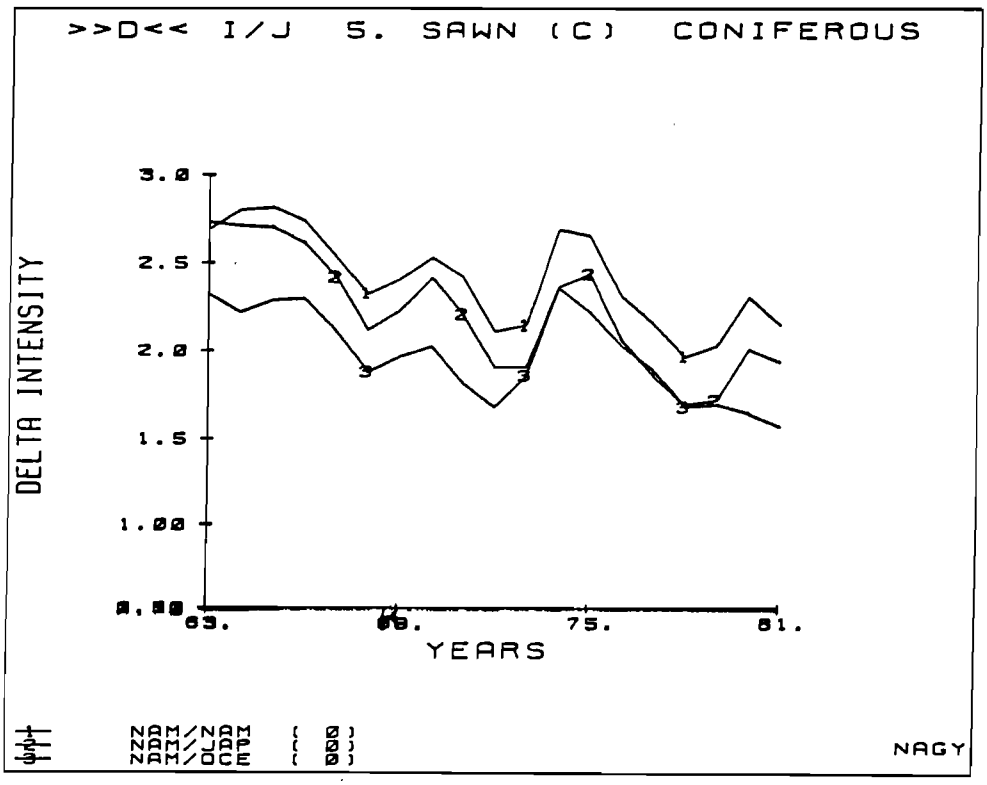

Figure 58. Trade intensities of North American exports of Coniferous Sawnwood.

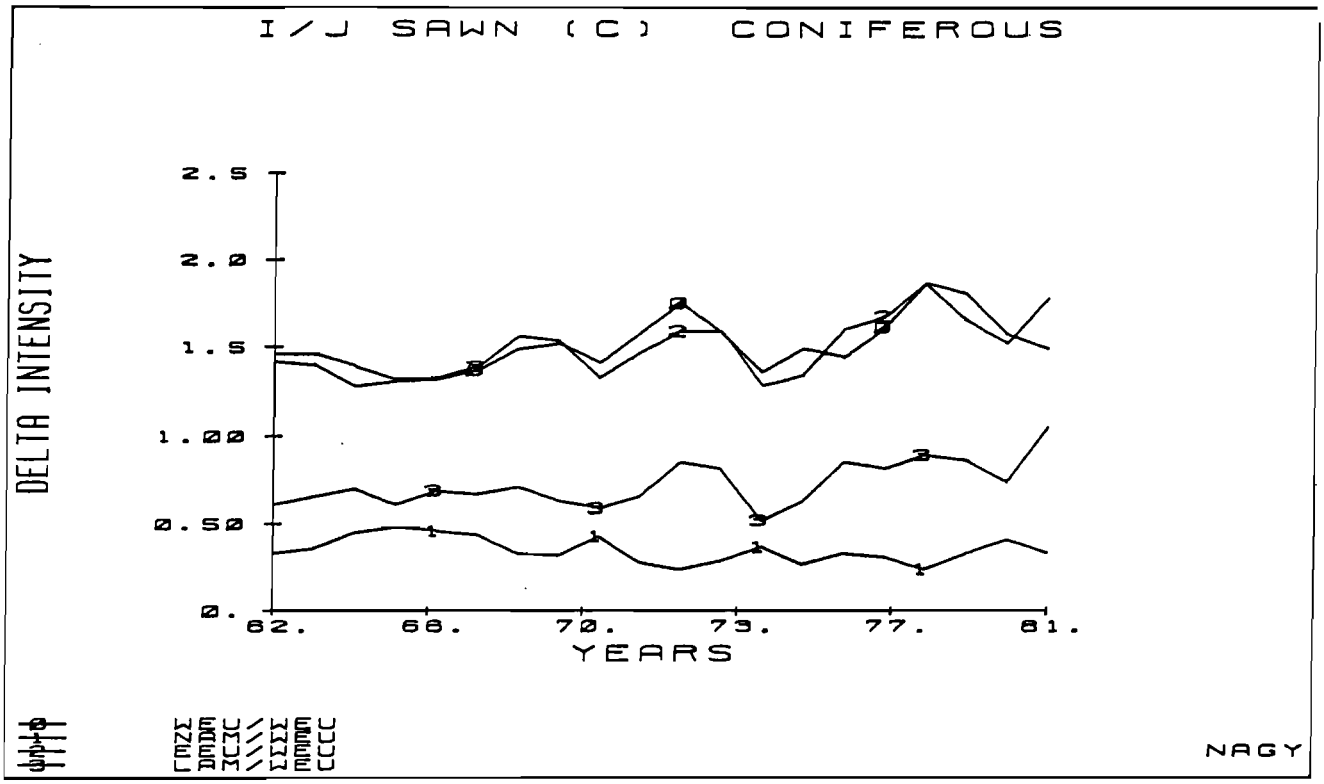

Figure 59. Trade intensities of Western European imports of Coniferous Sawnwood.

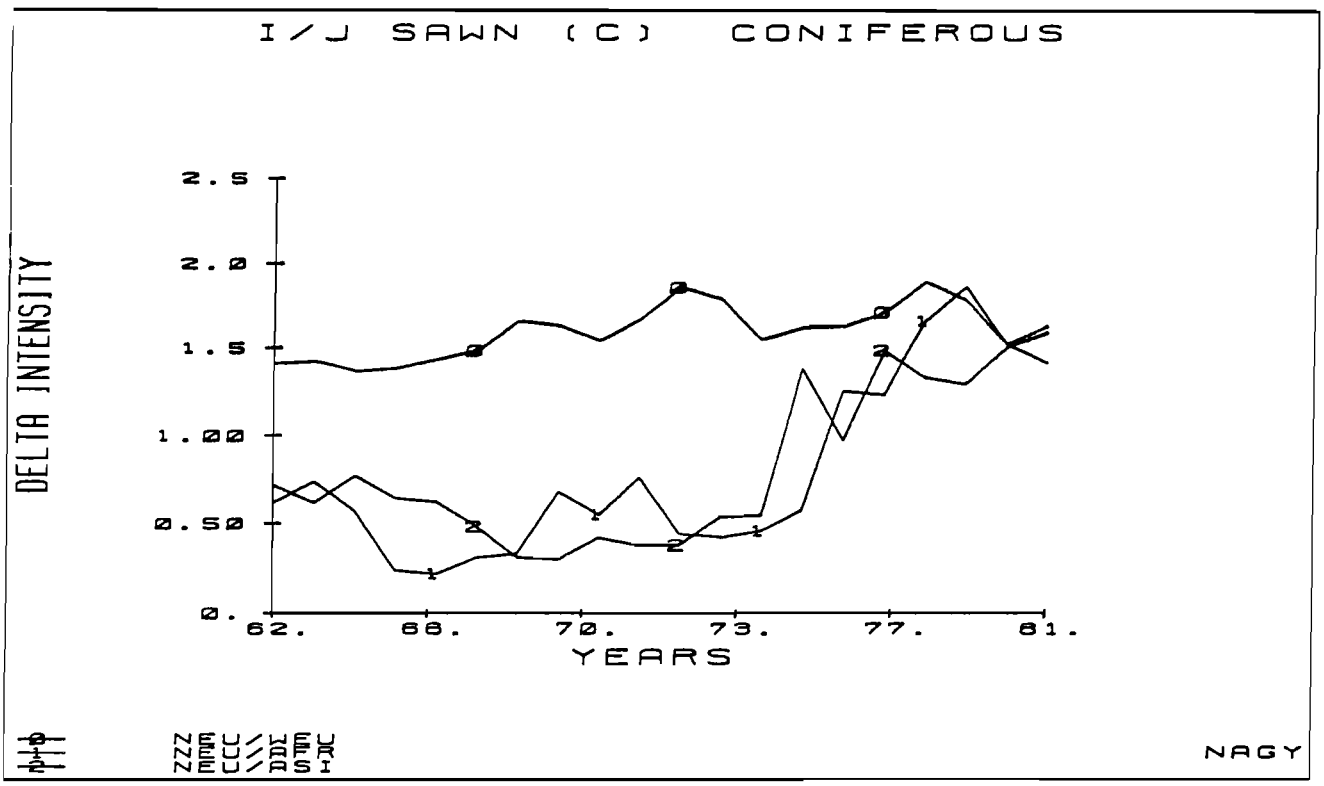

Figure 60. Trade intensities of Northern European exports of Coniferous Sawnwood.

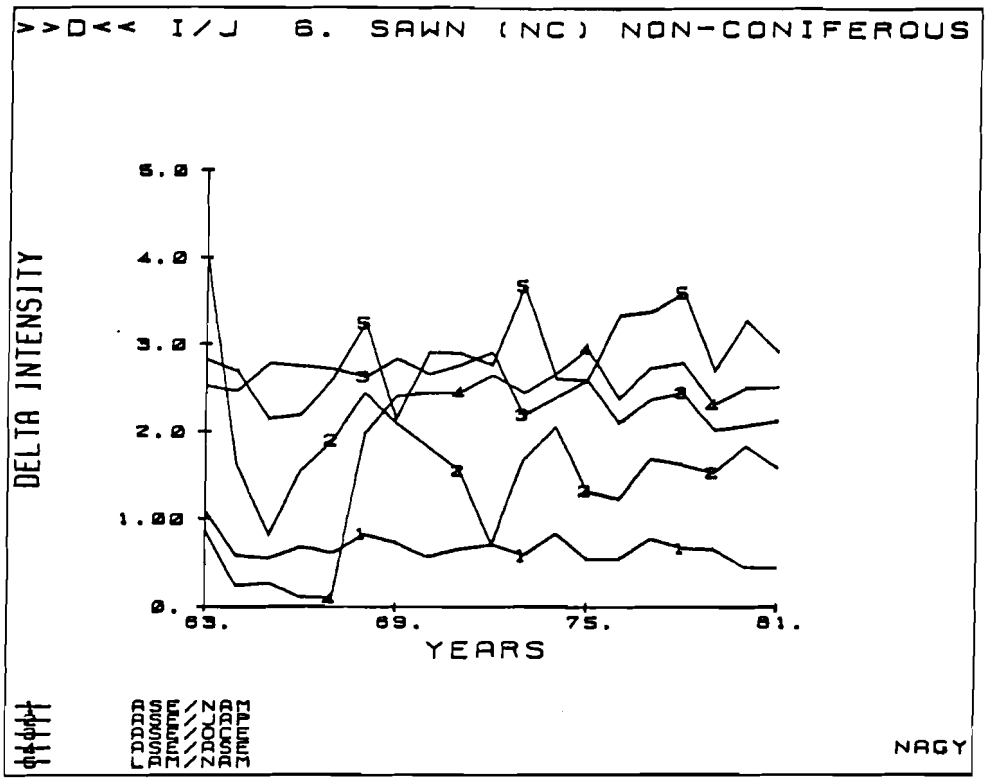

Figure 61. Trade intensities of ASEAN and Latin American exports of Non-Coniferous Sawnwood.

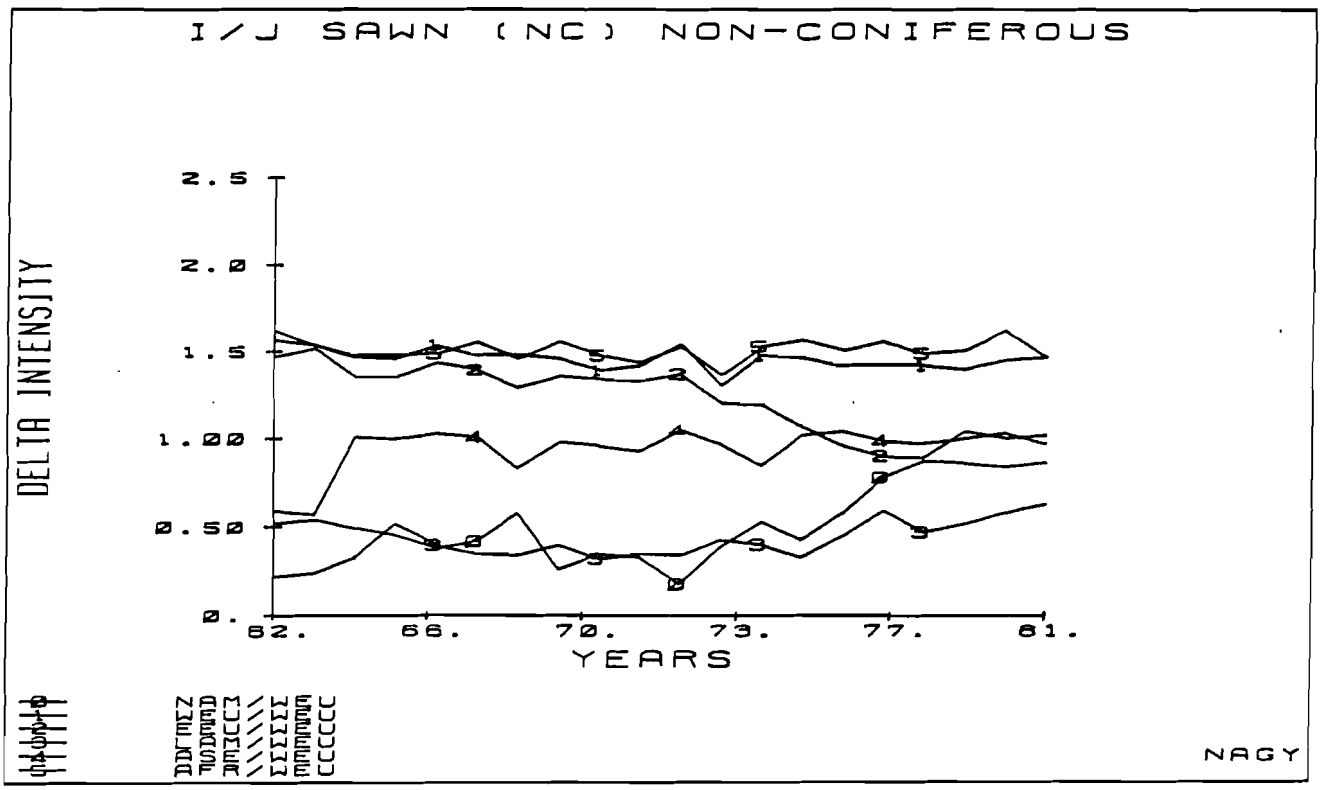

Figure 62. Trade intensities of Western European imports of Non-Coniferous Sawnwood.

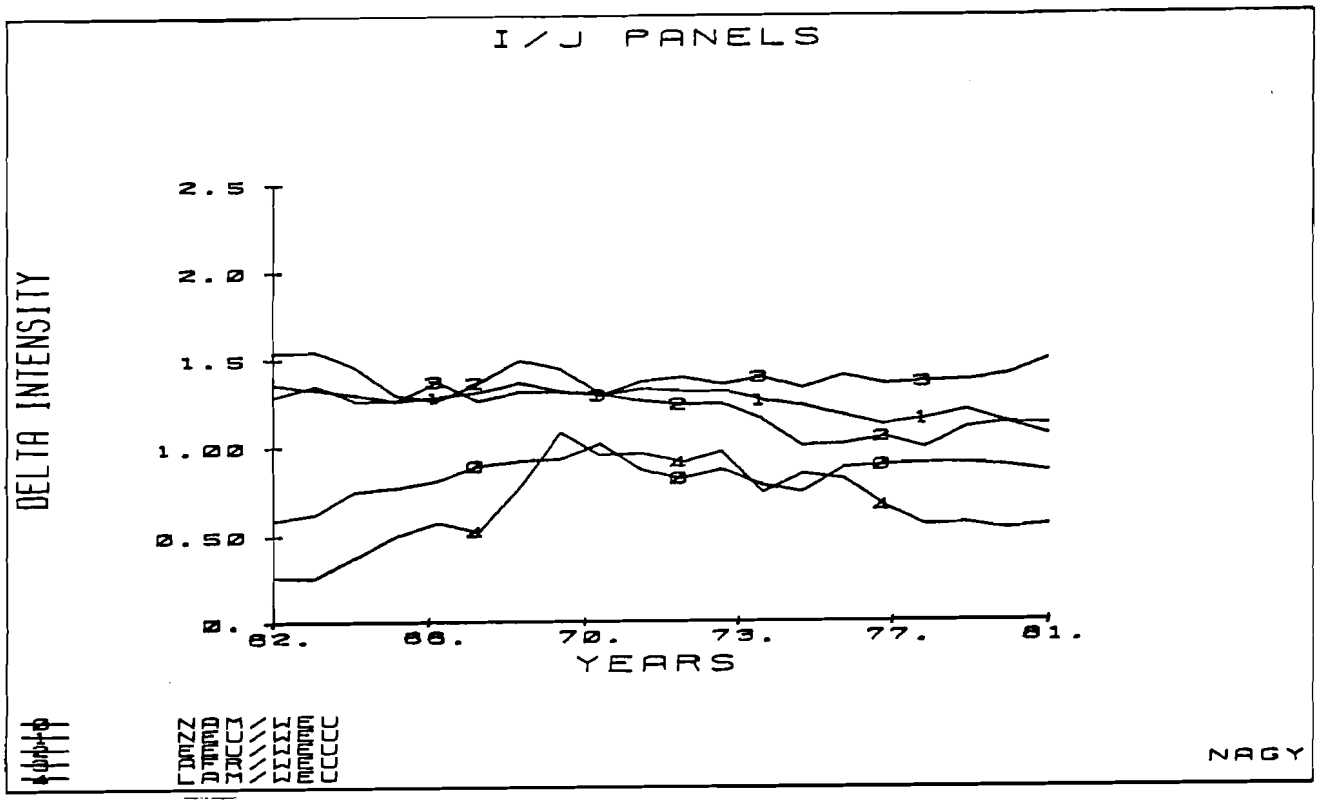

Figure 63. Trade intensities of Western European imports of Panels.

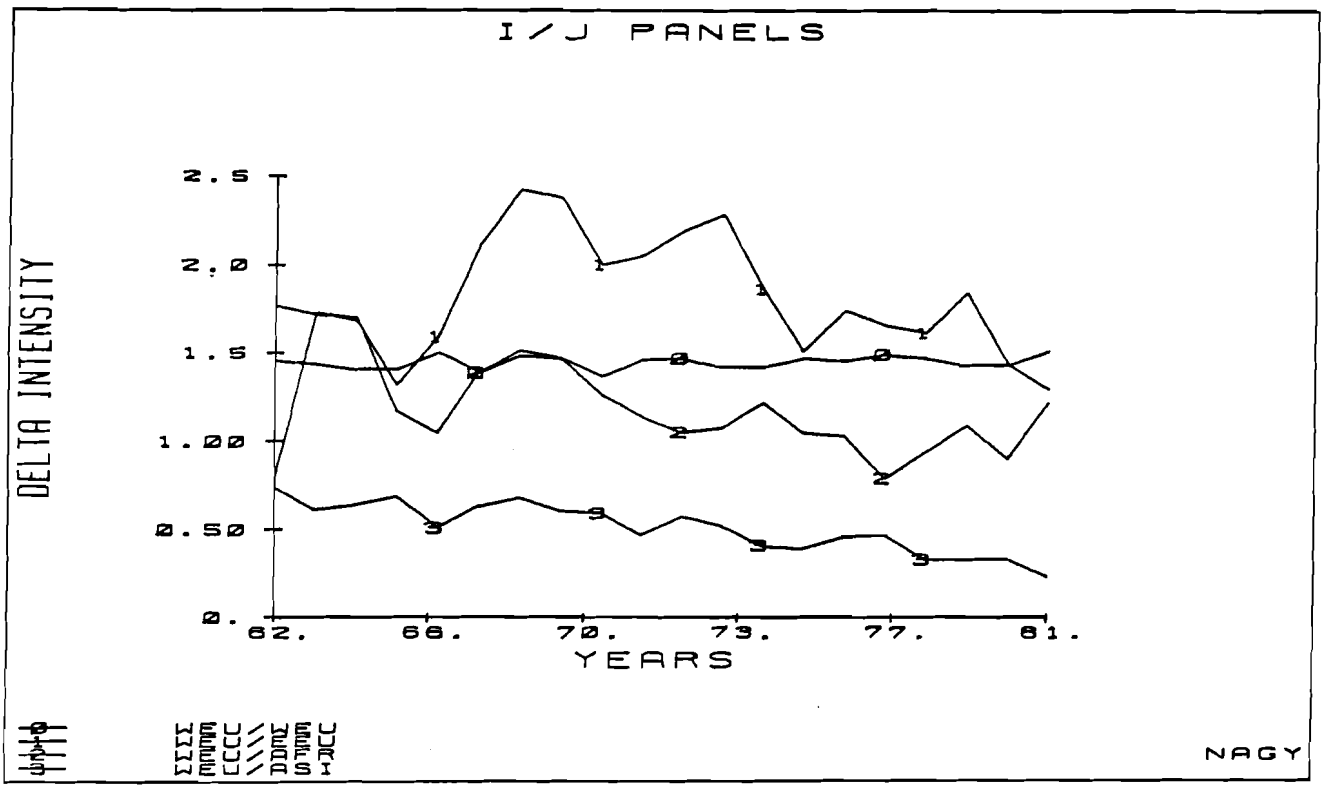

Figure 64. Trade intensities of Western European exports of Panels.

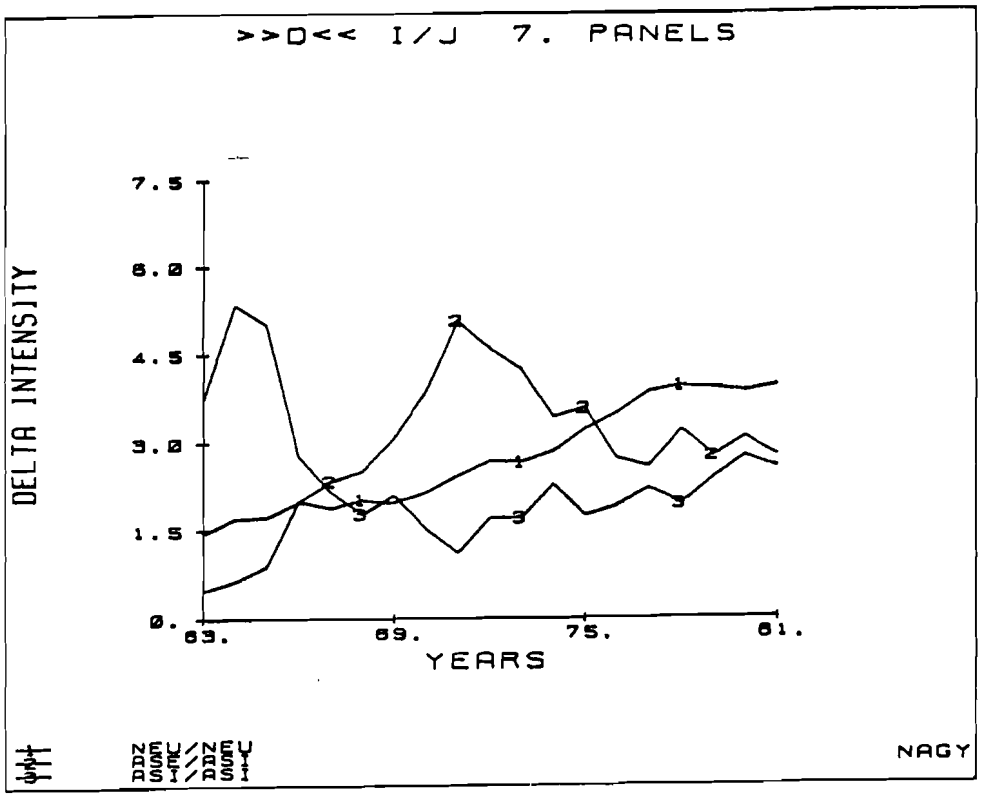

Figure 65. Trade intensities of selected flows of Panels.

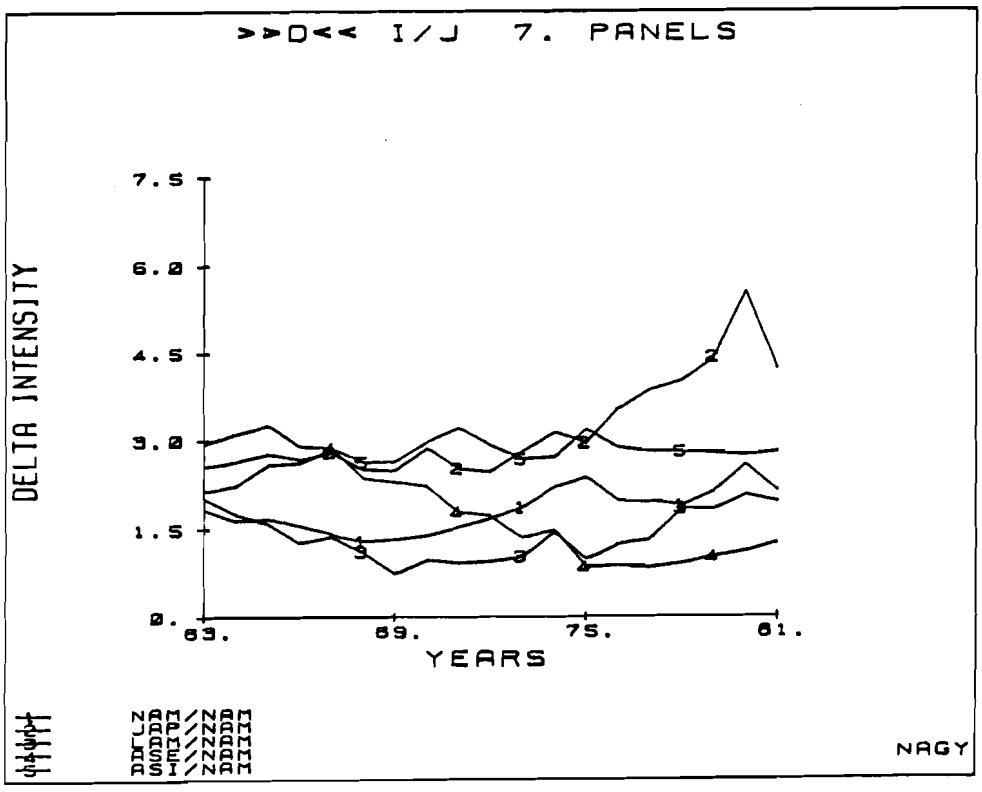

Figure 66. Trade intensities of North American imports of Panels.

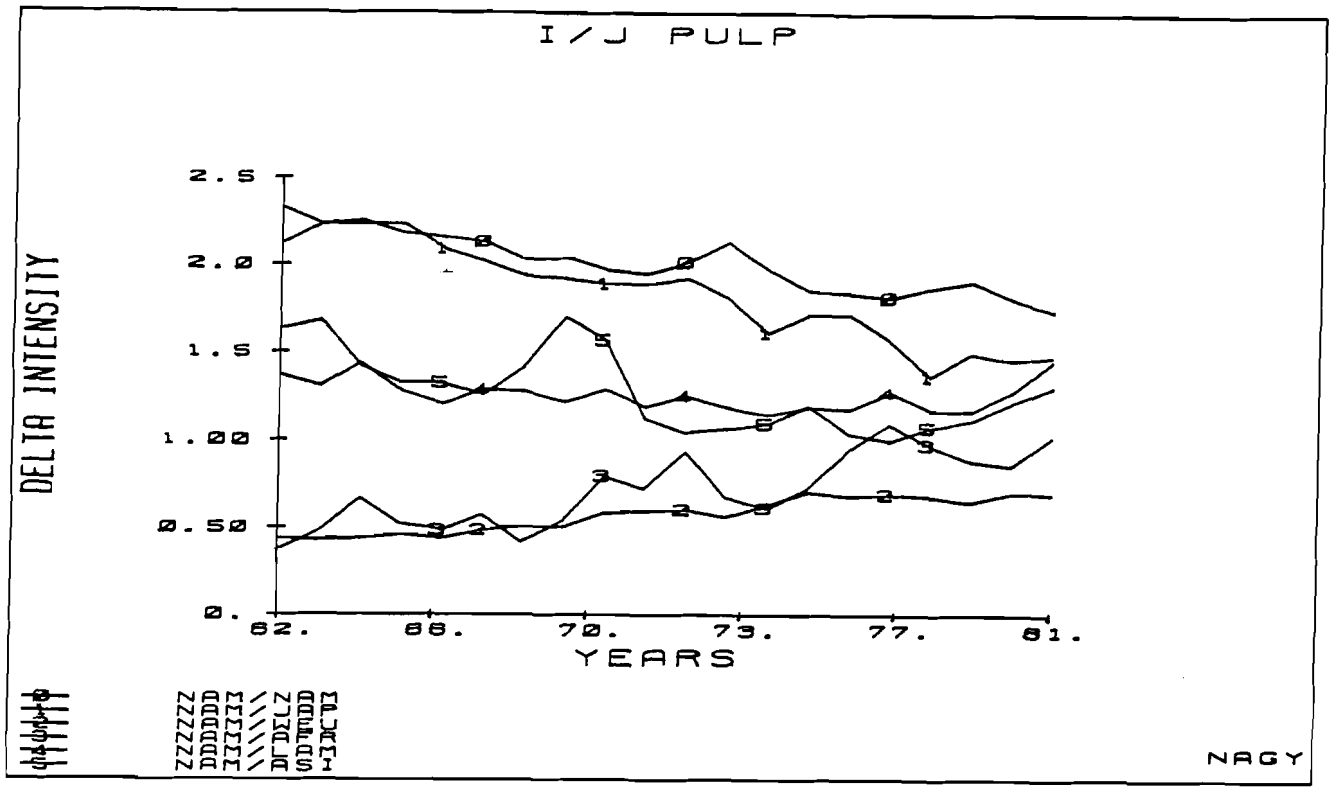

Figure 67. Trade intensities of North American exports of Pulp.

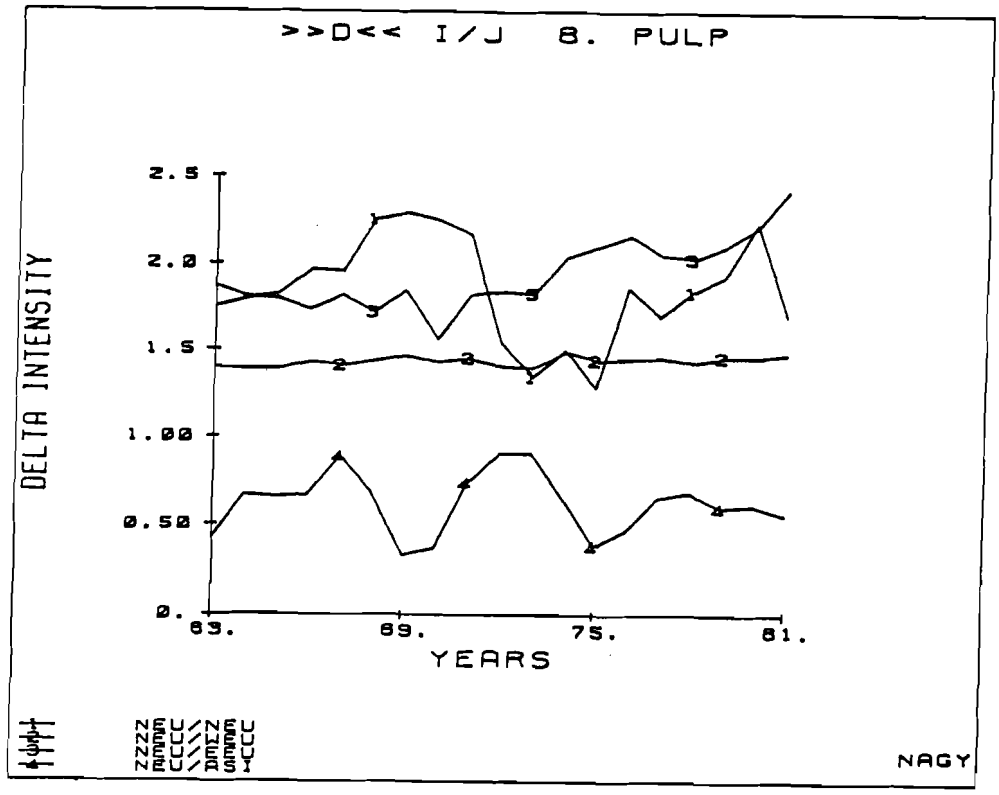

Figure 68. Trade intensities of Northern European exports of Pulp.

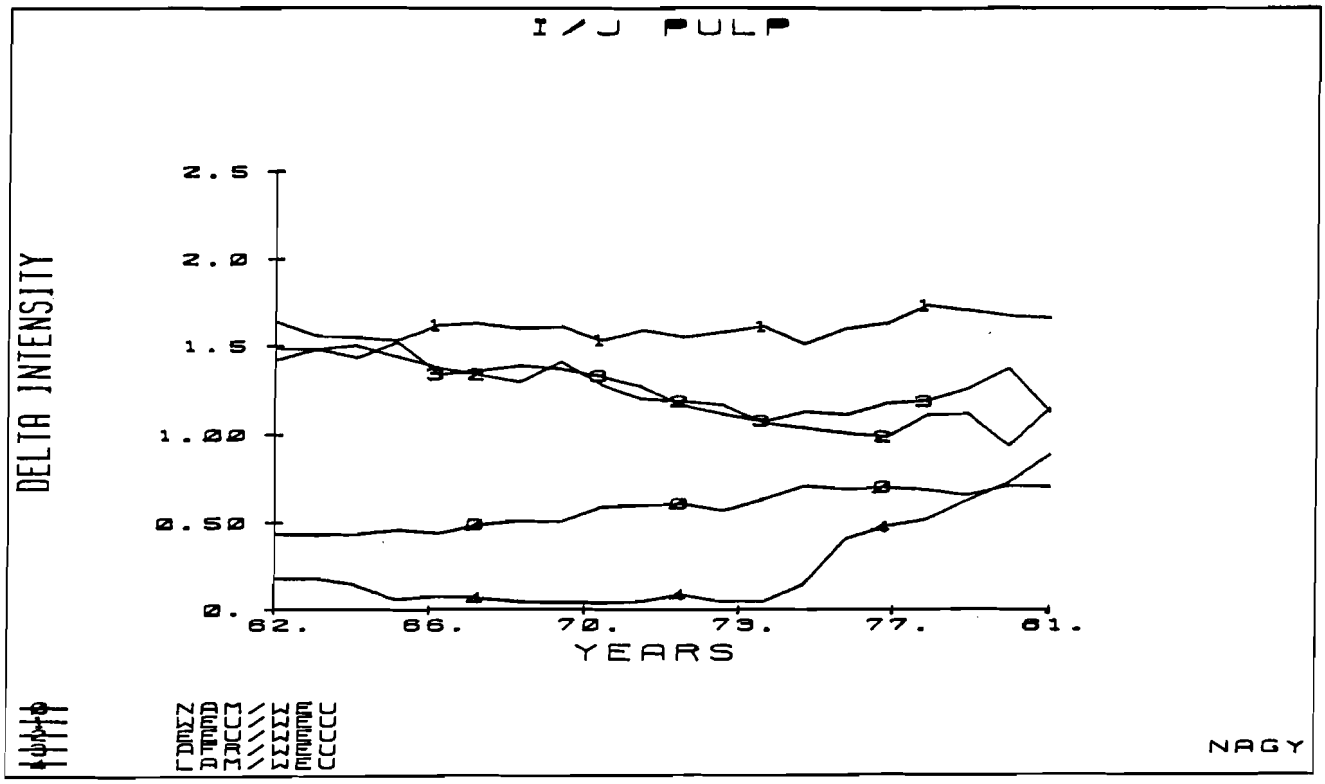

Figure 69. Trade intensities of Western European imports of Pulp.

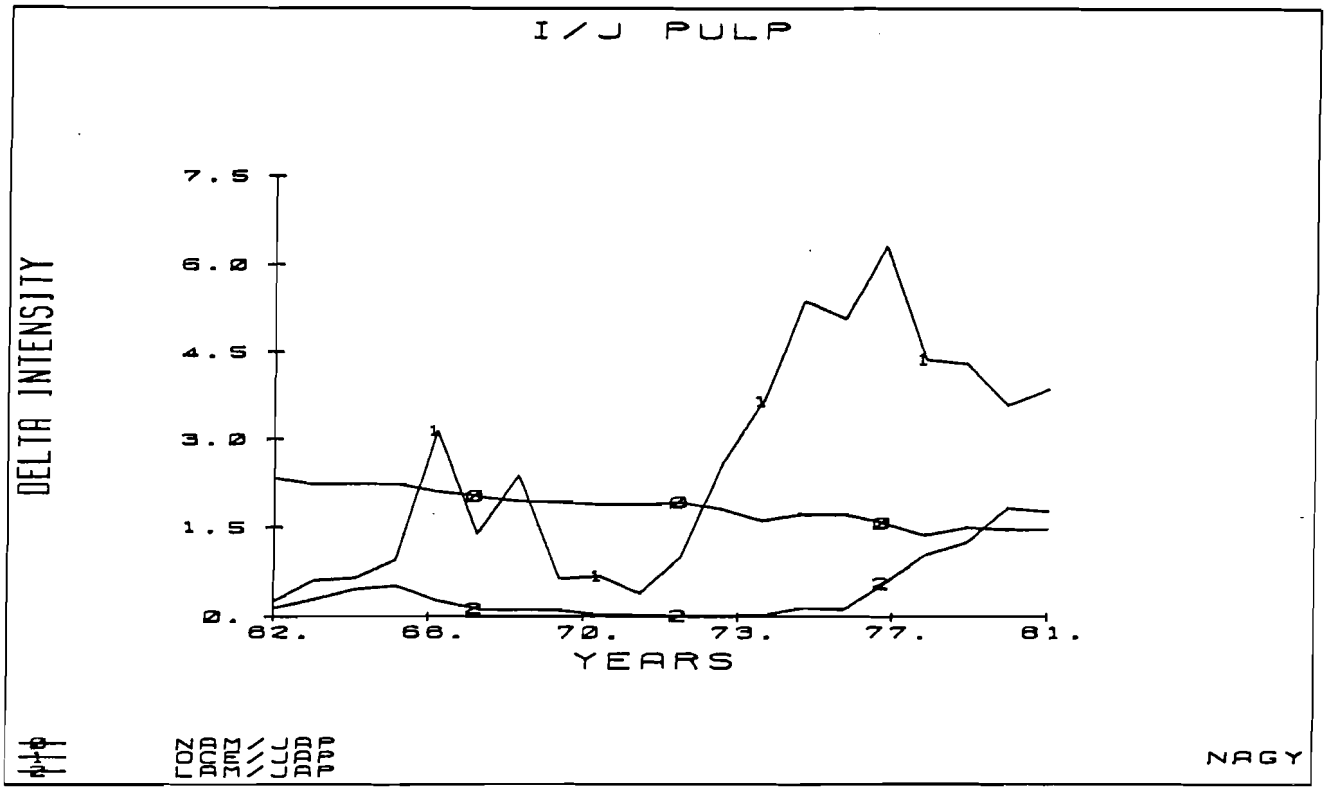

Figure 70. Trade intensities of Japanese imports of Pulp.

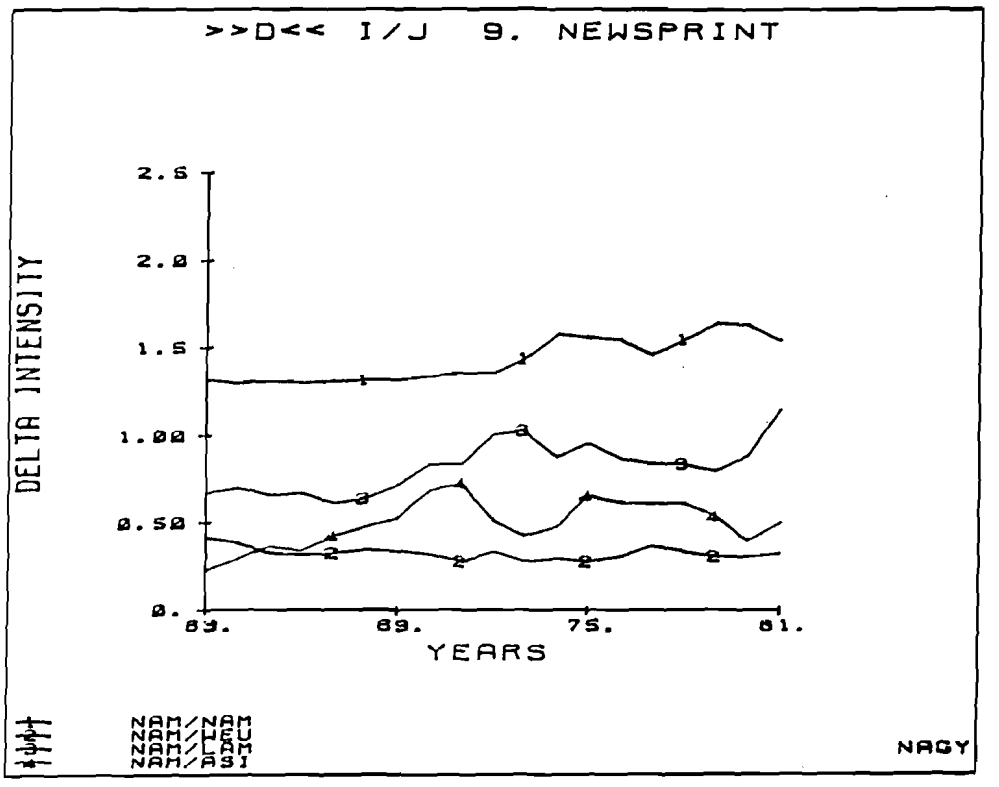

Figure 71. Trade intensities of North American exports of Newsprint.

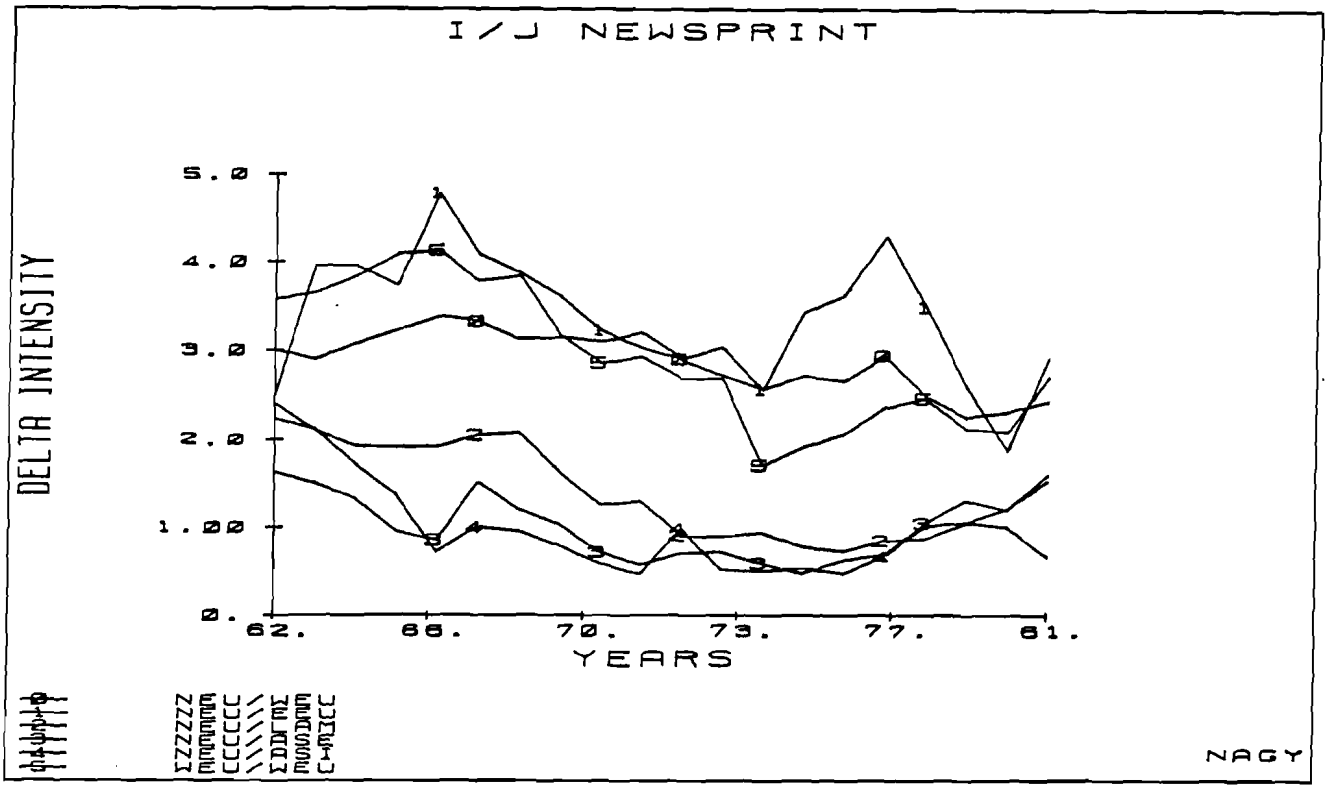

Figure 72. Trade intensities of Northern European exports and Western European intra-regional trade of Newsprint.

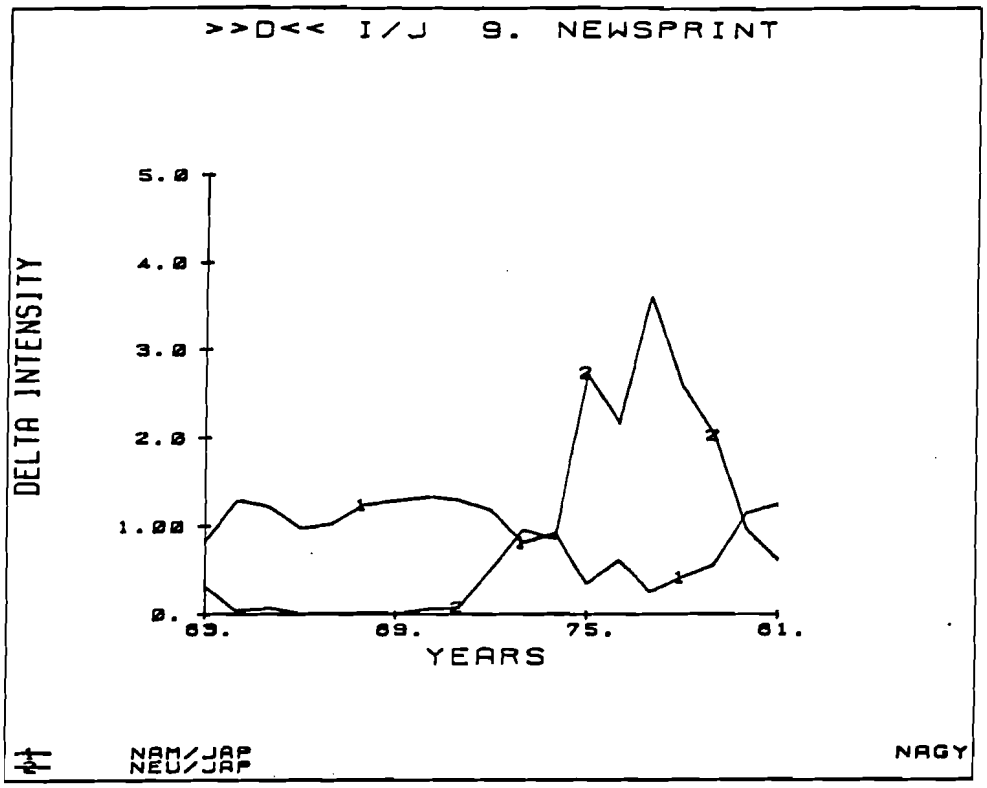

Figure 73. Trade intensities of Japanese imports of Newsprint.

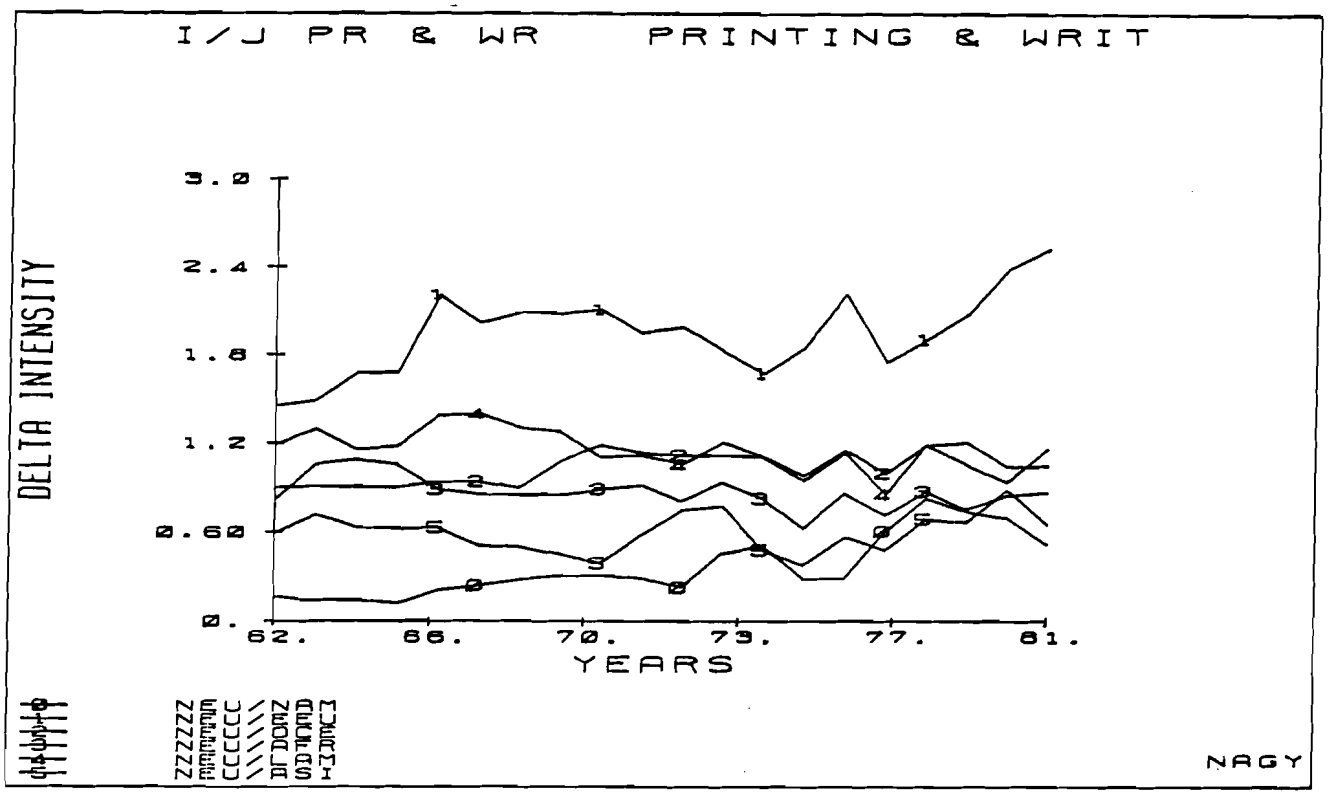

Figure 74. Trade intensities of Northern European exports of "other printing and writing paper".

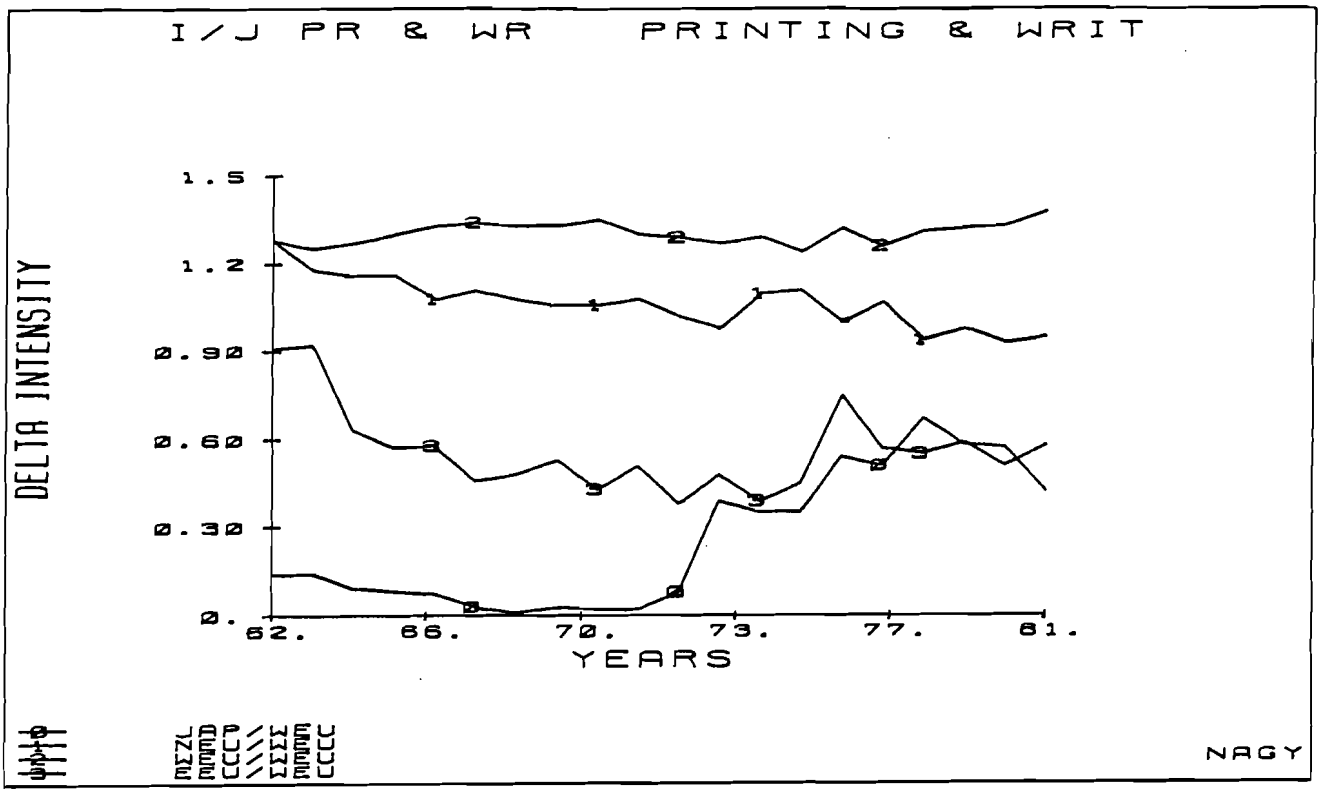

Figure 75. Trade intensities of Western European imports of "other printing and writing paper".

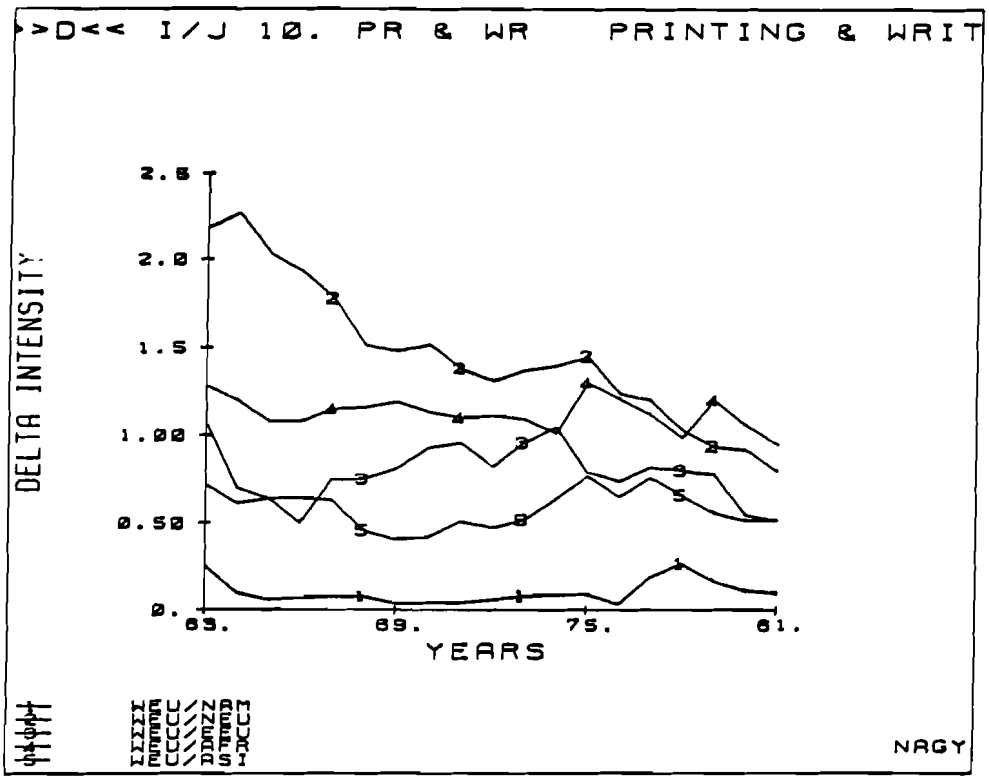

Figure 76. Trade intensities of Western European exports of "other printing and writing paper".

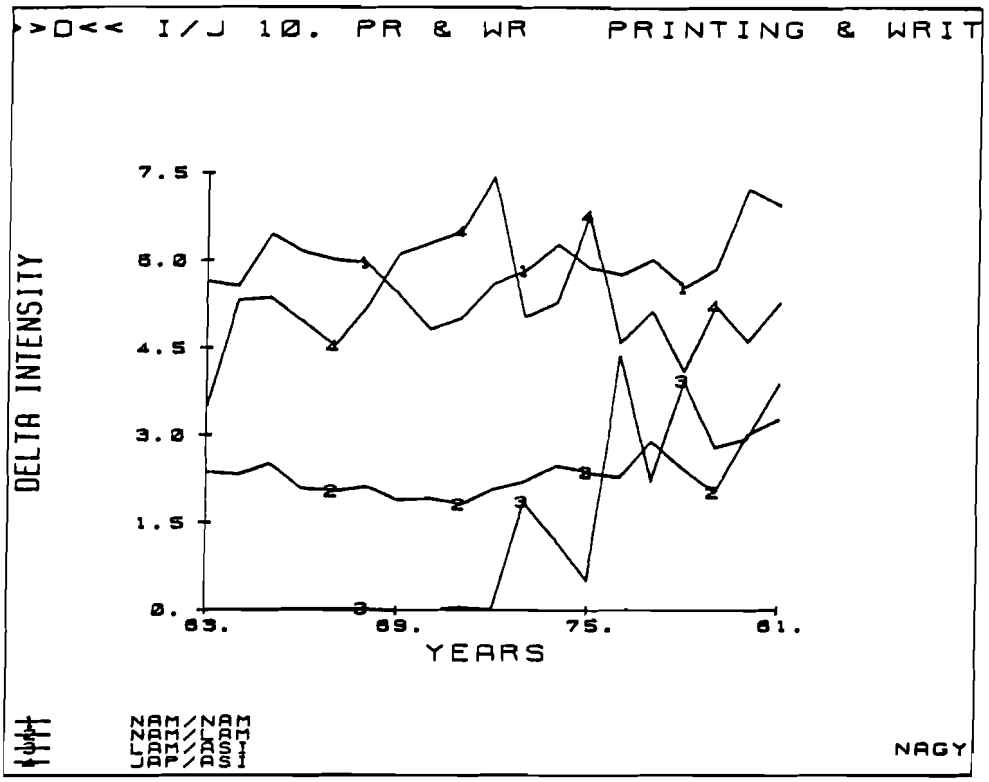

Figure 77. Trade intensities of selected flows of "other printing and writing paper".

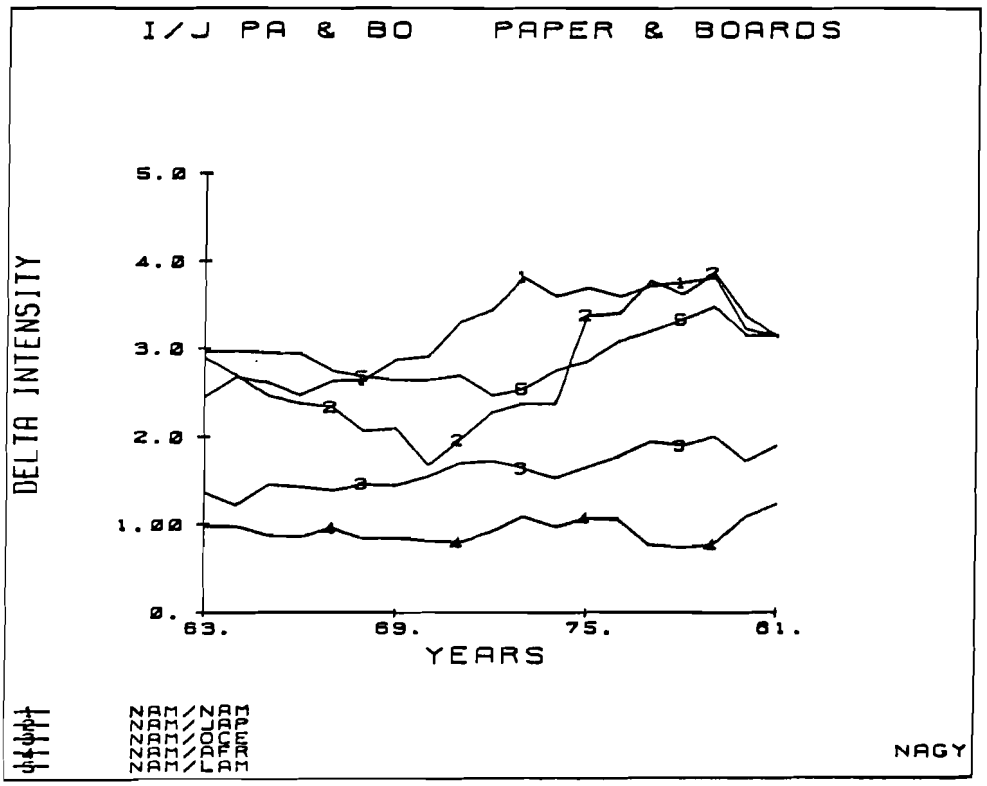

Figure 78. Trade intensities of North American exports of "other paper and board".

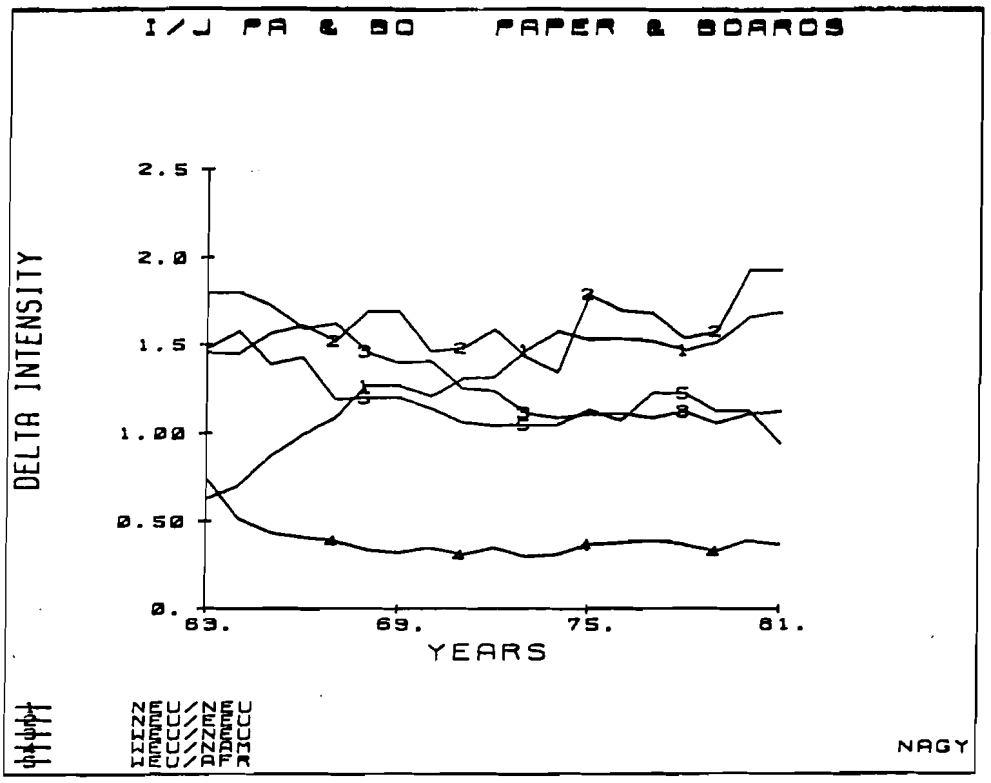

Figure 79. Trade intensities of Northern and Western European exports of "other paper and board".

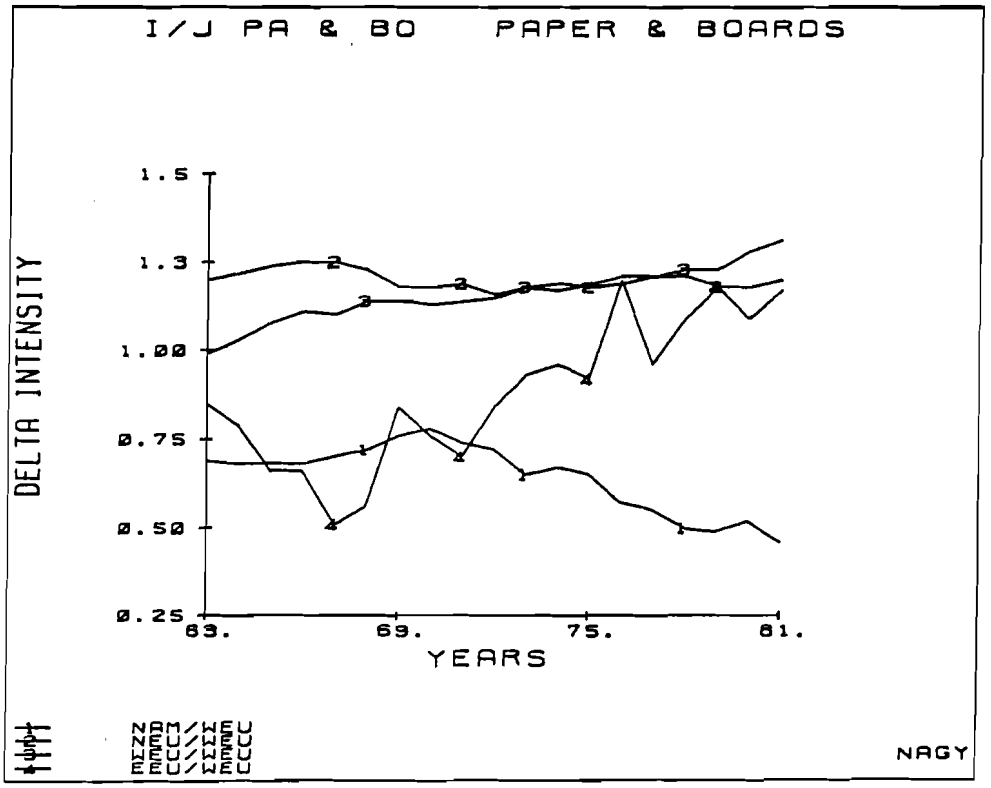

Figure 80. Trade intensities of Western European imports of "other paper and board".

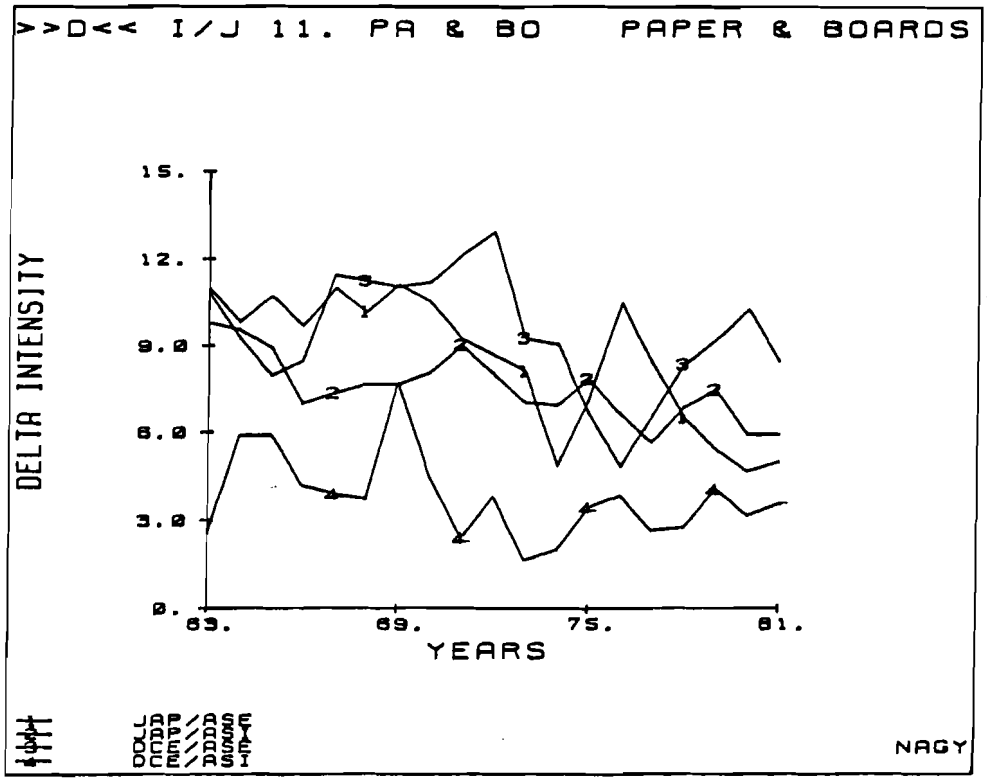

Figure 81. Trade intensities of Japanese and Oceania exports of "other paper and board".

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