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Introduction

Trade in tropical timber and its relation to management of tropical forests must be understood in the context of markets for all forest products and, of course, specific markets for industrial products from tropical forests. In this regard, at least three issues require particular attention. First, how have patterns of trade in tropical timber changed as a result of changes in the type and level of forest products consumption in major markets? Condition in major markets - Asia, Europe and North America - must be reviewed to assess patterns of consumption and the role of tropical timber products in relation to total forest products consumption and production. Of particular importance are an understanding of end uses of tropical timber, key determinants of demand, and trends in pattern use. The roles of prices, consumer preferences and prejudices, and technological developments in consumption must be taken into consideration. Because a significant volume of tropical timber products, like many primary and secondary forest products, are "consumed" in manufacturing processes (such as home construction, and manufacturing doors, windows and furniture), technological developments that lead to substitution of other products and materials can play an important role in the outlook for consumption of tropical timber.

A second issue is consumption of forest products in countries producing tropical timber. What are recent trends in consumption, and how are they likely to affect tropical timber markets as a whole? In large measure growth in domestic consumption of forest products in tropical timber producing countries is a natural consequence of economic and population growth. However, it is important to assess the extent to which the outlook for forest products consumption in tropical countries may differ from that of other developing countries. Readily available supplies of industrial forest products are likely to affect the pattern and rates of growth in consumption. To the extent that this consumption represents a significant source of demand for tropical timber, existing patterns of trade will change. In addition, with growth in domestic consumption in tropical timber producing countries, production of industrial products from tropical forests will be increasingly beyond the scope of policy instruments focusing on international trade.

Finally, the emergence of new markets, particularly those in developing countries that are not producers of tropical timber, must also be examined. The effects of the trade policies of industrialized nations on tropical timber consumption and production are obviously limited by the importance of consumption and trade that takes place outside the boundaries of such intervention.

Any one of these issues is worthy of extensive study; here, however, each is simply addressed simply through a review of recent trends and recent literature. The objective is to provide a broad-based display of issues. Definitive results, such as estimates of rates of substitution between tropical and temperate timber products in specific markets, are beyond the scope of this effort; they are, in addition, limited by the quantity and quality of available data.

1. Markets in Industrialized Countries

Table 4.1 summarizes broad patterns of consumption (net imports) of tropical timber by product and major importing countries or region. Trends and patterns for each region will be addressed in turn. Japan is the predominant market for tropical timber, followed by Europe (data are shown for the European Community (EEC) only), with North America a distant third in consumption among industrialized regions. In the last decade or so, Korea and Taiwan have emerged as significant importers of tropical timber; in 1989-90, Korea and Taiwan imported a quantity of tropical timer nearly equal to that of the EEC. For both countries, a considerable portion of tropical timber consumption is in export-oriented industries, especially furniture, with North America and Japan as the major export markets. As a result, some double counting is reflected in this table; tropical logs imported by Taiwan, for example, are used to manufacture plywood that is exported to the United States, Europe, and Japan. Therefore, in table 4.1 some portion of the volume reported for Taiwan and Korea actually appears in two places.

Japan

Japan's domestic timber resources are substantial, covering roughly 25 million hectares with a stock of 3 billion cubic meters. Roughly two-thirds of Japan's domestic timber resource is softwoods, most of which is the result of a post WW-II reforestation program. Nevertheless, Japan depends on imported raw material and timber products to meet nearly three-fourths of domestic demand. This import-dependence has increased steadily since the mid-1970s, in part because the bulk of domestic timber resources are immature or expensive to harvest, and in part as a result of explicit trade and industrial policies. In the late 1980s Japan's demand for timber reached a peak of roughly 115 million cubic meters (roundwood equivalent); domestic resources supplied less then 30 percent of this volume (Ward 1991).

Japan continues to be the world's largest importer and consumer of tropical timber as it has been for more the two decades (table 4.1). In 1990, Japan accounted for roughly half of tropical timber imports of industrialized countries, and more than one-fourth of world trade in tropical timber products. These data are only slightly changed from the mid-1980s (Nectoux and Kuroda (1989). Table 4.2 shows the distribution of Japanese timber imports by products (logs, lumber, and plywood), and species (hardwood and softwood), both temperate and tropical. Tropical logs account for nearly all hardwood logs imported, but less than half of all logs imports; tropical lumber accounts for 80 percent of hardwood lumber imports, and less than 20 percent of total lumber imports. Tropical plywood accounts for nearly all plywood imports, and about one third of Japanese plywood consumption.

Table 4.3 summarizes the importance of tropical timber in the Japanese forest sector in 1990. In terms of both value and volume (all products expressed in a equivalent basis), imports in the form of logs still account for the majority of Japan's tropical timber imports. Domestic log production in Japan peaked in the mid-1960s, and has declined steadily since. Tropical logs are used primarily in the domestic plywood industry, although their relative importance is lower than at any time in the recent past. These data for 1990 show a decline in the tropical log share of raw material for plywood production from data reported by Ward Associates (1990) for 1988. Supply restrictions in tropical timber producing countries, competition form product imports, and a slow-down in construction activity (1991-92) have all contributed to long-term decline in Japanese plywood production. Currently, production is at the lowest level since the mid-1960s (Japan Lumber Reports 1992). Plywood imports increased by a factor of 10 between 1985 and 1990.

In 1990, domestic production of logs used in lumber manufacturing was roughly 18 million cubic meters, and was composed primarily of temperate softwood species; domestic production accounted for less than 40 percent of log supply to Japanese saw mills. Over the past 2 decades, Japanese lumber manufacturing had declined more than 30 percent in output and number of mills; employment in lumber manufacturing decreased by nearly 50 percent. As with the plywood industry, decreased availability of raw material, increasing raw material prices, and increased competition from imports have contributed to this trend.

Table 4.4 summarizes end use data for tropical timber in Japan; housing and construction account for the majority of Japanese consumption of tropical timber. Overall plywood accounts for the majority of Japanese tropical timber consumption; most plywood is used in sheathing and formwork in construction. End uses for lumber are less concentrated; housing fixtures (such as doors, windows and stairs) account for most use of tropical lumber (Ward Associates 1990). However, there are few applications in which there is not competition from temperate species (both domestic and imported) and other materials. Ward Associates (1990) reports that tropical hardwood lumber (whether imported or manufactured in Japan) lost market share in all end use markets over the period 1980-89. Total consumption of tropical lumber declined by more than 2 million cubic meters over this period.

Competition from other materials is a significant factor in the use of tropical lumber in furniture manufacturing; temperate hardwood and softwood lumber has replaced tropical lumber in a variety of applications (Ward Associates 1990). Similar patterns of substitution have occurred in packaging. Packaging accounts for less than 5 percent of tropical plywood use in Japan (table 4.4), and has maintained a steady share of wood used in this market; however, overall wood use in packaging has declined in the past decade, the share accounted for by tropical lumber has declined (Ward Associates 1990). Uncertainty concerning supply (or, at the very least, the process of changing sources of supply from domestic production to imports) likely contributed to this decline.

Changes in the mix of raw materials used are driven only in part by physical availability. For Japanese manufacturers, supplies might expand through use of non-traditional tropical species, or through use of non-tropical timber. In either case, we expect to see scarcity reflected in relative prices. Vincent and others (1990) found little statistical evidence for price-based substitution of lessor-known species (LKS) for well-known species (WKS of

tropical logs. However, there was some statistical support for the hypothesis of price-based substitution of temperate for tropical species in lumber manufacturing (Vincent and other 1991). Ward Associates (1990) reports that tropical LKS are increasingly being used in both lumber and plywood manufacturing. Nevertheless, nearly all of Japan's tropical log imports continue to come from Asia; Africa and Latin America supply very small quantities of logs to the Japanese market (Ward Associates 1990). Imports of tropical products are considerably more diversified, however.

Japanese imports of value-added wood products (such as moulding, joinery, doors and windows, and furniture) are small compared to imports of primary wood products (logs, lumber and plywood). Nevertheless, the value of imports of these products has gown rapidly, and in 1989 totalled nearly $600 million dollars (Ward Associates 1990). Tropical timber producing countries account for about 100 million dollars of the total trade; importers of tropical timber that process and export products (such as Taiwan and Korea), account for an additional 150 million dollars of these imports by Japan. Japanese imports of tropical timber furniture and furniture parts more than doubled in the past decade (Ward Associates 1990); nearly all of these imports are from countries that import tropical timber to maintain these industries.

The outlook for tropical timber in Japan is a continuation of recent trends: declining imports of logs, increasing imports of lumber and plywood, and even sharper increases in imports of value-added products (Ward Associates 1990). One of the most important indicators of demand for wood products in Japan is residential construction; as in the United States, this is closely correlated with economic activity and the business cycle. Over most of the period 1970-85, total housing starts declined, as did the size of houses built and the share of new houses that are wooden. All of this contributed to slow growth in Japan's consumption of solid wood products (logs, lumber and plywood) throughout much of the 1980s. Government intervention in housing markets and product promotion by US manufacturers (focused on construction methods) gave a boost to demand in the late 1980s, but one favoring softwood consumption lumber (Ward Associates 1990). Total Japanese forest products consumption declined in 1991 and early 1992; recession in the broad economy was reflected in declines in construction and housing starts - the two strongest determinants of Japanese consumption of solid wood products, including tropical timber products. Weakness in the Japanese economy in the early 1990s can be expected to result in slow growth in Japanese consumption of tropical timber.

Much, if not most of the decline in market share for tropical timber reflects price-based substitution. Ingram (in press) reports growth in tropical sawn wood prices in Japan in the late 1980s, after a period of declining real prices beginning in the late 1970s. According to these data, deflated prices of tropical sawn wood increased sharply at the end of the decade. Perhaps even more important than tropical sawn wood prices adjusted for inflation is the price of tropical sawn wood relative to the price of substitutes. Figure 1 illustrates one measure of relative prices. The ratio of the price of lauan sawn wood to hinoki sawn wood declined over the period 1970-78 (encouraging the use of lauan over hinoki sawn wood). While there are significant cycles in the relative price measure over the period 1978-90, there is also a clear upward trend. This is the same period over which Ward Associates (1990) reports loss of market share for tropical lumber.

Europe

Europe is considerably more self-sufficient in forest products than is Japan; taken as a whole, European countries rely on imports for roughly 15 per cent of total consumption. Tropical timber accounted for less than 20 per cent of these imports on a volume basis (ITTO 1990). Therefore, tropical timber accounts for roughly 3 percent of European consumption of industrial timber products. Tropical timber products are important in the European forest sector nevertheless, occupying niche markets of relatively high value (ITTO 1990). This, too, is in contrast to the Japanese market where relatively low-value applications (concrete formwork, for example) account for a significant share of tropical timber consumption.

Europe accounts for roughly one half of world forest products imports (all species and products) and, although second only to Japan as an importer of tropical timber products, as of the late 1980s Europe accounted for only 20 percent of world tropical timber imports (ITTO 1990); see Table 4.1. Recent trends are broadly similar to those in Japan: a reduction in imports of tropical logs beginning in the early 1970s, a relative increase in imports of processed tropical timber products, and an overall decline in total consumption. Both trends- an increase in the share of imports in processed form, and a decline in consumption (or, at least, no significance increase) of tropical timber products can be expected to continue (ITTO 1990). Table 4.5 shows the trend in consumption of temperate and tropical nonconiferous logs in the EEC. Based on data reported by Cooper (1990) and ITTO (1990, 1991) it appears that roughly half tropical log imports by the EEC is used to manufacture plywood; one-third is used to manufacture sawnwood; the remainder are used to produce veneer.

As a result of proximity and historical ties, Africa supplies the majority of European imports of tropical logs; sources of tropical sawn wood and plywood are more diversified, and include producers in Asia and Latin America. Six countries account for 89-90 percent of EEC consumption of tropical sawn wood and plywood: United Kingdom, France, Germany, Italy, Netherlands, and Belgium. Of these, the United Kingdom is the largest single consumer of tropical timber (18 percent of sawn wood, and 37 per cent of plywood consumption in 1988) (Cooper 1990).

Table 4.6 summarizes patterns of end use of tropical sawn wood and plywood in three EEC countries. These data illustrate and reflect characteristics of European tropical timber markets: first and foremost, markets and patterns of use are not homogeneous across European countries. France, Germany and the United Kingdom differ in types of imports, sources of imports, and patterns of use. The United Kingdom, for example, relies almost entirely on imports of products while France and Germany have, in the past, relied quite heavily on imports of logs. French imports (of tropical logs) are supplied almost exclusively by African producers, while German imports are primarily from Asia. Table 4.6 illustrates the importance in European consumption of tropical timber of end uses in which appearance is a critical component of suitability.

Both Cooper (1990) and ITTO (1990) suggest that the outlook for tropical timber products in Europe holds, at best, a prospect of modest growth in consumption. For a number of countries and end uses Cooper (1990) suggest static or declining markets. Competing products and, to some extent, changing tastes and preferences, will lead to loss of market share or absolute reductions in quantities of tropical timber products consumed. As they rely

more heavily on log imports, tropical plywood manufacturers in Germany and France, for example, face adjustments not unlike those in Japan: reduction in domestic manufacturing (in the absence of shifts to new sources of raw material), and increases in imports of processed products to maintain existing levels of consumption and patterns of use.

North America

Although Canada and the United States are the largest importers of forest products, both countries are relatively small participants in tropical timber markets (see table 4.1). Nevertheless, North American imports of tropical logs, sawn wood, veneer, and plywood totalled nearly $600 million (US) in 1990 (see table 4.7). The United States is the primary market, accounting for 95 percent of the net imports in both volume and value terms. Tropical hardwood plywood dominates North American tropical timber imports, accounting for three-fourths of the value, and nearly 90 percent of the volume of imports. Indonesia, Malaysia and Brazil supply most North American imports of tropical timber. Imports from Africa are negligible. Non-tropical countries, such as Taiwan and Hong Kong, account for a small share of North American imports of tropical timber products.

It is important to note that North American imports of other manufactured forest products from tropical countries, including pulp and paper products, are substantial. United States and Canadian imports of all forest products from tropical countries in 1990 exceed $1 billion (US). Table 4.8 summarizes United States imports of forest products from tropical countries, and illustrates the shift in the pattern of imports similar to those noted for Japan: the importance of value added products including, in this case, pulp and paper products. Primary tropical products (logs, lumber, veneer and plywood) account for only one fourth of US imports of forest products from tropical countries.

Table 4.9 summarizes data on end uses of tropical lumber and plywood in North America. As in European markets, relatively high-value uses dominate. Nevertheless, tropical timber products face strong competition in nearly all end uses (Ward International 1992). Recent declines in construction activity (1990-91) reduced overall demand for all wood products, including tropical timber. However, temperate hardwoods, other wood-based products (such as particle-based panels), and other materials present significant competition for tropical timber (Ward International 1992). Trends in relative prices for imported hardwood plywood in the United States show patterns similar to those for tropical lumber in Japan: increasing relative prices that can be expected to discourage consumption of tropical plywood, and encourage consumption of substitutes.

2. Forest Products Markets in Tropical Countries

A summary of recent projections (FAO 1991) of consumption of forest products in developing and developed countries (table 4.10) provides background for a review of recent trends in tropical countries. For each of the broad aggregates of timber products, FAO projections of the growth in consumption expected over the next two decades in developing countries exceeds that expected in developed countries. In many cases, projected rates of growth for developing countries are double those of developed countries. Because developing countries are largely, although not exclusively, those in the tropical region, it is

reasonable to use these projections to draw attention to the need to more specifically examine recent trends in forest products consumption in tropical countries.

Although the implications of the FAO projections are at first dramatic, they largely originate in two simple facts. First, when percentage change is calculated against a small base quantity, rates of increase are exaggerated. In terms of absolute quantities, for all products except fuelwood, the scale of developed country consumption is far greater than that in developing countries. In 1975 for example, consumption of industrial roundwood in developed countries was nearly 5 times that in developing countries; consumption of sawn wood in developed countries was more than 5 times that in developing countries. However, by 1990 the ratio of consumption in the two country groups was roughly 3 to 1, and in two decades the ratio is projected to be roughly 2 to 1. Nevertheless, trends in consumption by developing countries - in both the historical and projected data - must be considered in absolute terms as well as in percentage terms.

Second, the FAO projections rely in large part on projected population growth (as well as income growth) in calculating projected consumption of forest products. Higher population growth rates in developing countries - nearly three time growth rates in developed countries - lead naturally to expectations of higher rates of increase in all aspects of consumption. In contrast to the "mature" markets of Europe and North America, with relatively slow population growth rates, tropical countries generally have markets and economies undergoing rapid change and development. As a result, over the next two decades developing countries are likely to be the fastest growing markets for timber and timber products.

The implications of these trends for tropical countries, and tropical timber producers, must be more closely examined. Growth in consumption of industrial products adds pressure on tropical forests that already account for nearly half of world timber harvest. The share of roundwood removals used for fuel in tropical countries has declined steadily, but only because demand for industrial products is increasing. More than 80 percent of the estimated harvest from tropical forests is used for fuel, and the harvest for fuelwood in developing countries exceeds total industrial timber production in developed countries.

Based on both the scale of consumption, and the mix of products, it is reasonable to ask if tropical countries are capable of meeting domestic demand with domestic resources. The world's industrial timber economy is predominantly based on temperate zone coniferous species. In spite of the fact that the tropical timber share of industrial roundwood harvest has increased significantly in the past four decades, in 1990 tropical timber accounted for less than 15 percent of industrial roundwood. In 1950, tropical timber accounted for 5 percent of the industrial timber harvest (Pringle 1976). To the extent that increased consumption of forest products in tropical countries follows the pattern of the industrialized forest economies of the temperate zone, domestic resources, although abundant in many cases, will not match the mix of raw materials required by technologies in production and consumption. As a result, imports of forest products may be necessary to satisfy consumption requirements.

Table 4.11 summarizes trends in consumption in tropical countries for major categories of industrial forest products over the period 1970 to 1990. Rates of growth in consumption are consistent with FAO trends and projections (table 4.10). For all four product groups, consumption increased by a factor of 2 (wood-based panels, coniferous sawn wood) or 3

(paper and paperboard) times over the period 1970-90. Perhaps more interesting than consumption trends considered in isolation is a simultaneous comparison of production and consumption. Figures 2-5 compare trends in production and consumption for the four product groups for tropical countries taken as a whole and illustrate important aspects of the trends and outlook for forest products markets in tropical countries. Table 4.12-15 show trends in consumption (only) for each of the tropical regions (Asia, Africa and Latin America).

First, the growth in both production and consumption of nonconiferous sawn wood is not surprising (figure 2). What is interesting is the relative absence of strong cycles corresponding with global economic cycles; such cycles are more pronounced in data for industrialized countries. It is also noteworthy that net exports of nonconiferous sawn wood have changed little over the 20-year period. This is not true in the case of wood-based panels. Here (figure 3) is evidence of growth of a substantial, export-oriented industry. It is the pattern of consumption in which a strong upward trend is altered at the time of the world-wide recession in 1982 and never recovers.

Figures 4 and 5 also display interesting, but perhaps not unexpected results. Consumption of coniferous in tropical countries sawn wood grew least quickly of all four products; nevertheless, consumption growth rates were considerably higher than those in developed countries. And although growth in production was also significant, net imports are substantial (12-15 percent of consumption) and are not declining appreciably, even as domestic production increases. However, it is in consumption of paper and board products that tropical countries are most dependent on imports - for nearly 40 percent on consumption.

3. Markets in Developing Countries

Table 4.1 reflects two significant developments in world markets for tropical timber. the first, as discussed above, involves the slight decline in total volume of imports by industrialized countries, and the trend toward imports of processed products (sawn wood and plywood) instead of logs. The second change reflected in table 4.1 is the growing importance of new "consumers", in this case Korea and Taiwan and, to a lessor extent, Hong Kong and Singapore. Both Taiwan and Korea have very limited domestic timber resources, and rely on imports of both raw materials and products. All four countries have developed export-based industries, lead especially by Taiwan, now the world's leading exporter of furniture.

As an approximation of data showing changes in patterns of trade in tropical timber products, table 4.16 shows exports of nonconiferous saw and veneer logs, nonconiferous sawn wood and plywood by developing countries. These three products aggregations, produced by developing countries, are dominated by tropical timber; therefore, in this context, "developing countries" has a reasonable correspondence with tropical timber producers. These data are similar to those used by Buttoud and Hamadou (1986) in describing emerging patterns of forest products trade between developing countries. Trends they observed - the relative importance of trade between developing countries, and the increasing importance of processed products along all trade routes - have continued.

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Table 4.1--Net imports of tropical timber products in major markets, 1990

Product	North America	Japan	Europe (EEC)	Republic of Korea	Taiwan[b]
			Thousand cubic meters[a]		
Logs	3	11,319	3,303	3,731	4,193
Sawn wood	202	1,371	3,094	587	na
Veneer	24	117	229[b]	13	-
Plywood	1,099	2,718	1,030[b]	541	433
			Thousand cubic meters (roundwood equivalent)[c]		
Logs	3	11,319	3,303	3,731	4,193
Sawn wood	364	2,468	5,569	1,057	na
Veneer	46	222	435	25	-
Plywood	2,528	6,251	2,369	1,244	996

na = not available

[a] Product basis.
[b] Data for 1989.
[c] Conversion factors (m^3 roundwood per m^3 product) are: sawn wood, 1.8; veneer, 1.9; and plywood, 2.3.

Sources: International tropical Timber Organization (1991), Stichting Bos en Hout (1991), Wood-Products Stockpile Corp. (1991), Foreign Agricultural Service (1990).

Table 4.2--Japanese imports of logs, lumber, and plywood, by temperate and tropical, and hardwood and softwood, 1990

Type	Logs	Lumber	Plywood[a]
		Thousand cubic meters	
Tropical			
Hardwood	11,300	1,371	2,718
Softwood[b]	227	308	2
Temperate			
Hardwood	1,017	343	282[c]
Softwood	16,455	7,061	50
Total			
Hardwood	12,317	1,714	3,000
Softwood	16,682	7,369	52
Total	28,999	9,083	3,095[d]

[a] Converted from square meters at 135 m^2 per m^3.
[b] Softwood volume from South Seas and "other".
[c] Hardwood plywood not classified as tropical; Indonesia is the primary supplier.
[d] Includes plywood classified as "other".

Source: Wood-Products Stockpile Corp. (1991)

Table 4.3--Importance of tropical timber in the Japanese forest sector, 1990

	Imports of tropical logs			Imports of tropical	
	Total	Used for lumber	Used for plywood	Lumber	Plywood
	Thousand cubic meters				
Volume	11,300	2,614	8,684	1,371[c]	2,718[d]
	Percent				
Share of supply[a]	24	5	88	5	26
Share of imports[b]	39	11	92	15	88

[a] Tropical share of total log supply (from domestic production and imports), and tropical share of total lumber and plywood supply.

[b] Tropical share of total log, lumber, and plywood imports (including softwood logs).

[c] Includes hardwood lumber from South Seas and a small quantity of hardwood lumber from sources other than the South Seas, North America, Russia, Chile, and New Zealand.

[d] Tropical hardwood plywood imports (WSC 1991) converted from square meters (366.9 million m2) at 135 m2 per m3.

Sources: Calculated and estimated from data reported by Japan Wood-Products Information and Research Center (JAWIC) (1991), Japan Wood-Products Stockpile Corp (WSC) (1991), and Japan Lumber Reports (1992).

Table 4.4--End uses for tropical lumber and plywood in Japan, 1989

End use	Lumber	Plywood
	Percent	
Housing and construction	37	66
Furniture	29	9
Packaging	13	4
Other	21	21

Source: Ward Associates (1991).

Table 4.5--Nonconiferous log consumption, EEC

	Temperate	Tropical	Total	Share tropical
	Thousand cubic meters			*Percent*
1965	17,963	4,759	22,722	20.9
1966	18,557	4,933	23,490	21.0
1967	18,328	4,720	23,047	20.5
1968	18,462	5,361	23,823	22.5
1969	19,139	6,689	25,828	25.9
1970	20,058	6,017	26,075	23.1
1971	18,947	6,189	25,136	24.6
1972	18,666	6,882	25,548	26.9
1973	19,992	7,942	27,934	28.4
1974	19,162	6,043	25,205	24.0
1975	17,516	4,757	22,273	21.4
1976	17,548	6,161	23,708	26.0
1977	19,347	5,795	25,142	23.0
1978	19,617	4,935	24,552	20.1
1979	19,057	5,321	24,378	21.8
1980	19,766	5,393	25,159	21.4
1981	18,988	4,112	23,099	17.8
1982	17,142	3,841	20,982	18.3
1983	17,288	3,764	21,052	17.9
1984	17,568	3,681	21,249	17.3
1985	16,992	3,400	20,391	16.7
1986	17,688	3,308	20,996	15.8
1987	17,538	3,025	20,563	14.7
1988	17,879	3,245	21,123	15.4
1989	17,915	3,381	21,296	15.9
1990	18,594	3,303	21,897	15.1

Source: original data are from ECE/FAO.

Temperate, nonconiferous log consumption is calculated as apparent consumption of all nonconiferous logs less net imports of tropical logs.

Data for former DDR are included.

Table 4.6--End uses for tropical sawn wood and plywood in selected European countries

Product and end use	United Kingdom	France	Germany
Sawn wood			
Joinery	24	39	15
Windows, doors	23	22	67
Furniture	33	25	18
Construction	11	11	
Other	9	3	
Plywood			
Shopfitting, joinery	34	33	
Furniture	17	18	15
Industrial	19		66
Construction	19	25	19
Other	11	24	

Source: Based on data reported by Cooper (1990).

Table 4.7--Value of North American forest products imports of tropical timber, 1991

Million US $

Product	Canada	United States
Logs	-	3
Sawn wood	4	94
Veneer	2	45
Plywood	20	399
Total	26	541

Source: Ward International (1992).

Table 4.8--United States imports of forest products from tropical countries, 1990[a]

Commodity category	Total	Of which tropical[b]
	Millions of dollars	
Logs	15.1	4.2
Sawn wood	116.5	82.6
Veneer	53.9	21.6
Plywood	467.3	383.7
Subtotal, primary	652.8	492.1
Other solid wood[c]	491.7	na
Pulp and paper	516.2	na
Wooden furniture	396.2	na

na = not available

[a] Tropical countries are those countries with significant land area in the tropical zone; figures do not include data for imports from Taiwan, Singapore, and Hong Kong, but do include data for imports from Mexico.

[b] Commodities identified as tropical timber; the species composition of manufactured products and furniture is not identified in trade data.

[c] Includes milled and manufactured products such as joinery, windows, doors, tools, and tableware.

Table 4.9--End uses for tropical lumber and plywood in North America, 1990

End use	Lumber	Plywood
	Percent	
Housing/construction	15	30
Furniture	35	25
Cabinets	10	15
Millwork	25	10
Containers	1	1
Other	14	19

Source: Ward International (1992).

Table 4.10–Summary of FAO World Outlook Projections for forest products

Percent per annum growth in consumption

Product	1965-75	1975-b87[a]	b87-95	1995-2000	2000-10
Developing countries					
Roundwood	3.0	2.6	2.3	2.1	2.0
Fuelwood	2.6	2.2	2.2	1.7	1.4
Industrial rndwd	5.5	4.2	3.0	3.5	3.7
Pulp wood	6.9	8.1	3.9	5.7	6.1
Sawn wood	4.8	4.5	2.9	3.2	3.3
Wood-based panels	11.5	7.7	7.3	8.2	8.2
Paper & paperboard	5.4	7.5	6.2	6.8	7.2
Developed countries					
Roundwood	0.1	1.8	1.4	1.5	1.6
Fuelwood	-3.3	4.3	0.5	0.3	0.2
Industrial rndwd	0.8	1.4	1.6	1.8	1.8
Pulp wood	3.0	2.9	2.6	2.9	3.2
Sawn wood	-0.1	1.0	1.2	1.4	1.5
Wood-based panels	6.9	2.6	2.9	3.3	3.5
Paper & paperboard	2.7	3.6	2.5	3.0	3.2

[a] The base period for these projections (b87) is the average consumption 1985-89.

Source: Food and Agriculture Organization (1991).

Table 4.11--Trends in consumption of industrial forest products in tropical countries, 1970-90[a]

	Coniferous sawn wood	Nonconiferous sawn wood	Wood-based panels	Paper & paperboard
	Thousand cubic meters			*Thousand MT*
1970	8,156	20,127	3,076	7,318
1975	10,676	26,249	4,581	8,822
1980	14,673	37,978	8,100	14,268
1985	16,414	44,945	9,016	16,861
1990	17,631	52,829	8,918	23.373
Average annual growth (percent)				
1970-90	3.9	4.9	5.5	6.0

[a] Apparent consumption for the tropical countries of Africa, Asia, and Latin America; excludes countries in those regions that are outside the tropical zone.

Source: Calculated from data reported by Food and Agriculture Organization (AGROSTAT).

Table 4.12--Apparent consumption of nonconiferous sawn wood in tropical countries, 1970-90

	Tropical countries of:				
	Africa	Latin America	Asia	Oceania	Total
	Thousand cubic meters				
1970	2,034	6,594	11,407	92	20,127
1971	2,217	7,095	11,161	62	20,535
1972	1,976	6,783	12,981	136	21,876
1973	2,114	7,146	12,645	97	22,002
1974	2,477	7,624	13,959	78	24,138
1975	2,790	8,622	14,740	97	26,249
1976	2,619	9,763	15,630	89	28,101
1977	3,000	10,158	18,018	75	31,251
1978	3,742	10,667	18,923	77	33,409
1979	3,833	10,625	18,196	77	32,731
1980	4,596	12,231	21,063	88	37,978
1981	4,854	12,908	21,632	54	39,448
1982	4,530	12,659	24,552	57	41,798
1983	4,277	12,982	24,914	58	42,231
1984	4,257	13,670	25,487	60	43,474
1985	4,676	13,689	26,521	59	44,945
1986	4,805	14,303	25,856	67	45,031
1987	5,025	14,289	28,786	70	48,170
1988	5,049	14,212	28,372	71	47,704
1989	5,142	14,595	34,600	69	54,406
1990	5,124	14,851	32,785	69	52,829

Source: Food and Agriculture Organization (AGROSTAT).

Table 4.13--Apparent consumption of coniferous sawn wood in tropical countries, 1970-90

	Tropical countries of:				
	Africa	Latin America	Asia	Oceania	Total
	Thousand cubic meters				
1970	441	6,204	1,500	11	8,156
1971	500	6,010	1,701	16	8,227
1972	457	6,293	1,742	18	8,510
1973	461	5,912	1,807	13	8,193
1974	395	6,452	1,806	12	8,665
1975	438	8,317	1,908	13	10,676
1976	431	9,267	2,716	12	12,426
1977	447	9,970	2,692	12	13,121
1978	408	10,532	2,711	14	13,665
1979	424	10,389	3,062	14	13,889
1980	505	10,771	3,343	54	14,673
1981	548	10,894	3,473	46	14,961
1982	521	10,659	3,824	46	15,050
1983	464	11,315	4,357	46	16,182
1984	528	11,985	4,375	46	16,934
1985	553	11,926	3,894	41	16,414
1986	565	11,758	3,709	41	16,073
1987	617	11,876	3,769	41	16,303
1988	666	12,249	4,019	43	16,977
1989	631	12,204	4,315	43	17,193
1990	629	12,102	4,857	43	17,631

Source: Food and Agriculture Organization (AGROSTAT).

Table 4.14--Apparent consumption of wood-based panels in tropical countries, 1970-90

	Tropical countries of:				
	Africa	Latin America	Asia	Oceania	Total
	Thousand cubic meters				
1970	264	1,265	1,521	26	3,076
1971	360	1,496	1,442	23	3,321
1972	385	1,861	1,481	24	3,751
1973	423	1,997	1,388	9	3,817
1974	499	2,131	1,319	8	3,957
1975	486	2,303	1,784	8	4,581
1976	581	2,590	2,122	6	5,299
1977	656	2,878	2,457	15	6,006
1978	692	2,957	2,622	16	6,287
1979	780	3,169	3,092	16	7,057
1980	942	3,611	3,535	12	8,100
1981	936	3,819	3,941	11	8,707
1982	980	3,782	4,871	13	9,646
1983	1,004	3,803	4,147	14	8,968
1984	903	3,763	4,294	14	8,974
1985	1,011	3,670	4,317	18	9,016
1986	1,010	3,750	4,370	24	9,154
1987	991	4,004	3,951	24	8,970
1988	1,026	3,901	4,687	29	9,643
1989	1,041	3,841	4,207	29	9,118
1990	1,040	3,784	4,048	46	8,918

Source: Food and Agriculture Organization (AGROSTAT).

Table 4.15--Apparent consumption of paper and paperboard in tropical countries, 1970-90

	Tropical countries of:				
	Africa	Latin America	Asia	Oceania	Total
	Thousand metric tons				
1970	390	4,323	2,601	4	7,318
1971	447	4,416	2,892	4	7,759
1972	397	4,803	3,002	5	8,207
1973	482	5,254	3,316	1	9,053
1974	549	6,055	3,171	1	9,776
1975	477	5,357	2,987	1	8,822
1976	516	6,137	3,473	3	10,129
1977	527	6,794	3,670	7	10,998
1978	542	7,063	4,236	9	11,850
1979	542	7,738	4,612	10	12,902
1980	554	8,967	4,734	13	14,268
1981	681	8,984	5,237	12	14,914
1982	569	9,105	5,420	8	15,102
1983	599	9,026	5,578	10	15,213
1984	529	9,872	6,148	8	16,557
1985	598	10,074	6,180	9	16,861
1986	585	11,011	6,583	9	18,188
1987	606	11,370	7,774	9	19,759
1988	614	12,690	8,528	9	21,841
1989	599	12,627	9,471	9	22,706
1990	603	12,357	10,404	9	23,373

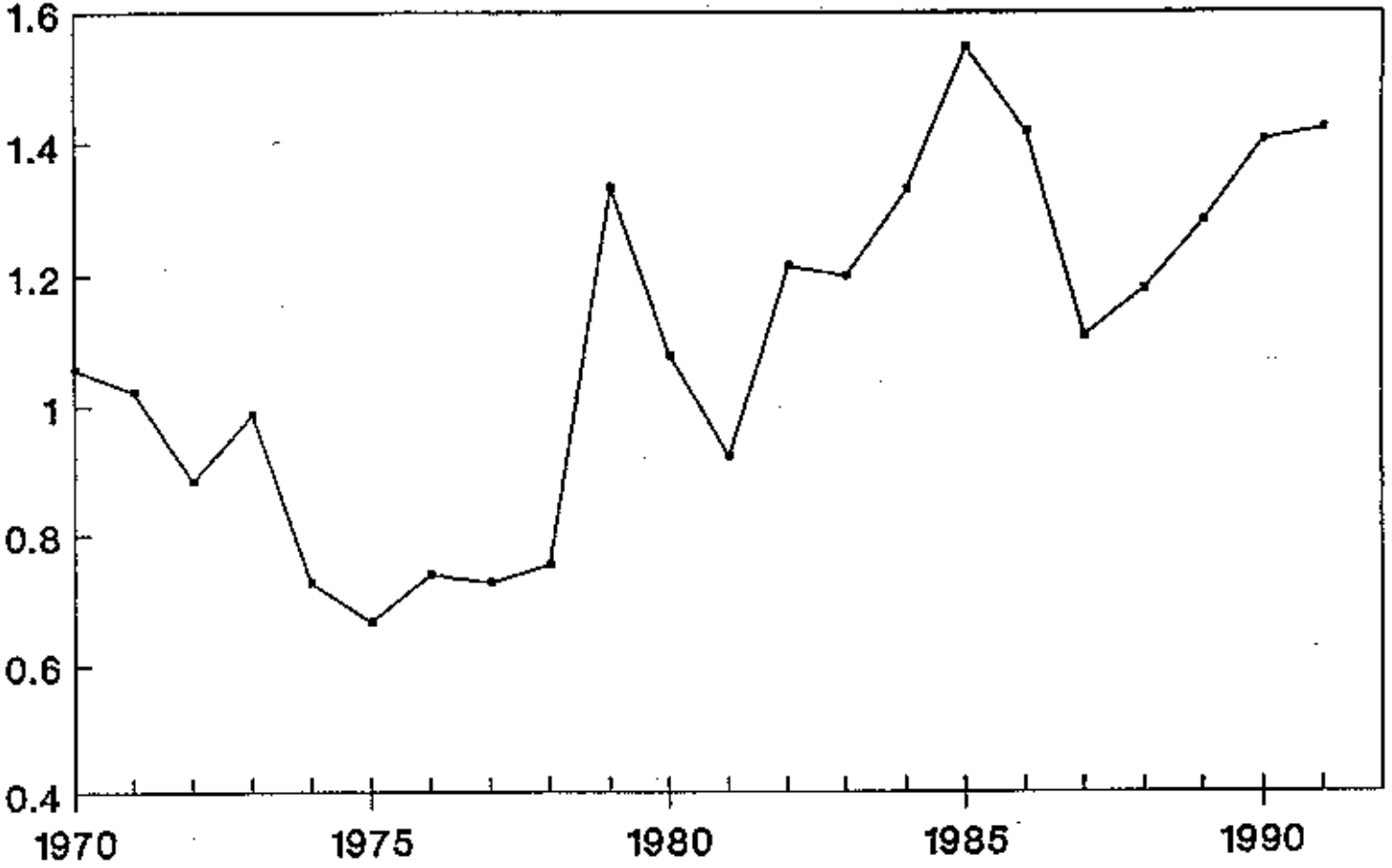
Source: Food and Agriculture Organization (AGROSTAT).

Table 4.16--Developing country exports of selected forest products, 1975-90

Product and destination	1975	1980	1985	1990
Nonconiferous saw and veneer logs (million cubic meters)				
Developing countries	10.1	13.7	9.2	12.0
Developed countries	24.2	24.6	17.7	14.7
World	34.3	38.3	26.8	26.7
Nonconiferous sawn wood (million cubic meters)				
Developing countries	2.0	4.2	4.0	4.9
Developed countries	2.7	4.1	3.9	4.2
World	4.7	8.3	7.9	9.1
Plywood (million cubic meters)				
Developing countries	0.4	1.5	3.4	6.4
Developed countries	2.6	2.7	2.5	5.5
World	3.0	4.2	5.9	11.8

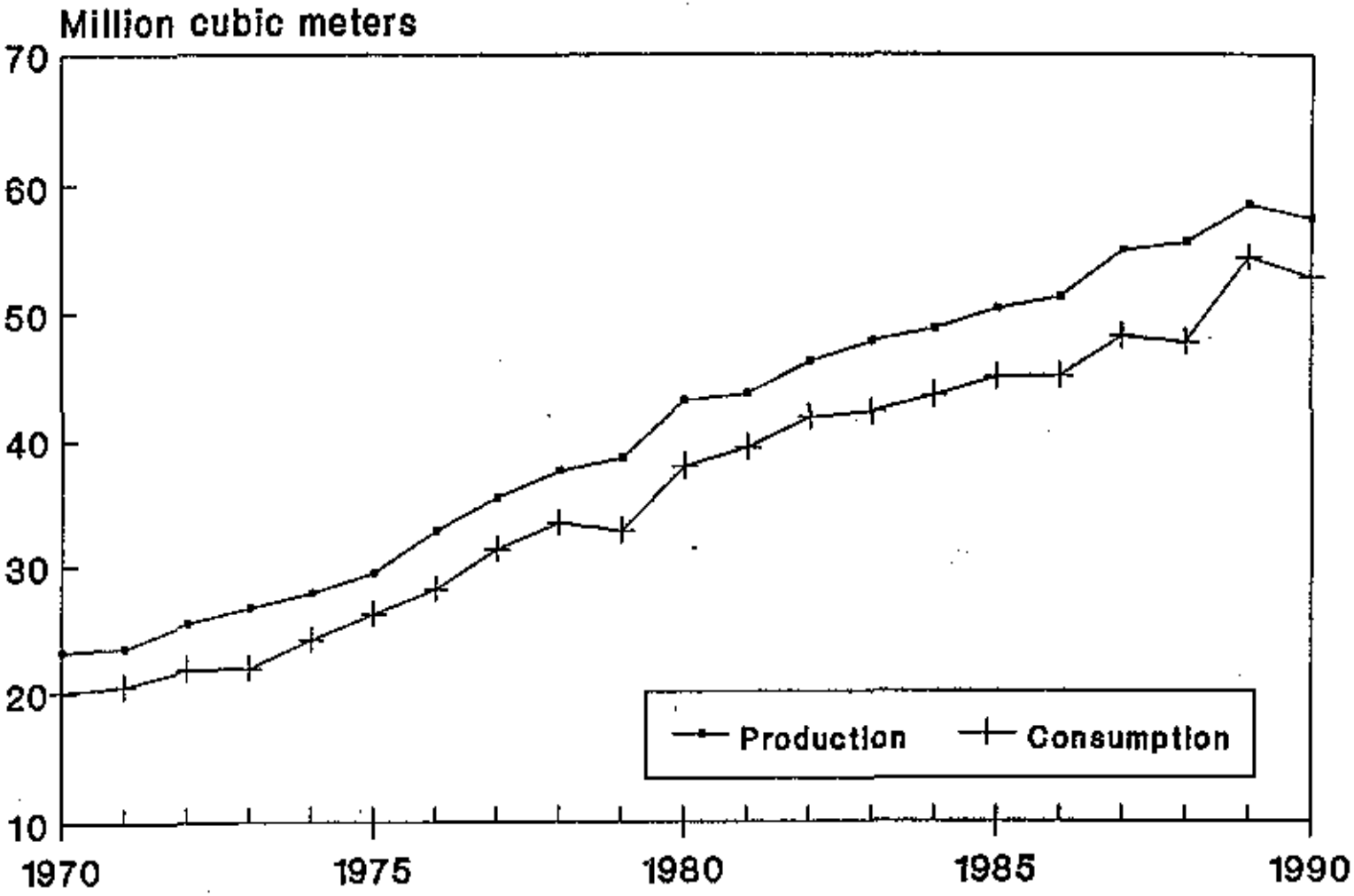
Source: Food and Agriculture Organization.

Relative prices of sawn wood in Japan: Lauan and Hinoki



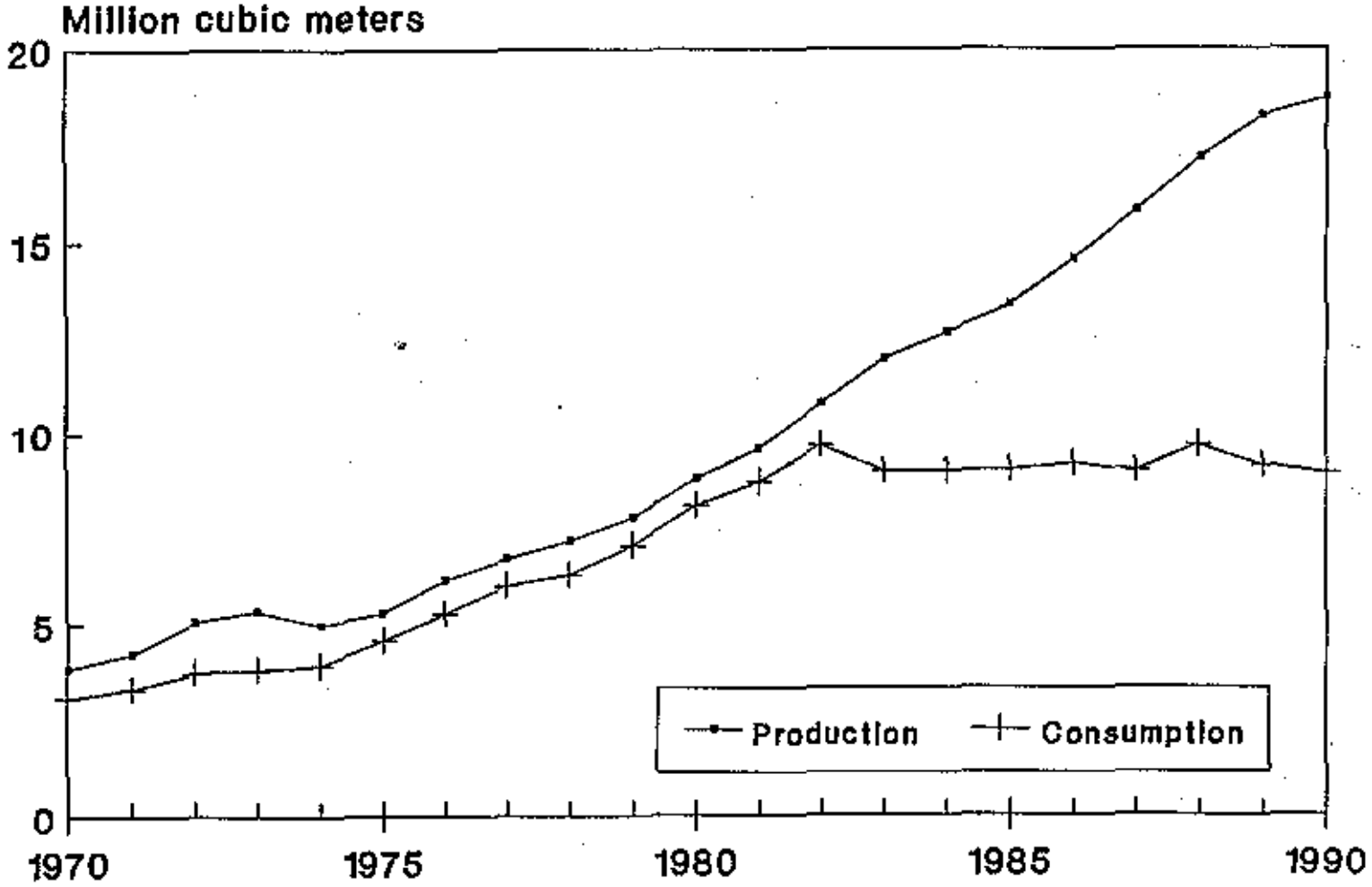
Source: FAO (1990); WSC (1992)

Production and consumption of nonconiferous sawn wood, tropical countries

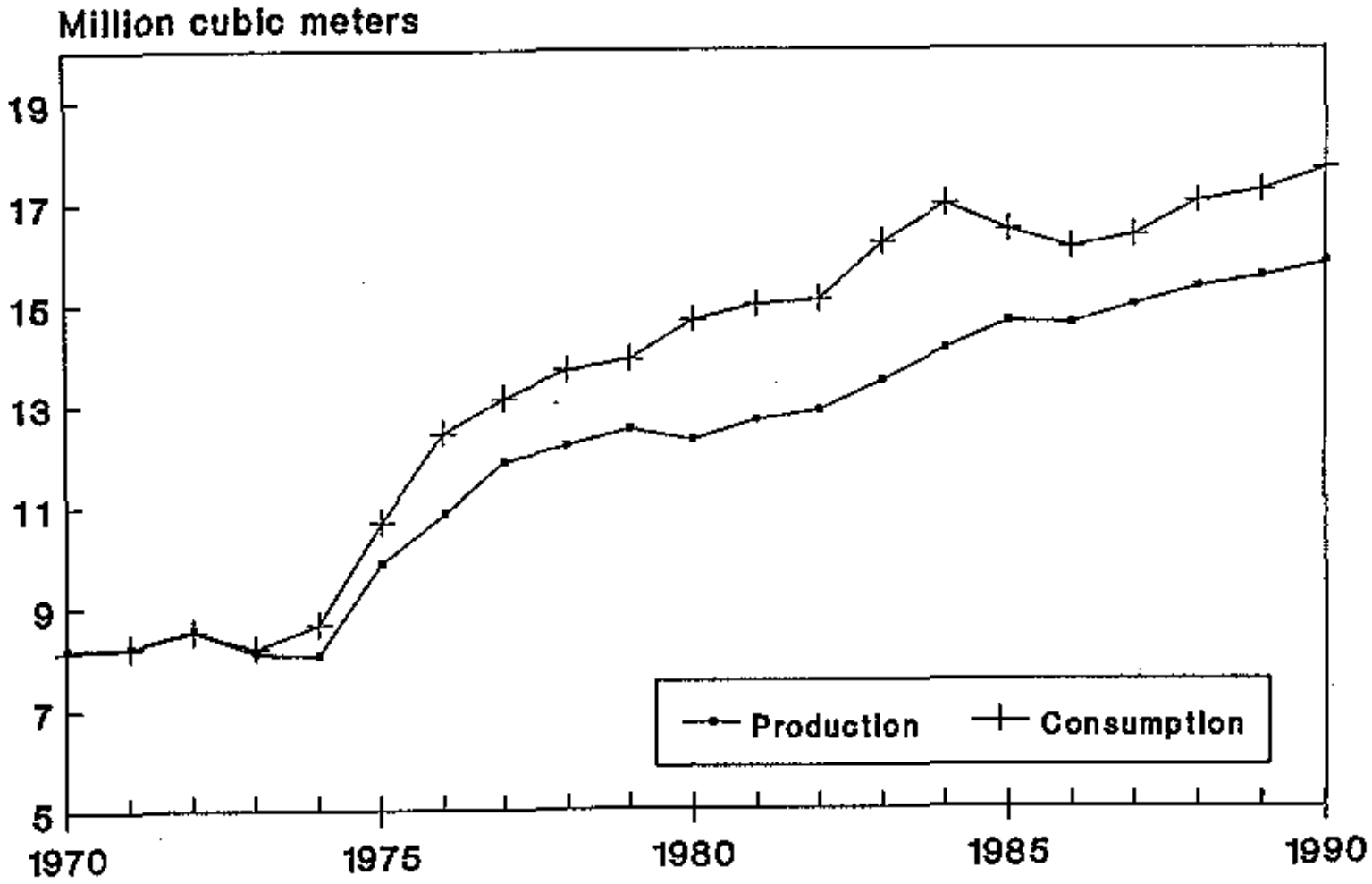


Source: FAO

Production and consumption of wood-based panels, tropical countries

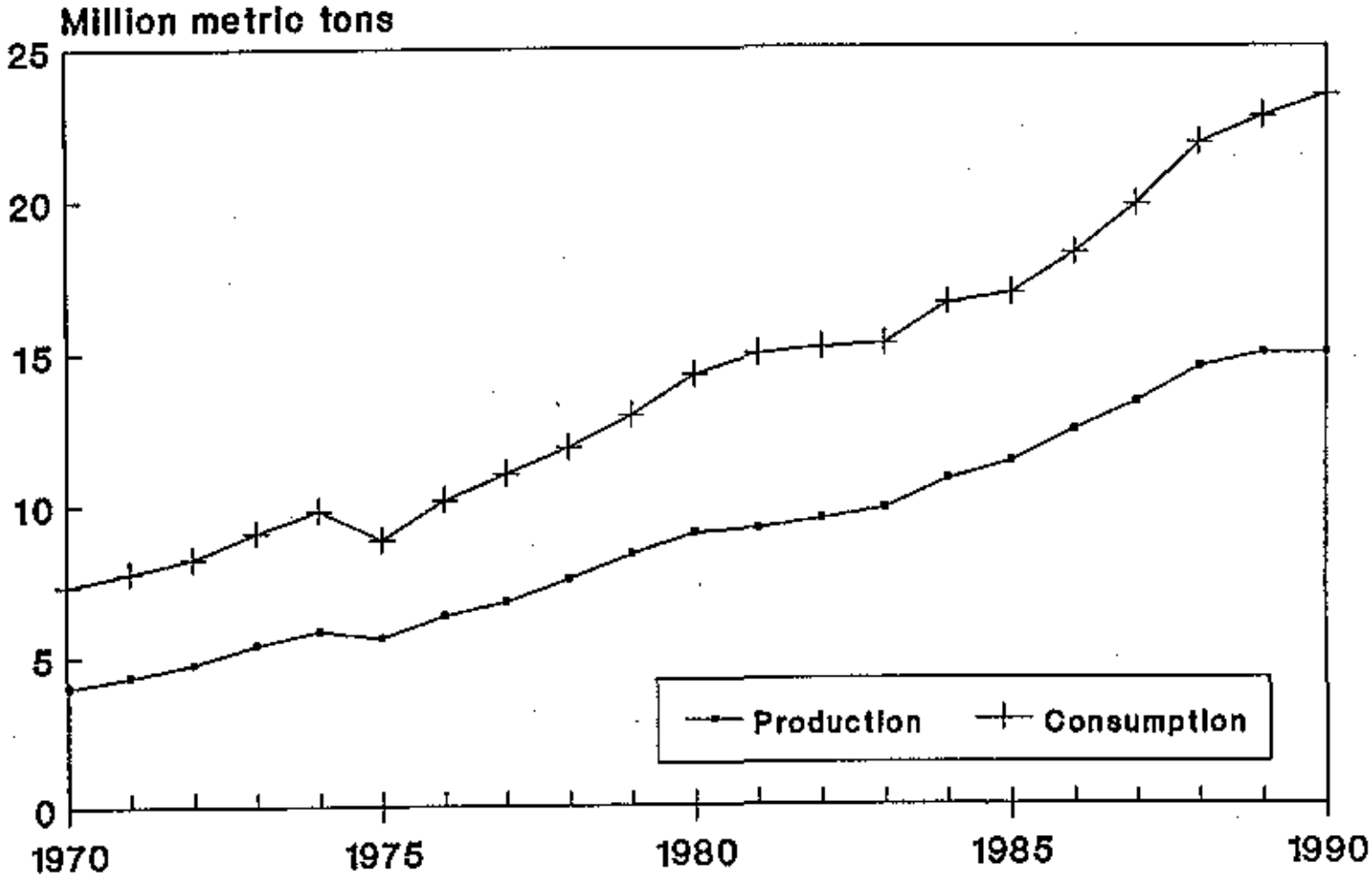


Production and consumption of coniferous sawn wood, tropical countries



Source: FAO

Production and consumption of paper and board products, tropical countries



Substitution in Forest Products Consumption: Issues, Trends and Implications for Tropical Timber Trade Policy

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1. Background

Markets for tropical timber are critical in maintaining tropical forest; forest management that provides financial returns with practices that maintain ecological conditions and processes can be one of the best methods for slowing rates of deforestation in the tropics (Poore 1989). However, a sequence of as-yet unanswered questions begins in the conclusion that sustainable management of tropical forests costs more than current management approach (Oxford Forestry Institute 1991). If raw material (log) production costs production costs are increased, and these increased costs are passed through to product prices, how will markets respond? Will consumers absorb these costs as an inevitable part of sustaining tropical forests? Or will consumers respond simply to higher prices by reducing consumption of tropical timber, thereby undermining the objective of sustaining tropical forests through economic returns from timber products of tropical forests? The lack of clear knowledge of the type and rate of likely market response to higher tropical timber prices inhibits policy development and analysis. If reduction in consumption or substitution of other material and products for tropical timber occurs quickly and broadly, new policy approaches must be developed.

In fact, we do not lack general knowledge of the processes or results of material substitution, but we do not have enough information on demand for tropical timber products to broadly and definitively project the results of increased tropical timber prices. However, for some tropical timber products, in some markets, we have evidence of changes in consumption in response to changes in price and the price of substitutes. This paper briefly reviews issues of materials substitution, and experiences in forest products to provide background useful in formulating tropical timber trade and management policies. Recent studies of tropical timber markets are reviewed for specific indications of possible market responses.

2. Substitution processes

The process by which materials are consumed and substituted for each other has been extensively treated in the economics literature. Abundant materials are used to replace relatively scarce materials to maintain types and levels of economic activity. Rosenberg (1973) uses examples of the use of timber in the United States and Europe to illustrate these processes. Compared to conditions in Europe, in the 18th and 19th centuries wood was abundant in the United States and use was inefficient. Increasing real prices, increasing relative prices, and new technology lead to the substitution of other materials for wood across a wide array of activities (Rosenberg 1973).

Based on a enumeration by Tilton (1983), four types of substitution can be identified: material for material, other factors for material; quality for material; and interproduct substitution. Forest products provide examples of all four types of substitution.

Material for material: - Timber use by railroads provides a 19th century example of this process. In the United States in 1850 wood supplied more than 90 percent of all fuel-based energy, and was nearly the sole source of fuel for steam engines; by the end of the century, a shift to coal fuel was nearly complete (Rosenberg 1973). More recent examples of material-for-material substitution include the use of concrete in place of wood for railroad ties, and the use of aluminium, steel and plastic in place of wood in structural and decorative uses.

Other factors for material: - In all industries consumption of materials is reduced by increasing non-material inputs. In forest products, timber consumption in the manufacture of sawn wood and other products has been reduced through increasing the use of labour and capital. In the past few decades in the United States, technology - in the form of capital inputs - has been reduced both raw material and labour use. Examples include computer-controlled saw milling machinery, "chip-and-saw" techniques to increase total material recovery, and the development of narrow kerf blades.

Quality for material: - Altering product quality or performance standards can be used to reduce material content. A general example of this is lumber production standards in the United States and elsewhere that specify smaller minimum dimensions for products sold as having larger nominal dimensions. Other examples include reductions in acceptable dimensions of standard framing lumber to 2 x 3 inches from 2 x 4 inches, and the use of low-grade core material in place of veneer in plywood.

Interproduct substitution: - This type of substitution does not alter the manufacturing process or the mix of materials used to produce individual good; instead the composition of goods or services is changed (Tilton 1983). Thus of electronic information in place of paper is one example of (widely expected, if not actually observed). Perhaps more important are significant changes in the level and composition of demand for forest products that have resulted from the introduction and substitution of new products, some of which are themselves manufactured from wood. The introduction of plywood that replaced lumber as sheathing material is perhaps the best example; plywood also replaced lumber and shingles in siding: particleboard has replaced lumber in much furniture construction.

This broad-based approach makes clear the importance of substitution as a factor in commodity production and consumption. Forest products manufacturing and marketing are no exception. The process of substitution is fundamental and ubiquitous, and the conditions and factors that cause it are not well understood (Tilton 1983). It is not possible to state generally and categorically which among changes in relative prices, changes in market institutions and regulations, development of technology, or changes in consumer tastes and preferences is most influential in causing or controlling the rate or extent of substitution. In large measure this is because the process of substitution can only be understood in the context of specific products used in specific markets, and within a relatively short time frame.

For tropical timber all four types of substitution must be considered. Material-for-material and interproduct substitution are likely to be the most important in the near terms, but all are important. Substitution opportunities include non-timber materials, the use of non-tropical timber, and the development of products using, for example, tropical veneers glued on cores composed of other materials. Which is most likely-or dominant-will depend on end use and market.

3. A brief review of literature

Unfortunately, the forest products literature offers little information on the substitution question that is directly useful to analysis of tropical timber markets. Generally, two types of studies have been done. The first is a descriptive approach; this might be quite general (dealing with issues) or quite specific in terms of technical details. Studies of U.S. forest products markets generally have addressed broad trends in substitution (see, for example, Haynes [1990], but do not provide specific estimates of factors motivating substitution, or rates at which it may occur in the future. Alexander and Greber (1991) estimates specific elasticities of substitution between softwood lumber and nonwood materials used in construction, using relative prices as the explanatory factor. Although their results are by no means definitive, there are indications of the type and magnitude of interaction among materials in this broad end-use market.

Studies focused more narrowly provide more information on causes, processes and opportunities for substitution, but cannot be generalized. See, for example, clark (1971) Spelter (1983) and Hansen and Sinclair (1991). Studies of this second type would be ideal for current tropical timber policy deliberations. Unfortunately few studies have specifically considered tropical timber.

Vincent and others (1990 1991) approach the substitution question by examining producer decisions on choice of raw material. Vincent and others (1990) examine substitution among tropical timbers, to examine the use of well-known species (WKS) and lessor-known species (LKS) of tropical timber. Here, as with Alexander and Greber (1991), relative prices are assumed to motivate substitution; that is, the hypothesis tested is that changes in relative prices of WKS and LKS lead to substitution. Results were generally inconclusive. Weak data is one explanation; the possibility that substitution, or the lack of it, may be more strongly motivated by other considerations is another.

Vencint and others (1991) examines substitution between tropical and temperate logs in Japanese lumber production; statistically significant results are reported. That is, relative prices are found to be a statistically significant factor in explaining substitution in raw material use. However, there is an inelastic relationship between consumption (by mills) of tropical logs and changes in prices of temperate softwoods. Not surprisingly, substitution was found to occur more readily within a species group than across groups. The magnitude of response to relative prices was such that it is not an important factor (to date) in raw material choice, for Japanese saw mills.

Some models of demand for tropical timber in the US market have included substitute products as explanatory factors. Haji-Othman (1991) included the price of substitutes - domestic hardwood lumber - in his model of US demand for tropical lumber. The price of

the substitute was not a significant explanatory factor, but demand was found to be very responsive to changes in the price of tropical lumber. Cengel and McKillop (1990) estimate US demand for tropical hardwood plywood using a specification in which hardboard is a substitute product. Price of domestic hardboard was found to be a significant explanatory factor in US demand for hardwood plywood from Japan, although there was not strong evidence in response to changes in import (own) price. Chou and Buongiorno (1982, 1983) estimated statistically-significant, own-price elasticities for imported hardwood plywood, but did not include prices of commodities other than hardwood plywood as explanatory variables. Chou and Buongiorno (1983) focuses on the processes and elasticities of substitution among sources of supply of hardwood plywood.

Using a model similar to Cengel and McKillop (1990), but aggregated across all sources of supply, own-price and cross-price elasticities were estimated for US imports of hardwood plywood (see appendix 1). Over the period 1971-91, imports were found to be responsive to import price, the price of substitutes, and activity in end-use markets. Using more recent data, own-price elasticity estimates are somewhat lower than the high own-price elasticities reported by Chou and Buongiorno (1983) and Cengel and McKillop (1990). However, these results illustrate the importance of substitution - relative prices - in demand for tropical plywood in the United States, and support Ward International's (1992) description of the importance of end-use activity in US demand for tropical plywood.

4. Studies of tropical timber markets

Recent studies of timber markets in Japan and Europe provide descriptive results that contribute to our understanding of substitution as it specifically relates to tropical timber. For the most part, these studies do not provide comprehensive or conclusive information, but they do provide indications of trends in tropical markets and evidence of substitution. For example, Ward Associate (1990) discusses Japanese market conditions for all wood products, and the current and future role of tropical timber products. Changes in market conditions (reductions in log imports and increases in product imports) are assessed in terms of net revenue to tropical timber producers, and the competitive position of tropical timber is assess by broad markets.

The general assessment is that tropical timber "is doing reasonably well" (Ward Associates 1990). However, tropical lumber has decreased to less than 10 percent of the lumber market in 1989 from more than 15 percent in 1980. Because acceptability among consumers remains high (based on function and appearance), price and availability are given as reasons for reductions in market share (Ward Associates 1990). Markets for tropical plywood in Japan are expected to grow, based increasingly on imports of products rather than on domestic (Japanese) production. However, substitute materials (softwood logs and veneers) and substitute products (medium density fibreboard and oriented strand board) are identified as strong competitors in a number of key end-use markets. Nevertheless, over the next decade tropical timber consumption in Japan is expected to remain roughly constant when measured in terms of total (roundwood equivalent) volume (Ward Associates 1990). Log volumes consumed will decrease sharply and products volumes consumed are expected to increase sharply.

The market for tropical timber in the United Kingdom is described as "buoyant" by the Oxford Forestry Institute (1991), implying a relatively inelastic response to higher prices. However, Cooper (1990) and ITTO (1990) provide evidence of markets for tropical timber in Europe that, if not weak, are certainly susceptible to change resulting from changes in relative prices and changes in consumer preferences.

Cooper (1990) reviews tropical timber markets in European countries. He outlines detailed end-uses for tropical timber and discussions with decision-makers (i.e., consumers of tropical timber who are in many cases producers of consumer goods). The qualitative factors that determine the demand for tropical timber in these uses are presented. These factors include, for example product characteristics that lead to the choice of tropical timber (the basis for evaluating the existence of possible substitutes), and the strength of consumer loyalties. Quantification and statistical estimates are the next logical step, albeit one requiring considerable effort. Specific forecasts of European tropical timber markets are not developed.

ITTO (1990) estimates tropical timber's share of total sawn wood consumption for Europe as 3.9 percent in 1986, a decline from 4.5 percent in 1972. Consumption of tropical plywood is estimated to have been roughly unchanged over the period 1976-86. The outlook for tropical timber consumption for the next decade is projected to be similar to the past decade: decreasing log consumption (by European countries) and increasing product consumption with little net change in the total volume of tropical timber consumed. Consumption of all timber products is projected to increase; as a result, tropical timber is expected to decline in relative importance (ITTO 1990).

Ward International (1992) reviews North American timber markets, focusing on markets and uses for tropical timber. North America - predominantly the United States - is the largest forest products market in the world, but tropical timber and timber products account for a very small part of consumption. Trade between Canada and the United States accounts for the vast majority of North American trade in forest products; imports into either the United States or Canada from other sources are small. However, tropical timber accounts for significant proportion of imports from non-North American sources. Tropical timber accounts for half of US hardwood lumber imports, and 90 percent of US hardwood plywood imports (Ward International 1992).

Recent trends in North American markets for tropical timber are strongly influenced by the recent recession; production, imports and consumption of all forest products peaked in 1988-89, and declined 1990-91. Primary tropical timber products (logs, lumber, plywood and veneer) barely maintained their share of this declining market; for most products, consumption in the early 1990s is below levels of consumption in the early 1980s. Growth in North American consumption of tropical timber is forecast to accompany growth in total consumption (Ward International 1992), but tropical timber faces competitive pressure from low cost substitutes in a number of end use markets. Tropical timber products "are, at best, only holding their own in North America" (Ward International 1992). Competitive substitutes include forest products manufactured from temperate species, and products manufactured from non-wood materials. For example, in furniture markets - the largest market for hardwood products - reconstituted panel products such as medium density fiberboard (MDF) and particleboard compete with, and are substituted for, tropical plywood.

Although in some cases, these products provide a market for tropical veneer as a surface material, the total volume of tropical timber consumed decreases substantially. Changing tastes and preferences that appear to favor temperate over tropical woods in some exposed uses also contribute to pressure on the competitive position of tropical timber (Ward International 1992).

As is the case with Japanese and European markets for tropical timber, the North American market is also characterized by a shift away from raw materials and semi-processed materials, and towards imports of value-added tropical timber products. However, because North American imports of tropical logs have never been significant, the shift is away from lumber and plywood and towards imports of manufactured products such as millwork, doors, furniture and furniture parts. Non-tropical countries in Asia (such as Taiwan) and Europe (such as Denmark) are major suppliers of furniture in which tropical timber is a component (Ward International 1992). Tropical timber remains a competitive material in these products and end uses, and value added products represent the best prospect for growth in North American imports and consumption of tropical timber (Ward International 1992). However, tropical timber producers face increased competition from a large number of potential suppliers.

Analysis of tropical timber consumption based on trade data must be done with caution, as these data can be quite misleading. First, the high degree of aggregation underlying these data can easily mask conditions that are quite different than they first appear. Second, as the consumption of trade in tropical timber changes, the choice of where consumption is measured becomes critical to an assessment of market response. For example, consumption of tropical logs has declined in every European market; in nearly every case, important of products (sawn wood, plywood and manufactured goods) have increased. Changes in the composition of trade do not necessarily indicate the direction of change in overall consumption of tropical timber. Changes in consumption are made more difficult to measure by lack of complete current and historical consumption data that distinguish tropical from other timber. Historical data that include information on the use of tropical logs in consuming countries are needed. Efforts of tropical timber producing countries to increase processing beyond sawing lumber or manufacturing plywood further complicate the assessment of trends. If data on specific end uses of logs, lumber, and plywood are not available, countries importing smaller quantities of sawn wood and higher quantities of joinery products or furniture may be assumed to be consuming less tropical timber than is actually used.

Summary: implications for tropical timber trade

Even in the absence of the data needed to develop detailed models of changes in consumption of tropical timber products in specific uses, price trends can be used to indicate one source of pressure for substitution. Table 1 builds on the Ward Associates (1990) analysis of the Japanese market (see their table (IX-E). Changes in prices of temperate (hinoki) and tropical (lauan) lumber clearly illustrate incentives to find substitutes for tropical timber. The real price (cost relative to an index of all commodity prices) and the relative price of lauan lumber have increased almost steadily since 1970. In contrast, the real price of hinoki lumber has fluctuated, but shows no trend over the same period (figure 1). As a result, the

relative price of lauan lumber has increased in the last decade, and especially in the period 1987-91. This should be expected to lead to reductions in market share, as reported by Ward Associates (1990).

Data from the US market show similar patterns. Indexes of real prices for hardwood plywood imports, and domestic hardwood plywood (and related products) are shown in table 2. Although hardwood plywood imports include some temperate plywood, tropical hardwood plywood accounts for 90 percent of US hardwood plywood imports, and about one half of hardwood plywood consumption. In real terms (deflated by the all commodity producer price index), the price of hardwood plywood imports in the US fluctuated 1970-85, but shows no trend until the late 1980s (figure 2). Some of the sharp change in the price index 1989-90 may be anomalous - the result of changes in commodity classifications in trade data (1989). Nevertheless, increases in real prices of tropical plywood have been sustained. Perhaps even more significant, over the period 1970-88 the price of imported hardwood plywood increased relative to a composite index of hardwood plywood and related commodities that can be expected to act as close substitutes. Therefore, it is only surprising that tropical plywood has apparently maintained its share of the US market (Ward International 1992).

Ingram (in press) adds additional information to this view of price trends by examining broad trends in tropical timber imports by North America, Japan and Europe. Increasing real prices were found in all markets. Most price increases occurred in the last decade; changes in prices relative to those of current or prospective substitutes were not examined. Generally, Ingram (in press) provides additional indications of price-based inducements to seek substitutes for tropical timber. To confirm this, further work must examine prices of specific tropical timber products (a) relative to all commodities (ie real price trends), and (b) relative to actual or potential substitutes. Even without a completely developed statistical analysis we can determine the extent to which historical trends provide, or fail to provide, economic signals that would induce substitution or reduction in consumption.

Additional, more detailed, and more comprehensive studies must be undertaken to improve our understanding of tropical timber market responses to changes in prices and other factors. In addition to price changes, studies must address, for example, labelling and certification (efforts to effect consumer attitudes without changing prices) and regulatory and legal factors (such as building codes and product standards). Cooper (1990) outlines methods for studies of high value end uses of tropical timber in Europe. It is important to keep in mind the fact that the substitution decision can be made at a number of stages in the manufacturing process. Although the responses of "final" consumers typically are examined in econometric studies, manufacturers choices of inputs also should be considered. Because many tropical timber products are "embedded" in broader consumer goods (for example, as doors or window frames in houses) it will bet difficult to establish the basis for consumer choices. Finally, any analysis of consumption trends requires prices consistent with the stage of processing, and should also be based on cost in use. Prices of substitute raw materials are appropriate when examining manufacturers production decisions, but may not reflect costs of final products; choice of the price indicator must be consistent with the market and use being examined.

Although not systematic, data from a variety of markets and sources show that prices of selected tropical timber products have increased (1) relative to prices of all commodities, and

(2) relative to prices of potential substitutes. Models of demand for tropical timber products generally have shown consumption to be responsive to the real price of tropical timber products, and responsive to the price of selected substitute commodities. As a result, we should expect the market responses - reductions in demand for tropical timber - that, in fact, have been observed in descriptive studies. If policy intervention results in increases in costs of production of tropical timber relative to production costs of competitive products (temperate timber, and other materials), and these costs are reflected in increased product prices, further weakening of markets for tropical timber should be expected.

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Table 1--Tropical and temperate lumber prices in Japan, 1970-91

	Lauan[a]		Hinoki[b]		
	Nominal	'80 Yen	Nominal	'80 Yen	Ratio[c]
	Thousand yen per cubic meter				
1970	42.3	87.4	40.0	82.6	1.06
1971	43.0	89.6	42.1	87.7	1.02
1972	40.8	84.3	46.2	95.4	0.88
1973	54.7	97.7	55.4	99.0	0.99
1974	73.2	99.3	100.8	136.8	0.73
1975	67.7	89.2	101.9	134.3	0.66
1976	77.6	97.4	105.0	131.7	0.74
1977	82.2	101.2	113.3	139.5	0.73
1978	79.5	100.5	105.5	133.4	0.75
1979	133.3	157.0	100.0	117.8	1.33
1980	141.1	141.1	130.9	130.9	1.08
1981	126.2	124.5	137.0	135.1	0.92
1982	135.9	131.7	112.0	108.5	1.21
1983	129.4	128.2	108.0	107.0	1.20
1984	130.6	129.8	98.3	97.7	1.33
1985	134.0	134.6	86.6	87.0	1.55
1986	130.2	144.4	91.8	101.8	1.42
1987	137.3	157.7	124.1	142.5	1.11
1988	138.4	160.6	117.5	136.4	1.18
1989	152.2	172.3	118.7	134.3	1.28
1990	167.8	186.1	119.4	132.4	1.41
1991	165.5	183.2	116.4	128.9	1.42

[a] Lauan boards, grade 1, 3.0 - 3.4 x 30 cm x 4.0 m.
[b] Hinoki square, grade 1, 10.5 cm x 10.5 cm x 3.0 m.
[c] The ratio of lauan price to hinoki price.

Sources: Food and Agriculture Organization (1990); Japan Wood-products Information and Research Center (1992).

Table 2--Hardwood plywood price indexes in the United States, 1970-92

	Import unit value index		All hardwood plywood index[a]		
	Nominal	Deflated[b]	Nominal	Deflated[b]	Ratio[c]
1970	0.344	0.933	0.566	1.534	0.608
1971	0.348	0.913	0.556	1.459	0.626
1972	0.362	0.909	0.576	1.447	0.628
1973	0.522	1.159	0.623	1.384	0.837
1974	0.591	1.105	0.719	1.344	0.823
1975	0.458	0.785	0.660	1.130	0.694
1976	0.545	0.892	0.677	1.108	0.805
1977	0.669	1.030	0.705	1.086	0.949
1978	0.698	0.998	0.774	1.107	0.901
1979	0.957	1.216	0.934	1.187	1.025
1980	1.134	1.263	0.975	1.086	1.163
1981	1.048	1.070	0.993	1.013	1.056
1982	1.000	1.000	1.000	1.000	1.000
1983	0.908	0.823	0.993	0.900	0.915
1984	0.977	0.942	0.996	0.960	0.980
1985	0.864	0.837	0.899	0.871	0.961
1986	0.879	0.877	0.910	0.908	0.965
1987	1.046	1.017	0.929	0.904	1.125
1988	1.147	1.073	0.942	0.881	1.218
1989	1.830	1.631	0.998	0.889	1.834
1990	2.256	1.940	1.034	0.889	2.181
1991	2.224	1.908	1.028	0.882	2.163
1992p	2.276	1.943	1.056	0.902	2.154

[a] Hardwood plywood and related products.

[b] Nominal index divided by the all commodity producer price index.

[c] Ratio of import unit value index and hardwood plywood composite index.

Sources: Ulrich (1990); US Bureau of Labor Statistics, US Department of Commerce.

Appendix 1--A model of United States demand for hardwood plywood imports

Some recent studies provide estimates of the own price elasticity for tropical plywood imports, but are less clear on the question of substitution--that is, the change in imports in response to changes in the price of substitutes. Chou and Buongiorno (1983) focus on substitution among sources of supply, but do not consider the price of domestic hardwood plywood, or other substitute products in the demand for imports. Cengel and McKillop (1990) estimate U.S. demand for hardwood plywood from Korea, Taiwan, and Japan, and include the price of a substitute, Type II hardboard, as an explanatory factor. Neither of these studies uses data more recent than 1979. Therefore, a simple model of U.S. demand for hardwood plywood was formulated to provide estimates of own-price elasticity using more recent data, and better estimates of the response of demand to changes in the price of substitutes.

Demand for imported hardwood plywood was modeled as a function of the import price, the price of domestic hardwood plywood and related products, and levels of activity in end-use sectors of the U.S. economy:

$$Q = \alpha P_m^{\delta 1} P_d^{\delta 2} E^{\delta 3} \qquad (1)$$

Equation (1) combines Chou and Buongiorno's (1983) and Cengel and McKillop's (1990) specifications. Total import demand is estimated in a single equation. Data series chosen to represent the price of substitutes, and end-use activity differ from those used by Cengel and McKillop (1990). Equation (1) was estimated using data from 1971-91; results are shown below.

All coefficients in table 3 have expected signs, and are significant at the .01 level. These results are consistent with previous econometric results, and support Ward International's (1992) description of the importance of end-use activity in U.S. demand for tropical plywood. Estimated own price is -1.2, and the elasticity of imports with respect to the price of substitutes is 1.5; Chou and Buongiorno (1983) estimated an own price elasticity of -2.2 for hardwood plywood imports. Cengel and McKillop's (1990) estimates of own price elasticity range from -1.4 to -1.9; their estimate of the elasticity of imports from Japan with respect to hardboard price is 5.2. The results shown in table 3 confirm that demand for tropical hardwood plywood continues to be quite responsive to price; in addition, the importance of substitution--relative prices--in demand for tropical plywood in the United States is demonstrated.

Table 3--Coefficient estimates (t-statistics)

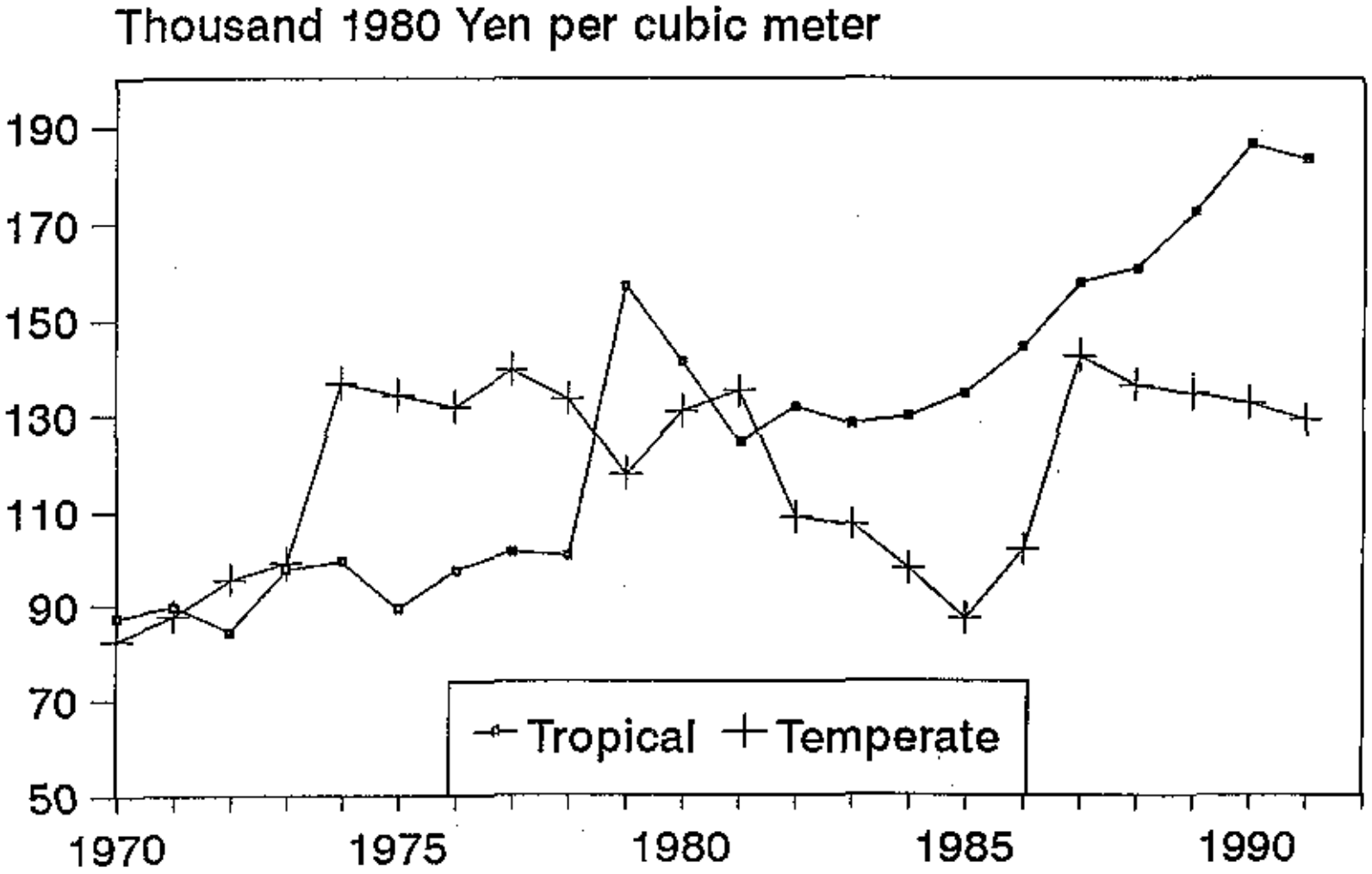
α	ß1	ß2	ß3	R^2	D-W[a]
8.0256 (144.09)	-1.1573 (-6.66)	1.4514 (5.45)	0.8293 (3.07)	0.83	1.37

[a] Durbin-Watson statistic.

Table 4--Definition of variables

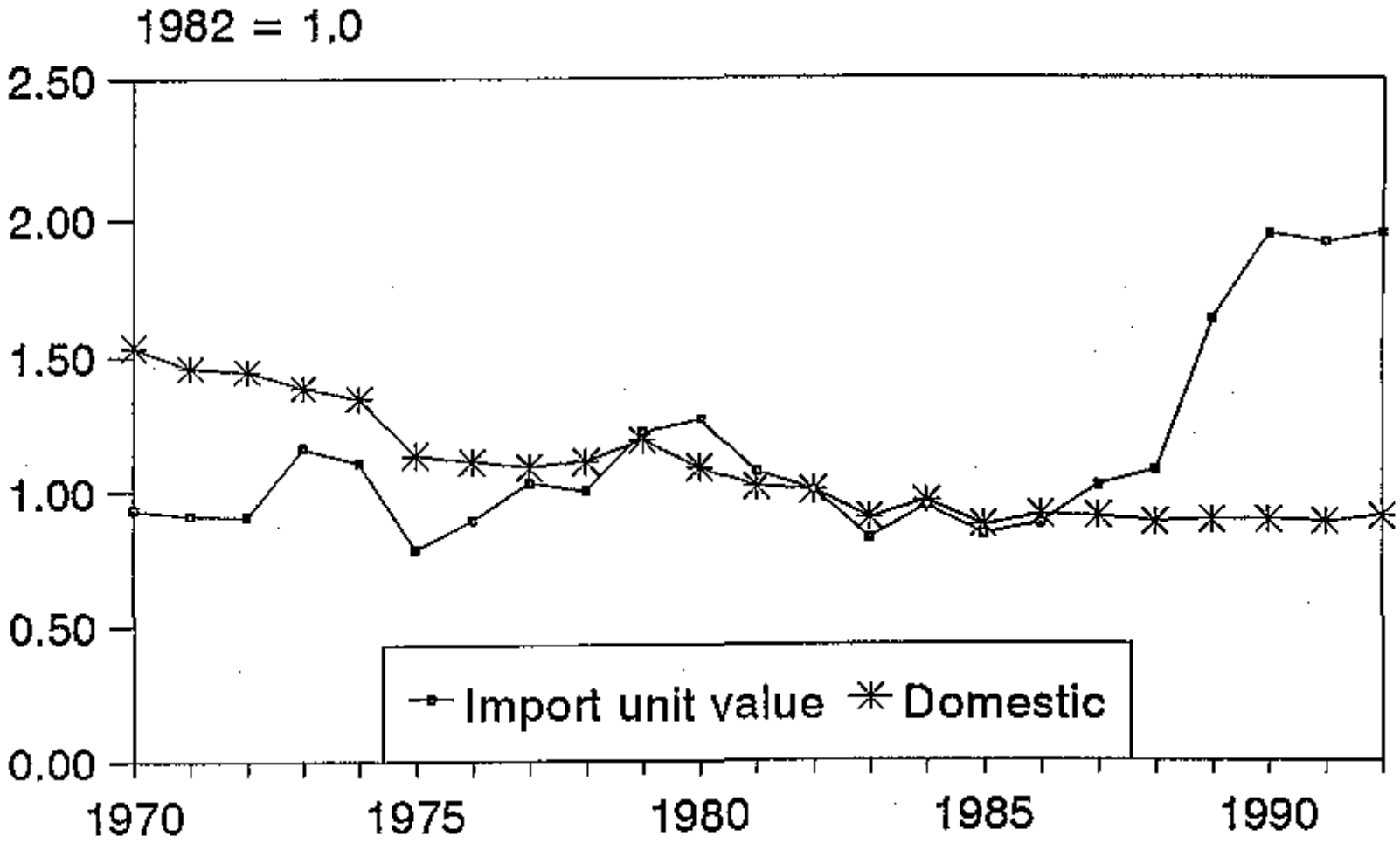
Variable	Description
Q	U.S. imports of hardwood plywood, million square feet, surface measure.
P_m	Index of the unit value of hardwood plywood imports, deflated using the all-commodity producer price index.
P_d	Hardwood plywood and related products price index, deflated using the all-commodity producer price index.
E	Index of end-use activity, constructed from an index of the real value of private construction, the index of total manufacturing production, and the index of furniture production.

Figure 1--Real prices of tropical and temperate lumber in Japan, 1970-91



Tropical: Lauan grade 1, 3.0-3.4 x 30 cm x 4.0 m
Temperate: Hinoki grade 1, 10.5 x 10.5 cm x 3.0 m

Figure 2--Indexes of real prices for hardwood plywood imports and domestic hardwood plywood, United States 1970-92



Domestic index includes related products

Data for 1992 are preliminary

Source: Ulrich (1990) and US Bureau of Labor Statistics

United States Trade in Forest Products: Trade with Tropical Countries and Trade in Tropical Products

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Abstract

Data on the value of United States imports and exports of forest products 1985-91 are summarized, with particular attention to imports of tropical timber and forest products trade with tropical countries. Long-term trends (1950-90) and preliminary data for 1992 are also reported. Forest products trade data is grouped in two broad categories, solid wood and pulp and paper, and sixteen commodity groups within these broad categories. Commodity groups are based on the Harmonized System commodity trade classification. Patterns and trends in the value of US forest products trade with tropical countries reveal that trade in secondary products and pulp and paper products now accounts for half of US imports from tropical countries. In addition, tropical countries represent important markets for US producers, with total US forest products exports to these countries valued at 3 billion dollars in 1992, and net trade valued at 1.4 billion.

Introduction

This report summarizes US trade in forest products, focusing on US trade in tropical timber, US trade with tropical countries, and US trade with countries that are members of the International Tropical Timber Organization (ITTO). The International Tropical Timber Agreement (ITTA) (United Nations 1984) is a multi-national commodity trade agreement whose central objectives are to support and promote conservation of tropical forests through sustainable management, utilization, and trade in tropical timber. When established a decade ago, ITTA identified countries as either producers or consumers of tropical timber, and focused attention on trade in tropical logs and primary products manufactured from non-coniferous tropical timber. Primary products include logs, sawn wood, veneer and plywood.

Renewal of the ITTA must take into consideration the complexity of forest products trade linkages among tropical developing and temperate developed countries. Issues that must be addressed include shifts in tropical country exports from primary products to "secondary" products that include a wide variety of manufactured goods, and the increasing importance of forest products imports by tropical countries. Recent data on United States forest products trade illustrates these issues.

Compared to Japan, Taiwan, Korea, and the European Community, the United States is a relatively unimportant participant in markets for tropical timber; tropical timber is a minor component of US consumption of industrial forest products. Nevertheless, US imports of tropical timber products are significant in terms of value - more than 600 million dollars in 1991. In terms of the value of trade, however, tropical countries are more important as

markets for US exporters of temperate forest products than as sources of supply for US consumption. This report provides a broader context for understanding United States trade in tropical timber and forest products trade with tropical countries. Patterns and recent trends in trade reflect the increasing complexity of the United States role in tropical timber production and trade.

Data sources and methods

Official US trade data is compiled and maintained by the US Department of Commerce (USDOC); all data used in this report is taken from USDOC computer records. Data summarized in this report covers the period 1985-91; individual commodity data was aggregated by commodity groups and groupings of trade partners. For 1985-88, data is USDOC estimates of the correspondence between HS commodity codes and earlier classification of US commodity trade (TSUSA). Although this correspondence may have errors associated with individual commodities, the correspondence is reasonably accurate for broad aggregates such as those listed in table 1.

Solid wood products are defined as all commodities in chapter 44 of the HS (US International Trade Commission 1990); pulp and paper products are defined as commodities in chapter 47 and nearly all commodities included in chapter 48. Commodities in chapter 44 for which a tropical timber component is explicitly identified were selected using 6-digit HS codes and aggregated to display trends in tropical timber imports. Although tropical timber data was extracted for 1985-91, USDOC estimates of the value of tropical timber imports prior to 1989 did not appear reliable. Only data that was collected using the HS codes (1989-91) was retained.

US forest products trading partners were grouped into three categories: ITTO producer countries (those producing tropical timber), ITTO consumer countries, and all other countries. ITTO countries are shown in table 2; trade with any country not shown in table 2 is included in the "other countries" grouping. In more aggregated compilations, US trade with all tropical countries, temperate countries, and selected individual countries is also reported. Tropical countries are defined as countries with significant area in the tropical zone.

Background

Production and trade in industrial timber products is generally recognized as only one of many factors influencing tropical deforestation (Repetto and Gillis 1988). Nevertheless, trade in tropical timber has come under increasing pressure in the past decade (Vincent 1990). Changes in timber management practices have been suggested as a means of reducing impacts of industrial timber production on tropical forests; these methods, however, are likely to be more costly than current practices. Increased costs, if reflected in commodity prices (as should be expected), will limit markets for tropical timber products and, ultimately, limit the role of tropical timber in providing revenue and incentives for maintaining tropical forests (Barbier and others 1992a, 1992b). Sustainable forest sector development and trade requires

integration of environmentally benign timber production, efficient processing and effective marketing.

Prospects for supporting sustainable management of tropical forests through intervention in trade are complicated by competition among producers of tropical timber, and competition between tropical timber and substitute products that include temperate timber, and non-timber materials (Barbier and others 1992b). The effects of trade policy measures on management of tropical forests can only be understood through information on trade and use of tropical timber products. In turn, developments in trade and use of tropical timber products can be understood only within the broad context of the forest sectors of both producing and consuming countries. Two specific developments that must be examined are the importance of tropical country trade in pulp and paper products, and shifts in the composition of tropical timber trade toward secondary (more highly processed) solid wood products.

Pulp and paper products represent a considerable and increasing share of the volume and value of world forest products production, consumption and trade. Although production and exports of industrial products from tropical forests is predominantly in solid wood products, tropical countries are producers - and exporters - of small quantities of fibre products. Tropical countries are also consumers of pulp and paper products, and must rely to a large extent on imports to satisfy consumption (Food and Agricultural Organization 1992). The need to satisfy domestic consumption requirements is increasing the importance of production and trade in pulp and paper products for tropical countries. At the same time, efficient production processes capable of complete utilization of harvested raw material are a requisite of global forest sector competitiveness. Integrated solid wood and pulp and paper manufacturing typically contribute to competitiveness in temperate countries, and eventually may do so in tropical countries as well. Therefore, an understanding of production, consumption, and trade in pulp and paper products is a critical component of an understanding of future industrial use of tropical forests.

Similarly, the effort to maximise economic benefits from production of industrial timber commodities has led many countries, including a number of tropical timber producers, to emphasize further processing of primary products prior to export. In fact, promotion of such efforts is included in ITTA objectives (United Nations 1984). Although the initial scope of these efforts was to promote production and export of sawn wood or plywood in place of log exports, a number of countries have progressed well beyond this stage to production of a variety of shaped, milled and manufactured products. Policy measures that began with restrictions on log exports to induce sawn wood production now include, in some cases, restrictions on exports of sawn wood. Any understanding of US trade with tropical countries therefore must include recognition of these policy measures and their impact on the mix of production and exports. Compilations that include only trade in logs, sawn wood, veneer, and plywood fail t o capture an increasingly important component of the volume - and especially the value - of industrial timber production from tropical forests.

Overview of US forest products trade

The United States is the world's leading importer of forest products, and the second leading exporter of forest products. Since 1950 trade in forest products has expanded significantly, although forest products trade as a share of all merchandise trade decreased over this period. Forest products now account for roughly 4 percent of US merchandise imports, down from more than 10 percent in the 1950s. In 1990, import of forest products were 17.7 billion dollars, up from 1.1 billion (current dollars) in 1950. Adjusted for inflation, imports increased at an average annual rate of 3.4 percent over the period 1950-90 (figure 1). As is the case for all merchandise imports, imports of forest products reflect the timing of the US business cycle. Forest products imports peaked in 1989, declined in 1990-91, and increased in 1992 (based on data through October 1992), reflecting the timing of the recent recession and recover in US economic activity.

Imports of forest products from Canada account for nearly 75 percent of all forest products imports (table 3); softwood lumber, pulp and newsprint account for three fourths of all forest products imports from Canada. Pulp and paper products account for two thirds of US imports from all sources (table 4). Unlike Japan, where tropical timber accounts for as much as 15 percent of forest products consumption, United States consumption and imports of forest products depends largely on temperate zone forests. Softwood species from North America make up the bulk of US forest products consumption. Tropical timber accounts for a negligible share of US consumption of logs and lumber, and about 4 percent of US consumption of panel products (Ward International 1992). Tropical plywood does account for half of US consumption of hardwood plywood, however.

Three tropical countries - Indonesia, Mexico and Brazil - are among the top five suppliers of forest products to the United States (based on the total value of trade), but together account for only 7 percent (1.1 billion dollars) of the value of US imports of forest products (table 3). Forest products imports from all tropical countries are 10 percent of total US imports of forest products; tropical countries account for 20 percent of US imports of solid wood products.

Imports of primary tropical products - logs, sawn wood, veneer and plywood - were valued at 670 million dollars in 1991 (table 5). These commodities account for less than 5 percent of US forest product imports (table 5), and about 10 percent of US imports of solid wood products. Imports of primary tropical timber products peaked in 1985; since 1980, imports of tropical lumber and plywood have fallen substantially (Ward International 1992). Imports of secondary ("value-added") products from tropical countries have increased since 1980 (Ward International 1992).

Although small in comparison to total forest products imports and consumption, US imports of tropical timber account for a significant share of imports of specific commodity groups. For example, tropical plywood accounts for about 80 percent of all plywood imports, and more than 90 percent of US imports of hardwood plywood. Tropical lumber accounts for half of US imports of hardwood lumber (Ward International 1992).

Over the past 40 years, US exports of forest products grew more rapidly than imports, increasing to 15.7 billion in 1990 from 190 million dollars in 1950. Adjusted for inflation,

exports increased at an annual rate of 7.7 percent over the period 1950-90, and the most rapid, sustained expansion of exports has been the recent past (1985-91) (figure 1). This recent increase in US exports is largely attributable to the devaluation of the US dollar in 1985, but export promotion and efforts to have trade barriers reduced or removed have contributed to the growth in US forest products exports. Shipments to three countries - Japan, Canada and Mexico - account for half of all US forest products exports (table 6). As with US imports, trade with temperate countries accounts for most forest products exports; trade with tropical countries accounts for a somewhat larger share of exports than of imports, however. Exports to tropical countries (including Mexico) account for 18 percent of US forest products exports (table 6).

As is the case with imports, pulp and paper products dominate in US forest products exports; pulp and paper commodities account for 60 percent of the value US exports to all destinations (table 7). Five of the sixteen commodity groups - logs, lumber, pulp, packaging paper and board, and miscellaneous paper manufactures - account for more than 85 percent of total exports. Softwood logs and softwood lumber account for 30 percent of US exports, and more than 60 percent of exports of solid wood products.

In 1991, US imports and exports of forest products were roughly equal in value. Balanced forest products trade is characteristic of US recessions, and typically results from a sharp reduction in imports combined with increased exports (see figure 1). The expansion of US exports 1985-91 and the recession 1990-91 all but eliminated the forest products trade deficit. Until recently, imports exceeded exports for both solid wood and pulp and paper. In the past few years (1989-91), however, the value of solid wood product exports exceeded the value of solid wood product imports, but not by enough to offset net imports of pulp and paper products. Preliminary data for 1992 indicate an increase in net imports of forest products based on net imports for both commodity groups (see figure 1).

Trade with tropical countries

Figure 2 summarizes recent trends in the composition of US forest products trade with tropical countries. The United States is a net exporter of forest products to tropical countries; over the period 1985-91, the value of net trade in forest products with tropical countries increased to nearly 1.5 billion dollars from 300 million dollars. This trade surplus declined slightly in 1992 (to an estimated 1.3 billion dollars) as a result of increased US imports; US exports of forest products to tropical countries continued to increase in 1992 (figure 2). US exports to tropical countries more than doubled between 1985 and 1991, while US imports from tropical countries peaked in 1989, declined 1990-91, and increased in 1992. Shipments to Mexico account for nearly half of US exports to tropical countries.

Pulp and paper products comprise the majority of US exports to tropical countries, and produce a trade surplus of 2 billion dollars (figure 2). In 1991 and 1992, nearly 80 percent of the value of exports to tropical countries was accounted for by pulp and paper. Packaging paper and board, pulp, and miscellaneous paper manufactures (in decreasing order of importance) account for most US pulp and paper exports to tropical countries. In contrast, solid wood products comprise the bulk of US imports from tropical countries. Plywood is

the single most important commodity group. Net imports of solid wood products from tropical countries were valued at 700 million dollars in 1991.

Imports of tropical primary products account for only one third of the value of all forest products imports from tropical countries, and half o the value of solid wood products imports from these countries. Fiber products and secondary products represent the majority of the value of US forest products imports from tropical countries. Imports from non-tropical countries (Asia and Europe) account for nearly 20 percent of the value of US imports of tropical primary products.

The pattern of United States trade with ITTO producer countries differs from US trade with all tropical countries. The most noticeable difference is in terms of net trade: the United States is a net importer of forest products from ITTO producers (figure 3). Nevertheless, US exports of forest products to ITTO producer countries have grown steadily, doubling between 1985 and 1991. As with US exports to all tropical countries - and US exports to all destinations - pulp and paper products account for the majority of exports to ITTO producer countries (figure 3). Exports of forest products to ITTO producer countries accounted for 30 percent of US exports to all tropical countries in 1991.

Primary tropical timber commodities account for only half of the value of US imports of forest products from ITTO producer countries (figure 4). Imports of pulp and paper represent a significant component of US imports from ITTO producers - about 25 percent of the total value of imports. Pulp imported from Brazil accounts for the most of this trade and nearly the entire value of US imports of pulp and paper from tropical countries. Secondary solid wood products, including a variety of manufactured goods, account for about 25 percent of the total value of US imports from ITTO producers, and about one third of the value of sold wood imports. Since 1985, more than half of the growth in the value of US imports from ITTO producer countries is accounted for by secondary solid wood products and pulp and paper products.

Summary

Patterns of trade with tropical countries - and ITTO producers in particular - illustrates (1) the importance of pulp and paper products, and (2) the importance of secondary products. Imports of pulp and paper products account for about 25 percent of US imports from ITTO producer countries. Even more substantial, however, are US exports of pulp and paper to tropical countries; exports to these markets are now valued at more than 2 billion dollars. US forest product imports from tropical countries are still predominantly solid wood products; however, the composition of imports is changing. Secondary products now account for one third of the value of US imports of solid wood products from tropical countries; between 1985 and 1991 this commodity group's share of imports increased by 50 percent.

Commodities that were the original focus of the ITTA now account for no more than half of the value of US imports from ITTO producers and other tropical countries. These data do not include the value of manufactured goods, such as furniture, in which wood is a significant material. Between 1985 and 1991, the value of furniture imports from tropical

countries increased five-fold, and in 1991 were valued at 400 million dollars. ITTO producer countries accounted fro more than half of this trade. Over the past decade tropical countries have significantly changed the composition of forest-based industries and exports, diminishing the importance of primary products. At the same time, the distinction between "producer" and "consumer" countries has blurred as the tropical timber producing countries have increased their imports of pulp and paper products. United States trade with tropical countries reflects these changes. The changing pattern and composition of trade requires careful consideration of the appropriate scope and structure of commodity trade agreements designed to influence resource management.

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Table 1--Commodity groups and Harmonized System codes

Commodity group	HS codes[a]
Solid wood	
Logs and chips	4401 - 4403
Hoopwood and wood wool[b]	4404 - 4405
Sleepers and sawn wood	4406 - 4407
Veneer	4408
Shaped wood[c]	4409
Particleboard and fiberboard	4410 - 4411
Plywood	4412
Frames, tools, etc.	4413 - 4417
Joinery, incl. doors	4418
Tableware, marquetry, etc.	4419 - 4421
Pulp and paper	
Pulp[d]	4701 - 4707
Newsprint	4801
Printing and writing paper	4802
Sanitary paper	4803
Packaging paper and board	4804 - 4810
Miscellaneous manufactures[e]	4811 - 4823
Tropical timber[f]	
Tropical logs	440331, 440332, 440333, 440334, 440335
Tropical sawn wood	440721, 440722, 440723
Tropical veneer	440820
Tropical plywood	441211
Other plywood	441212, 441219, 441229, 441299

[a] Each group includes all commodities with the indicated 4-digit or 6-digit prefix.

[b] Includes poles, piling, pickets, and materials suitable for further manufacturing.

[c] Includes flooring, molding, and siding.

[d] Includes waste paper.

[e] Includes coated and decorated paper, envelopes, boxes, etc., but does not include printed material.

[f] Data for these commodities are also included in the broader groups.

Table 2--ITTO member country groups*

Consumers (27)	Producers (23)
Australia	Bolivia
Austria	Brazil
Belgium	Cameroon
Canada	Colombia
China	Congo
Denmark	Ecuador
Egypt	Gabon
Finland	Ghana
France	Guyana
Germany	Honduras
Greece	India
Ireland	Indonesia
Italy	Ivory Coast
Japan	Liberia
Korea (South)	Malaysia
Luxembourg	Panama
Nepal	Papua New Guinea
Netherlands	Peru
New Zealand	Philippines
Norway	Thailand
Portugal	Togo
Soviet Union	Trinidad and Tobago
Spain	Zaire
Sweden	
Switzerland	
United Kingdom	
[United States]	

* Data for United States trade with any country not listed here is included in the "Other countries" group.

Table 3--United States imports of forest products, 1985-91[a]

Source	1985	1986	1987	1988	1989	1990	1991
				Thousands of dollars			
ITTO producers	727,243	832,981	1,076,616	1,197,695	1,056,064	1,156,178	1,098,052
ITTO consumers	11,137,510	11,564,655	13,139,578	14,374,692	15,535,192	15,383,744	14,107,447
Other countries	921,540	1,119,875	1,340,830	1,443,721	1,434,201	1,119,618	995,148
Total	12,786,293	13,517,491	15,551,024	17,016,108	18,057,457	17,659,540	16,200,857
ITTO producers							
Africa	7,752	10,529	14,085	14,744	10,531	10,667	8,672
Asia	428,354	476,557	632,419	843,583	624,074	701,848	648,321
Latin America	291,137	345,875	430,152	539,368	452,559	443,643	441,059
Subtotal	727,243	832,961	1,076,616	1,197,695	1,086,064	1,156,178	1,098,052
All tropical countries[b]	1,016,705	1,217,905	1,556,149	1,787,323	1,777,547	1,660,604	1,542,667
Temperate zone countries	11,769,588	12,299,586	13,994,875	15,228,785	16,279,910	16,008,846	14,657,990
Major partners:[c]							
Canada	9,398,918	9,704,647	10,980,642	11,895,487	13,229,832	13,030,996	12,017,119
Indonesia	272,295	342,046	442,458	432,598	407,365	455,326	388,507
Mexico	241,434	313,660	410,956	514,780	604,996	415,427	375,989
Finland	333,685	342,142	435,903	483,157	441,522	447,851	370,505
Brazil	257,236	306,171	361,309	452,191	390,904	375,330	380,852
Subtotal	10,503,568	11,008,686	12,632,468	13,808,218	15,074,619	14,724,930	13,512,952

[a] General imports, C.i.f.
[b] Includes Mexico.
[c] The top five sources of U.S. imports in 1991.

Source: Extracted from U.S. Department of Commerce data.

Table 4--United States imports of forest products by partner group and commodity group, 1985-91

Partner group	Commodity group*	1985	1986	1987	1988	1989	1990	1991
						Thousands of dollars		
ITTO producers								
	Logs and chips	2,292	1,736	2,020	2,170	12,116	7,869	4,240
	Hoopwood and wood wool	1,524	1,303	1,283	2,372	4,325	5,227	4,543
	Sawn wood	122,791	101,994	177,102	143,154	104,732	96,056	103,874
	Veneer	35,682	40,749	47,818	54,711	44,948	46,780	35,678
	Shaped wood	35,366	36,303	47,783	33,030	56,408	84,302	45,154
	Particleboard	33,408	36,582	39,985	28,950	32,219	25,200	20,951
	Plywood	298,502	360,320	465,622	431,013	405,027	464,983	430,799
	Frames, tools, etc.	13,650	12,961	23,219	28,843	37,229	42,986	45,898
	Joinery, incl. doors	21,849	27,417	35,087	43,343	29,378	38,771	38,590
	Tableware, etc.	41,506	40,516	53,366	70,091	88,155	106,257	115,145
	Solid wood	607,770	659,901	898,293	857,877	814,537	898,831	844,870
	Pulp	74,074	89,235	122,264	201,451	233,969	208,686	186,268
	Newsprint	1,433	3,785	1,532	3,579	1,557	0	204
	Printing & writing paper	8,349	15,916	13,473	51,237	2,316	5,906	5,098
	Sanitary paper	18	61	1,220	301	3	42	127
	Packaging paper & board	5,422	15,435	9,136	23,346	6,245	4,334	4,811
	Miscellaneous manufactures	30,196	40,654	35,687	58,801	30,086	38,697	46,757
	Pulp and paper	119,493	173,089	183,321	339,815	274,176	257,885	253,265
ITTO consumers								
	Logs and chips	69,755	63,379	77,031	95,739	97,708	92,248	83,789
	Hoopwood and wood wool	8,518	10,573	10,129	18,710	11,471	6,395	6,820
	Sawn wood	2,686,888	2,963,626	2,974,997	2,866,000	3,062,118	2,795,515	2,747,914
	Veneer	84,817	94,563	114,374	129,414	137,607	141,101	126,028
	Shaped wood	151,722	164,374	256,371	212,340	213,278	176,403	155,337
	Particleboard	174,023	188,456	173,392	177,709	261,794	244,388	216,537
	Plywood	101,827	93,280	101,774	85,082	74,882	77,038	64,951
	Frames, tools, etc.	27,105	34,608	45,351	48,573	57,397	57,981	60,166
	Joinery, incl. doors	230,871	245,983	224,902	230,575	252,848	269,840	254,237
	Tableware, etc.	116,612	137,686	146,517	169,495	176,713	218,107	227,488
	Solid wood	3,657,046	3,976,708	4,133,638	4,034,628	4,345,795	4,079,028	3,943,265
	Pulp	1,448,941	1,490,210	1,843,122	2,382,421	2,639,600	2,721,056	2,024,530
	Newsprint	3,988,642	4,028,348	4,529,291	4,948,747	4,642,234	4,458,572	4,154,338
	Printing & writing paper	471,355	499,287	584,864	728,331	1,254,368	1,372,435	1,319,687
	Sanitary paper	28,873	31,304	33,359	41,562	57,115	80,954	85,431
	Packaging paper & board	592,012	732,342	978,137	1,213,084	1,364,555	1,486,402	1,388,750
	Miscellaneous manufactures	749,556	806,216	851,123	1,025,596	1,031,276	1,185,264	1,227,322
	Pulp and paper	7,280,379	7,587,916	8,900,896	10,338,741	11,189,148	11,314,683	10,164,038
Other countries								
	Logs and chips	4,682	4,047	5,707	8,491	13,055	9,827	23,935
	Hoopwood and wood wool	675	1,269	984	534	1,241	1,791	1,083
	Sawn wood	32,606	38,550	55,658	55,470	49,554	47,436	64,849
	Veneer	4,433	4,757	6,618	8,362	13,617	9,030	6,282
	Shaped wood	61,639	70,218	87,695	117,011	110,438	114,032	106,573
	Particleboard	25,734	32,785	36,089	37,341	30,705	23,284	21,408
	Plywood	133,058	143,583	157,628	141,324	119,474	89,906	49,726
	Frames, tools, etc.	51,468	54,835	61,803	65,229	84,961	62,261	60,994
	Joinery, incl. doors	48,353	60,353	72,990	68,317	45,821	42,126	43,420
	Tableware, etc.	239,927	260,970	336,521	311,045	305,509	249,106	240,902
	Solid wood	602,575	672,149	821,686	819,145	754,375	648,899	621,172
	Pulp	28,618	42,884	44,149	81,867	80,787	75,591	80,504
	Newsprint	16,853	12,656	26,746	19,978	6,982	767	746
	Printing & writing paper	21,441	42,100	42,758	77,795	51,340	40,617	13,466
	Sanitary paper	7,598	15,234	8,820	7,438	56,049	41,618	10,039
	Packaging paper & board	17,554	33,120	56,061	87,269	53,887	51,126	42,388
	Miscellaneous manufactures	226,863	301,599	339,562	376,516	420,560	260,714	226,886
	Pulp and paper	319,017	447,803	519,096	630,881	679,415	470,434	374,039
All partners								
	Logs and chips	76,739	69,162	84,758	106,400	122,879	110,044	111,964
	Hoopwood and wood wool	11,717	13,139	21,396	21,625	17,037	13,413	12,448
	Sawn wood	3,044,263	3,105,170	3,207,158	3,064,624	3,216,404	2,939,007	2,916,637
	Veneer	125,032	140,069	168,811	192,507	196,172	196,911	169,988
	Shaped wood	248,727	271,093	392,049	362,381	380,122	354,937	307,064
	Particleboard	233,165	237,883	249,464	244,000	324,718	292,872	258,896
	Plywood	534,187	597,183	725,025	657,399	599,363	631,927	545,476
	Frames, tools, etc.	92,423	102,224	130,373	143,645	159,587	163,228	167,058
	Joinery, incl. doors	301,073	333,733	332,989	342,435	328,048	350,737	336,247
	Tableware, etc.	400,045	439,172	536,404	550,632	570,377	573,470	583,533
	Solid wood	5,067,391	5,308,758	5,848,627	5,705,648	5,914,707	5,626,556	5,409,307
	Pulp	1,551,633	1,632,448	2,109,535	2,865,730	3,164,366	3,005,533	2,301,302
	Newsprint	4,006,028	4,044,789	4,557,569	4,972,302	4,650,773	4,459,339	4,155,288
	Printing & writing paper	501,145	557,305	621,095	857,363	1,308,024	1,418,958	1,332,251
	Sanitary paper	36,480	46,599	44,408	48,301	113,167	122,615	95,597
	Packaging paper & board	614,988	778,097	1,043,334	1,304,119	1,424,487	1,551,862	1,435,950
	Miscellaneous manufactures	1,006,615	1,148,569	1,326,372	1,461,413	1,461,822	1,484,675	1,500,965
	Pulp and paper	7,718,889	8,208,808	9,702,313	11,319,437	12,142,739	12,042,882	10,781,342

* See table 1 for a description of commodity groups.

Source: Extracted from U.S. Department of Commerce data.

Table 5--United States imports of tropical timber products by partner group and commodity group, 1989-91*

Partner group	Commodity group	1989	1990	1991
		Thousands of dollars		
ITTO producers				
	Tropical logs	5,889	3,721	1,970
	Tropical sawn wood	86,200	78,813	89,210
	Tropical veneer	15,370	21,242	16,798
	Tropical plywood	331,546	383,366	350,146
	Other plywood	73,134	81,567	80,626
	Total	512,139	568,709	538,750
ITTO consumers				
	Tropical logs	134	106	211
	Tropical sawn wood	726	503	190
	Tropical veneer	0	1,584	7,200
	Tropical plywood	5,609	3,479	2,250
	Other plywood	68,224	72,453	62,119
	Total	74,693	78,125	71,970
Other countries				
	Tropical logs	4,041	1,286	573
	Tropical sawn wood	16,268	9,686	9,039
	Tropical veneer	227	683	1,137
	Tropical plywood	50,960	39,700	18,776
	Other plywood	68,397	49,746	29,979
	Total	139,893	101,101	59,504
All partners				
	Tropical logs	10,063	5,114	2,755
	Tropical sawn wood	103,195	89,002	98,436
	Tropical veneer	15,598	23,510	25,136
	Tropical plywood	388,114	426,543	371,176
	Other plywood	209,752	203,766	172,725
	Total	726,722	747,935	670,228

* General imports, C.i.f.

Source: Extracted from U.S. Department of Commerce data.

Table 6--United States exports of forest products, 1985-91[a]

Partner group	1985	1986	1987	1988	1989	1990	1991
				Thousands of dollars			
ITTO producers	387,253	441,530	509,552	557,922	620,646	718,106	830,044
ITTO consumers	4,980,382	5,760,382	7,452,739	9,589,704	10,917,434	11,775,748	11,742,138
Other countries	1,428,956	1,507,637	2,081,834	2,810,052	3,191,694	3,206,980	3,580,590
Total	6,796,591	7,799,549	10,044,125	12,957,678	14,729,774	15,700,834	16,152,772
ITTO producers							
Africa	11,353	12,505	15,324	16,186	13,758	11,892	12,301
Asia	172,033	168,476	234,264	279,956	321,678	374,884	399,248
Latin America	203,867	230,549	259,964	261,780	285,209	331,330	418,407
Subtotal	387,253	441,530	509,552	557,922	620,646	718,106	830,044
All tropical countries[b]	1,286,204	1,388,964	1,713,120	2,168,280	2,429,186	2,574,334	2,951,978
Temperate zone countries	5,498,387	6,430,585	8,331,005	10,791,388	12,300,608	13,126,500	13,200,794
Major partners:[c]							
Japan	1,686,855	2,073,646	2,786,733	3,514,023	4,366,659	4,091,509	5,029,406
Canada	980,412	998,090	1,228,571	1,509,483	1,629,672	2,601,951	2,792,179
Mexico	537,630	546,431	727,143	1,015,284	1,229,252	1,255,246	1,484,557
South Korea	319,612	427,298	585,847	799,704	933,547	902,635	830,258
Germany	335,629	404,547	480,511	602,306	676,135	674,867	722,932
Subtotal	3,860,138	4,450,012	5,800,805	7,440,800	8,835,265	9,526,168	9,859,330

[a] Total exports, F.a.s.
[b] Includes Mexico.
[c] The top five destinations of U.S. exports in 1991.

Source: Extracted from U.S. Department of Commerce data.

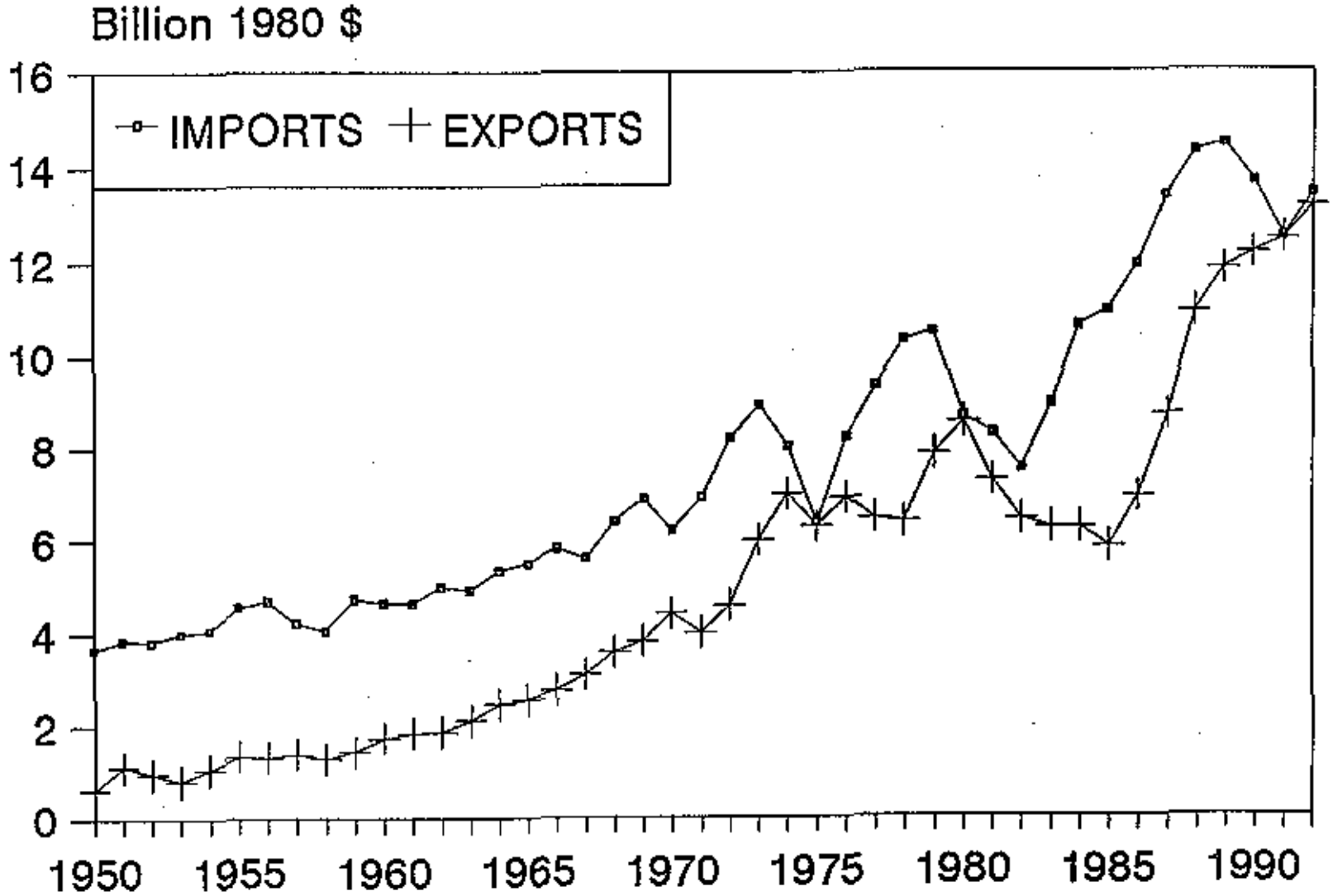
Table 7--United States exports of forest products by partner group and commodity group, 1985-91

Partner group	Commodity group*	1985	1986	1987	1988	1989	1990	1991
					Thousands of dollars			
ITTO producers								
	Logs and chips	6,139	7,638	5,848	9,184	10,542	24,037	15,234
	Hoopwood & wood wool	52	216	194	107	152	141	533
	Sawn wood	9,662	13,921	8,862	11,305	14,072	17,654	25,080
	Veneer	23	405	96	383	674	1,710	2,176
	Shaped wood	294	188	491	526	511	647	200
	Particleboard	1,259	1,380	1,007	1,773	2,328	4,374	2,501
	Plywood	2,668	3,375	3,252	2,797	3,106	3,201	4,687
	Frames, tools, etc.	1,490	1,474	1,813	4,414	4,068	4,457	5,060
	Joinery, incl. doors	2,085	1,664	2,653	3,923	1,471	2,589	3,084
	Tableware, etc.	2,609	2,339	2,888	2,985	3,596	4,634	3,779
	Solid wood	28,481	32,602	27,304	37,357	40,520	63,454	62,344
	Pulp	109,350	119,551	142,235	157,178	174,958	208,653	204,308
	Newsprint	22,040	29,704	24,547	28,445	35,172	30,078	55,592
	Printing & writing paper	9,755	7,486	10,764	11,617	20,995	17,456	32,664
	Sanitary paper	676	972	1,561	1,100	791	761	1,046
	Packaging paper & board	150,844	161,915	225,761	244,539	282,592	326,086	387,046
	Misc. manufactures	66,104	69,283	77,377	77,478	64,664	73,601	85,855
	Pulp and paper	358,769	408,931	482,245	520,558	580,113	654,655	767,611
ITTO consumers								
	Logs and chips	1,411,236	1,380,156	1,783,052	2,433,028	2,710,183	2,706,195	2,583,555
	Hoopwood & wood wool	7,889	9,824	13,298	17,178	9,365	6,091	8,822
	Sawn wood	603,506	793,206	1,094,676	1,482,207	1,621,375	1,763,061	1,776,003
	Veneer	63,146	80,514	114,764	142,440	150,191	180,102	193,919
	Shaped wood	17,406	18,700	34,650	44,571	66,299	116,521	128,510
	Particleboard	48,212	56,020	73,896	101,143	102,457	134,285	142,109
	Plywood	60,610	122,310	166,929	207,974	257,115	289,068	224,478
	Frames, tools, etc.	21,824	22,000	29,346	29,639	36,740	60,683	61,869
	Joinery, incl. doors	43,602	63,903	86,405	79,697	123,421	154,076	156,044
	Tableware, etc.	46,141	48,233	53,789	66,918	83,443	99,646	105,183
	Solid wood	2,323,774	2,615,979	3,450,807	4,605,795	5,160,589	5,612,040	5,381,412
	Pulp	1,301,885	1,607,055	2,120,056	2,744,657	3,312,278	3,027,927	2,687,035
	Newsprint	93,462	144,290	174,087	230,345	261,100	220,236	288,606
	Printing & writing paper	76,837	66,316	85,669	115,025	153,242	213,005	266,834
	Sanitary paper	10,780	14,518	18,786	22,719	19,061	25,128	49,885
	Packaging paper & board	586,519	705,522	861,713	974,180	1,079,745	1,359,668	1,566,629
	Misc. manufactures	578,062	607,063	741,705	887,112	831,489	1,307,812	1,342,033
	Pulp and paper	2,857,545	3,144,765	4,002,016	4,984,038	5,756,925	6,163,777	6,961,105
Other countries								
	Logs and chips	38,657	41,114	68,810	124,245	120,026	128,884	131,788
	Hoopwood & wood wool	2,136	1,693	1,850	1,064	4,313	2,188	7,317
	Sawn wood	143,385	185,185	234,225	313,784	426,939	384,543	448,823
	Veneer	9,762	15,851	14,574	20,568	22,837	20,760	25,894
	Shaped wood	3,527	5,541	5,002	7,543	7,837	7,528	10,015
	Particleboard	15,644	22,692	36,289	59,764	64,817	77,424	82,385
	Plywood	22,800	19,367	24,381	43,184	42,843	70,204	77,782
	Frames, tools, etc.	11,221	23,588	21,685	32,317	36,604	42,241	43,911
	Joinery, incl. doors	22,766	18,854	21,668	39,100	54,421	54,452	71,927
	Tableware, etc.	25,329	25,973	31,777	30,553	30,458	31,054	36,804
	Solid wood	295,207	360,838	458,251	672,122	813,293	819,458	936,446
	Pulp	377,395	433,253	641,326	826,440	878,037	834,780	758,848
	Newsprint	40,809	49,246	38,015	71,856	85,312	68,277	99,879
	Printing & writing paper	22,699	22,627	32,693	46,328	54,087	66,997	106,273
	Sanitary paper	8,863	5,925	10,611	15,533	12,103	15,583	20,181
	Packaging paper & board	284,468	319,586	426,016	530,850	561,324	631,657	730,211
	Misc. manufactures	400,524	405,790	472,919	646,698	777,500	770,168	928,271
	Pulp and paper	1,132,758	1,236,427	1,623,550	2,137,803	2,378,363	2,387,442	2,643,861
All partners								
	Logs and chips	1,458,032	1,428,910	1,855,710	2,566,437	2,840,751	2,849,216	2,730,577
	Hoopwood & wood wool	10,177	11,835	15,342	18,349	13,830	8,490	14,872
	Sawn wood	756,533	992,294	1,337,765	1,807,296	2,064,386	2,165,358	2,249,906
	Veneer	72,933	97,770	129,434	162,371	173,702	212,662	221,789
	Shaped wood	21,227	25,429	40,143	52,640	74,747	126,697	138,725
	Particleboard	65,115	80,101	111,202	162,680	169,602	216,093	226,995
	Plywood	86,298	145,052	194,542	253,955	303,164	362,473	306,957
	Frames, tools, etc.	34,535	47,062	52,844	66,370	77,412	107,381	110,860
	Joinery, incl. doors	68,433	104,421	110,926	122,720	178,313	211,127	233,955
	Tableware, etc.	74,079	76,545	88,454	102,457	117,485	135,336	145,766
	Solid wood	2,647,462	3,009,419	3,936,362	5,315,275	6,014,402	6,494,953	6,380,202
	Pulp	1,788,630	2,159,859	2,903,617	3,728,275	4,365,274	4,069,340	3,630,288
	Newsprint	156,311	223,240	236,649	330,646	382,584	316,591	425,279
	Printing & writing paper	109,291	96,429	129,096	173,170	228,324	297,458	405,771
	Sanitary paper	18,319	21,416	30,958	39,352	31,955	41,493	71,193
	Packaging paper & board	1,031,831	1,207,023	1,513,490	1,749,669	1,923,601	2,327,411	2,683,886
	Misc. manufactures	1,044,690	1,082,146	1,292,001	1,621,287	1,773,653	2,151,581	2,556,159
	Pulp and paper	4,149,072	4,790,123	6,107,811	7,642,389	8,715,401	9,205,874	9,772,577

* See table 1 for a description of commodity groups.

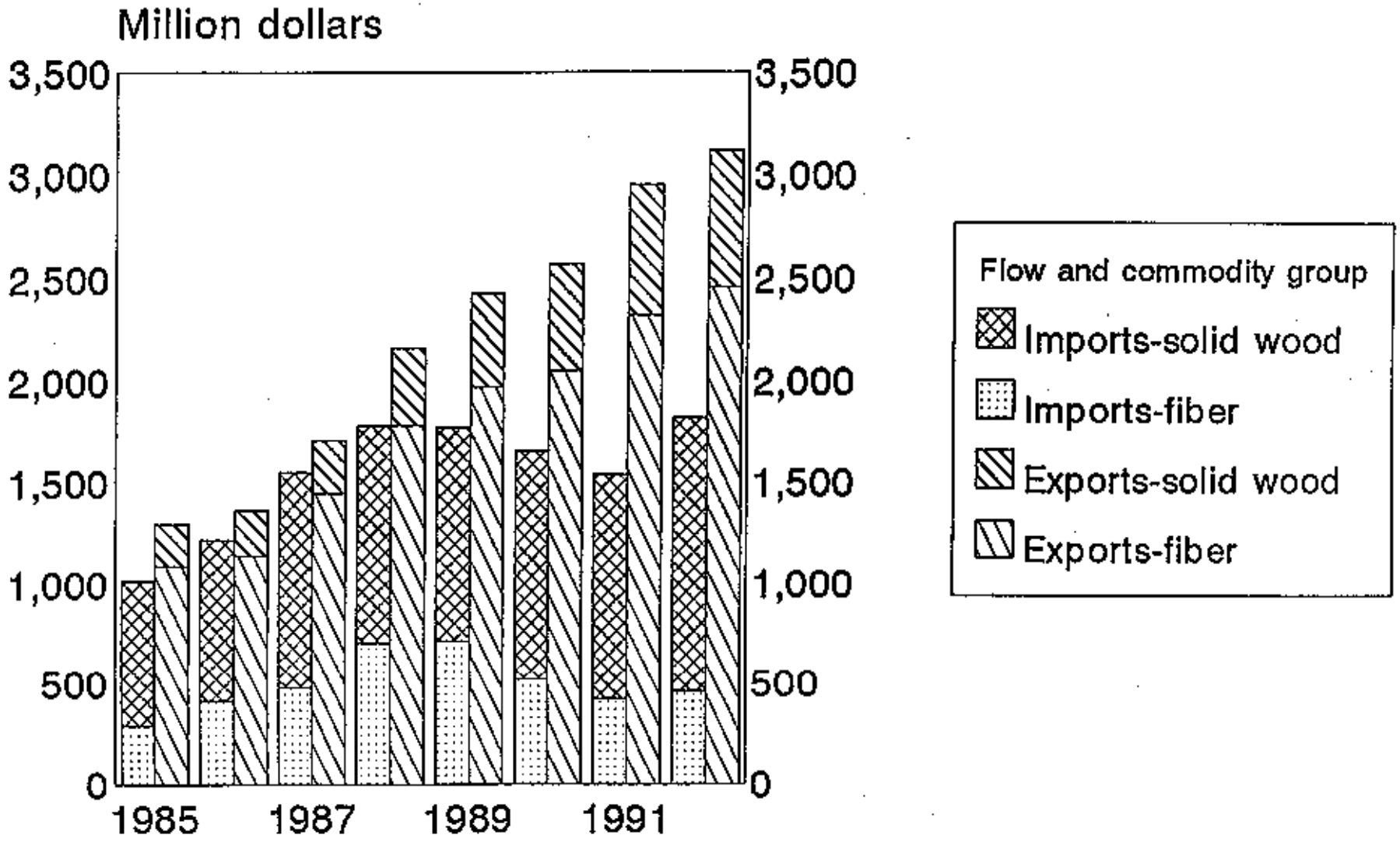
Source: Extracted from U.S. Department of Commerce data.

Figure 1--United States forest products trade, solid wood and fiber products, 1950-92



1992 data are preliminary

Figure 2--United States forest products trade with tropical countries, 1985-92



Includes trade with Mexico: data for 1992 are preliminary

Figure 3--United States forest products trade with ITTO producer countries, 1985-91

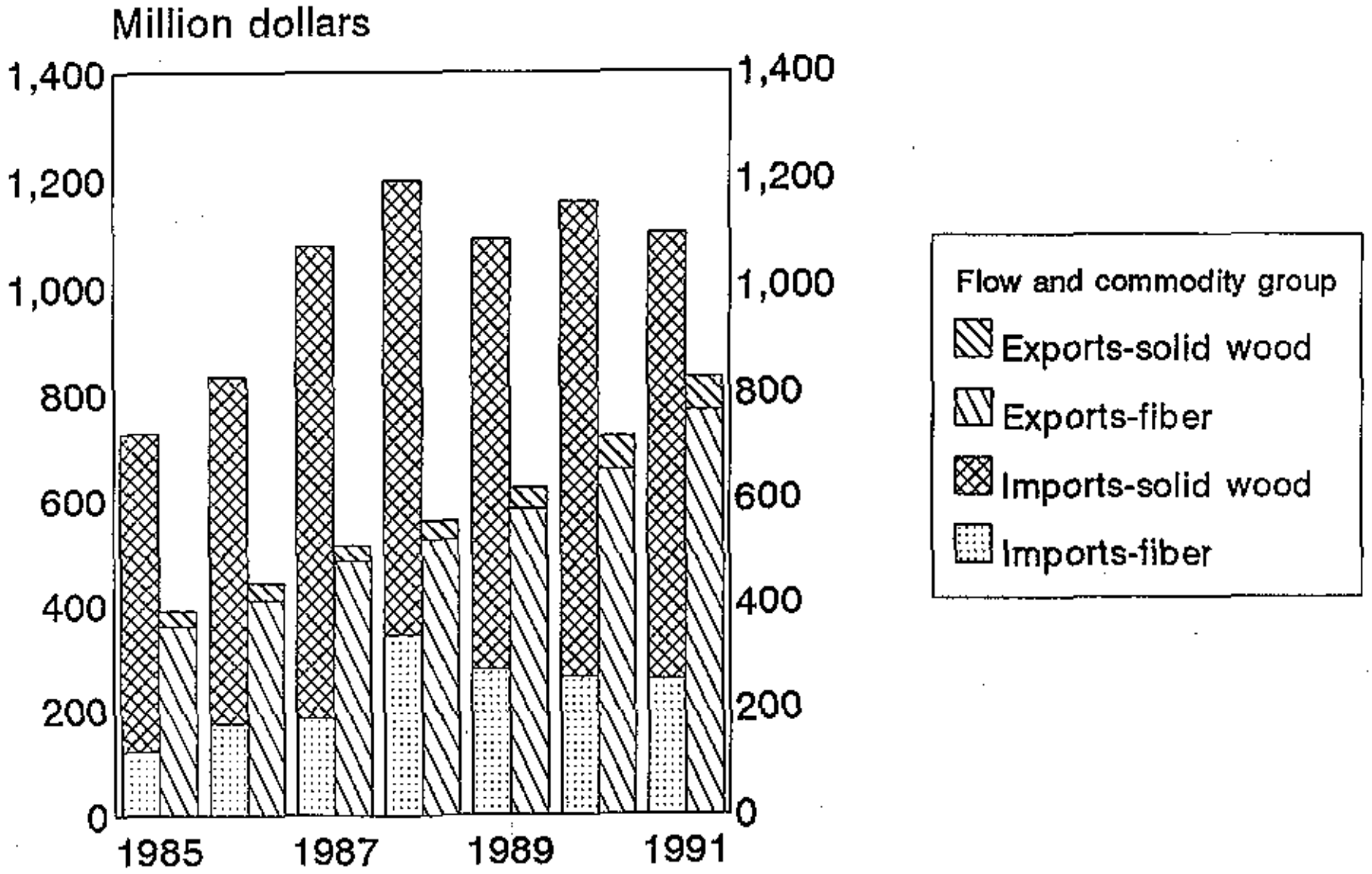
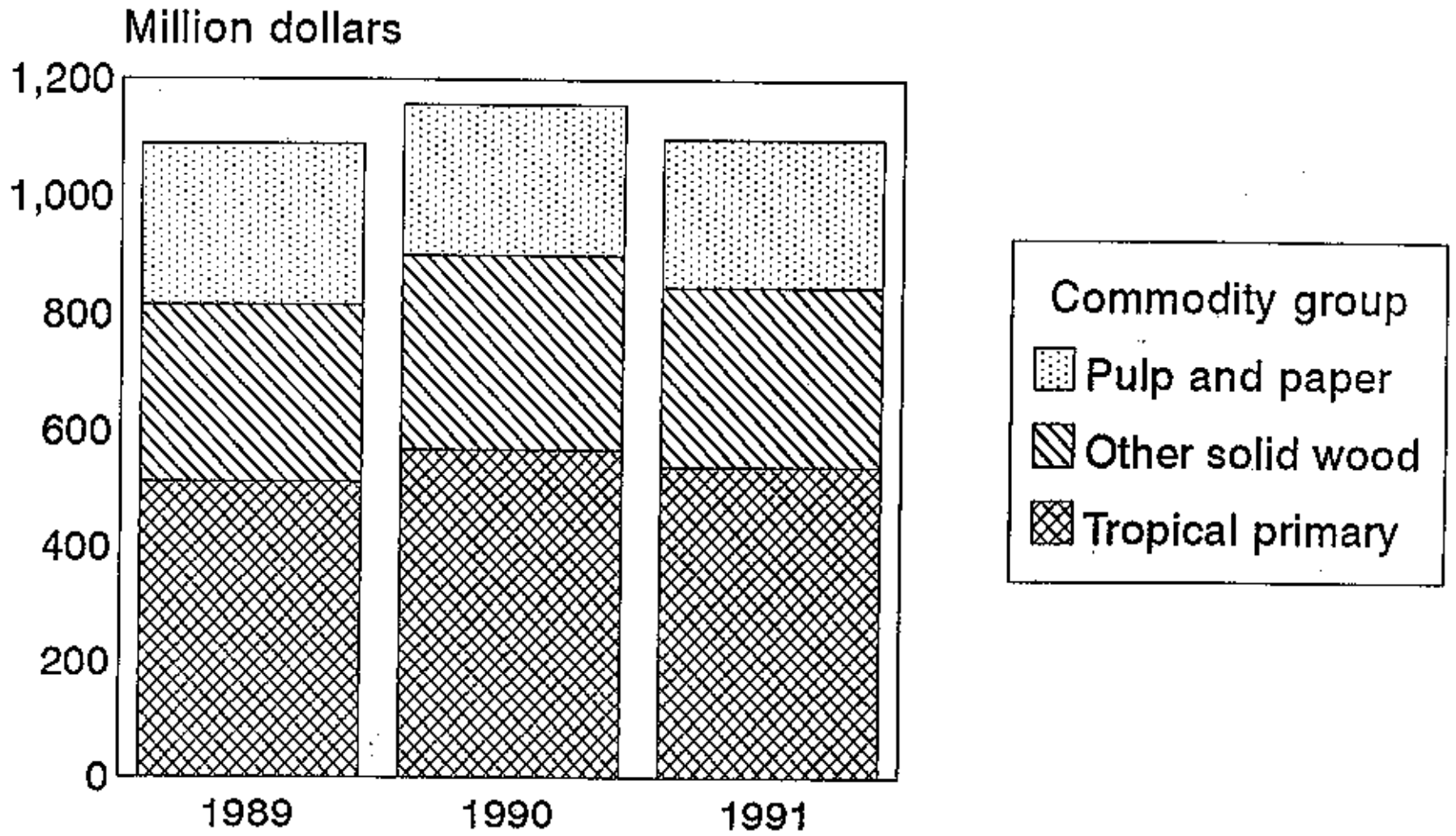


Figure 4--United States imports of forest products from ITTO producer countries, 1989-91



Tropical primary includes logs, sawn wood, veneer & plywood
Other solid wood includes manufactured commodities

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BOOKS

Edward B. Barbier
Economics, Natural-Resource Scarcity and Development: Conventional and Alternative Views, Earthscan, London, 1989 (paperback £17.50)

The history of environmental and resource economics is reviewed; then using insights from environmentalism, ecology and thermodynamics, Barbier begins the construction of a new economic approach to the use of natural resources, particularly to the problem of environmental degradation. With examples from the global greenhouse effect, Amazonian deforestation and upland degradation on Java, Barbier develops a major theoretical advance and shows how it can be applied. This book breaks new ground in the search for an economics of sustainable development.

David W. Pearce, Anil Markandya and Edward B. Barbier
Blueprint for a Green Economy, Earthscan, London, 1989 (paperback £8.95)

This book was initially prepared as a report to the Department of Environment, as part of the response by the government of the United Kingdom to the Brundtland Report, *Our Common Future*. The government stated that: '...the UK fully intends to continue building on this approach (environmental improvement) and further to develop policies consistent with the concept of sustainable development.' The book attempts to assist that process.

Edward B. Barbier, Joanne C. Burgess, Timothy M. Swanson and David W. Pearce
Elephants, Economics and Ivory, Earthscan, London, 1990 (paperback £10.95)

The dramatic decline in elephant numbers in most of Africa has been largely attributed to the illegal harvesting of ivory. The recent decision to ban all trade in ivory is intended to save the elephant. This book examines the ivory trade, its regulation and its implications for elephant management from an economic perspective. The authors' preferred option is for a very limited trade in ivory, designed to maintain the incentive for sustainable management in the southern African countries and to encourage other countries to follow suit.

Gordon R. Conway and Edward B. Barbier
After the Green Revolution: Sustainable Agriculture for Development, Earthscan Pub. Ltd., London, 1990 (paperback £10.95)

The Green Revolution has successfully improved agricultural productivity in many parts of the developing world. But these successes may be limited to specific favourable agro-ecological and economic conditions. This book discusses how more sustainable and equitable forms of agricultural development need to be promoted. The key is developing appropriate techniques and participatory approaches at the local level, advocating complementary policy reforms at the national level and working within the constraints imposed by the international economic system.

David W. Pearce, Edward B. Barbier and Anil Markandya
Sustainable Development: Economics and Environment in the Third World, London and Earthscan Pub. Ltd., London, 1990 (paperback £11.95)

The authors elaborate on the concept of sustainable development and illustrate how environmental economics can be applied to the developing world. Beginning with an overview of the concept of sustainable development, the authors indicate its implications for discounting and economic appraisal. Case studies on natural resource economics and management issues are drawn from Indonesia, Sudan, Botswana, Nepal and the Amazon.

David W. Pearce, Edward B. Barbier, Anil Markandya, Scott Barrett, R. Kerry Turner and Timothy M. Swanson
Blueprint 2: Greening the World Economy, Earthscan Pub. Ltd., London, 1991 (paperback £8.95)

Following the success of *Blueprint for a Green Economy*, LEEC has turned its attention to global environmental threats. The book reviews the role of economics in analyzing global resources such as climate, ozone and biodiversity, and considers economic policy options to address such problems as global climate change, ozone depletion and tropical deforestation.

E.B. Barbier and T.M Swanson (eds.)
Economics for the Wilds: Wildlife Wildlands, Diversity and Development, Earthscan Pub. Ltd., London, 1992 (paperback £12.95).

This collection of essays addresses the key issues of the economic role of natural habitat and wildlife utilization in development. The book argues that this role is significant, and composes such benefits as wildlife and wildland products, ecotourism, community-based wildlife development, environmental services and the conservation of biodiversity.

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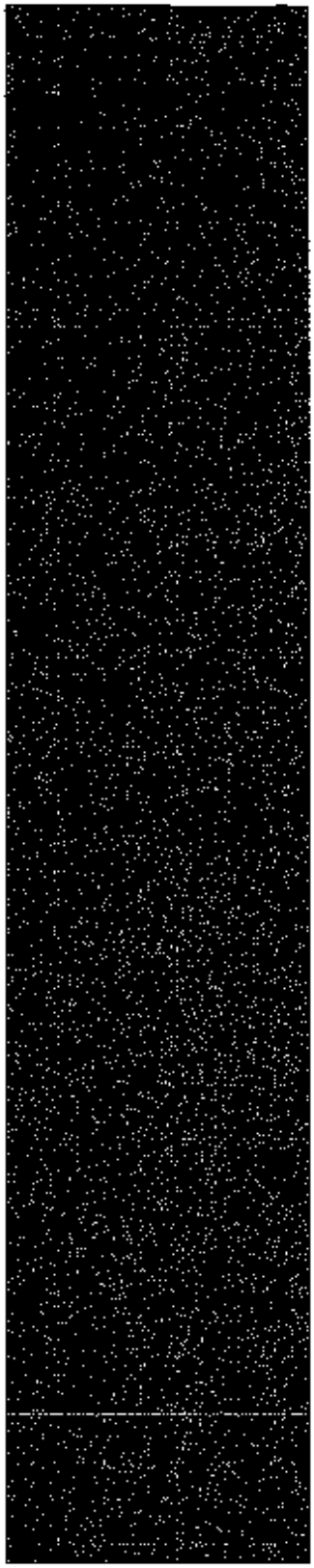

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