THE EFFECT OF CHANGES IN THE VALUE OF THE U.S. DOLLAR ON TRADE IN SELECTED COMMODITIES

Report on Investigation
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C O N T E N T S

CONTENTS

Figures

CONTENTS

Tables

CONTENTS

CONTENTS

Tables

CONTENTS

CONTENTS

Executive Summary

Exchange rates have recently attracted widespread and growing public interest as one of the most significant factors affecting the U.S. economy. Disadvantageous exchange rates, which raise the cost of U.S. exports in foreign markets and lower the cost of U.S. imports, are portrayed as an important factor in the U.S. trade deficit. Since 1973, when the United States and most other market economies entered the era of floating exchange rates, the U.S. dollar has fluctuated widely relative to other major currencies. The trade-weighted value of the dollar appreciated 31.7 percent in value relative to those other currencies during 1980-82, 1/ and the U.S. merchandise trade deficit reached $32.1 billion in 1982, representing a 46-percent increase over the 1980 deficit of $22.0 billion. Although imports of petroleum, natural gas, and related products have been the primary cause of the trade deficit, it is particularly significant that the nonpetroleum merchandise trade surplus dropped from $54.1 billion in 1980 to $27.0 billion in 1982. 2/

The consensus is that the relative appreciation of the U.S. dollar has had an adverse impact on overall levels of U.S. trade. However, it is extremely difficult to determine with certainty the extent to which changes in exchange rates affect trade, because other factors, such as international price competitiveness, technological leadership, and new supplying countries, are simultaneously affecting trading nations' competitiveness and trade levels. There is often little direct correlation between the percentage change in the value of the U.S. dollar against certain specific currencies and trade balances (table 1). For example, although the dollar appreciated 21 percent against the franc from 1981 to 1982, the U.S.-France trade balance improved slightly, whereas a 7-percent appreciation of the U.S. dollar against the West German deutsche mark accompanied considerable worsening of the U.S.-West German trade deficit.

1/ Floating Exchange Rates and U.S. Competitiveness, Investigation No. 332-124 Under Section 332 of the Tariff Act of 1930, USITC Publication 1332, December 1982, p. 3.

2/ U.S. Trade Shifts in Selected Commodity Areas, U.S. International Trade Commission, Publication 1378, May 1983.

Table 1.--All merchandise: Exchange rates and U.S. trade balances with selected countries, 1981 and 1982

Country and currency	Average currency unit			U.S. trade balance		
	1981	1982	Change	1981	1982	Change
	--Per U.S. dollar--		Percent	------1,000 dollars------		Percent
Japan (yen)	220.54	249.05	13	-15,965,908	-16,750,593	5
United Kingdom (pound)	.4972	.5723	15	-673,225	-2,540,809	277
France (franc)	5.4346	6.5724	21	1,450,189	1,504,472	4
Canada (dollar)	1.1989	1.2337	3	-7,054,316	-12,847,012	82
Italy (lira)	1136.77	1352.50	19	241,147	-734,654	305
West Germany (deutsche mark)	2.2600	2.4266	7	-1,243,968	-3,019,109	143

Source: Compiled from official statistics of the U.S. Department of Commerce and the International Monetary Fund.

To contribute to the understanding of this complex and important area, the Commission initiated this study to determine the relative importance of exchange rates in comparison with other trade-determining factors on six individual products. 1/ The major general findings of the study are as follows:

- Although concern over the strong dollar has been intensified by the growing U.S. foreign trade deficit, the Commission's analysis suggests that exchange-rate movements cannot always be assumed to be the predominant factor which determines changes in trade flows with respect to any individual product. The generalization that exchange-rate movements are the principal cause of trade shifts may overstate their importance relative to other causes influencing trade flows. In world trade, other factors interact to obfuscate the direct relationship between exchange-rate changes and trade flow patterns. Prices, competition from substitute products, constraints on supply, impediments to market access, transactions involving related parties, and changes in both product demand and consumer preferences can have a far greater impact on trade flow patterns. The Commission's analysis of the six products revealed that, although changes in exchange rates influenced trade, other trade factors were often more important. Variations in competitors' prices, product demand, local production, and manufacturing costs also played a key role in trade fluctuations.

- The Commission's investigation indicates that the assumption that trade in primary homogeneous products is generally more sensitive to

1/ The products include U.S. exports of polyester staple fiber to Canada and Hong Kong, denim to Italy and the United Kingdom, and primary magnesium to the European Community and Japan, and U.S. imports of bicycles from Japan, brass strip from Japan and West Germany, and pianos from Japan and West Germany.

exchange-rate changes than is trade in heterogeneous products is not necessarily correct when individual products are analyzed. The econometric analysis indicates that trade in primary homogeneous products (magnesium and polyester staple fiber) may not be more sensitive to exchange-rate movements than trade in intermediate products (denim and brass strip) or in consumer products (bicycles and pianos). In fact, exchange-rate changes were not found to significantly influence trade in polyester staple fiber with Hong Kong, trade in denim with the United Kingdom, and trade in magnesium with Japan. However, exchange-rate changes were a significant factor influencing trade, in terms of affecting price or volume or both, in magnesium with the EC and in bicycles, brass strip, and pianos with the selected countries.

- Exchange-rate fluctuations do not necessarily cause a proportionate change in prices of traded goods. The results suggest that foreign exporters of bicycles and brass strip generally reacted to exchange-rate changes by adjusting their export prices to maintain a relatively constant dollar price. However, the results suggest that foreign exporters of pianos do not maintain a relatively constant dollar price in the U.S. market for pianos. The results also suggest that price adjustments in response to exchange-rate changes may explain why the exchange rate had little effect on trade flows.

A summary of the competitive position of the six commodities in the U.S. and foreign markets and the results of the econometric analysis of the relative importance of exchange rates on trade in each of the products follow.

U.S. exports of polyester staple fiber to Canada and Hong Kong

- Foreign trade has played a key role in the economic activity of the U.S. industry in recent years.

The U.S. industry, the largest producer of polyester staple fiber in the world, ranks among the world's lowest cost producers, supplying almost the entire market in the United States and exporting a significant portion of its output. Export growth of more than 300 percent during 1977-81 accounted for three-fourths of the increase in its domestic production during that period, and an export decline of 60 percent in 1982 accounted for half the decrease in its output that year. U.S. exports of polyester staple accelerated from 125 million pounds, or 6 percent of U.S. production, in 1977 to almost 550 million pounds, or 21 percent of production, in 1981, before falling to 218 million pounds, or 11 percent of output, in 1982. U.S. production followed a similar pattern, increasing from 2.0 billion pounds in 1977 to 2.6 billion pounds in 1981, and then declining to slightly less than 2.0 billion pounds in 1982.

The export buildup during 1977-81 followed by the decline in 1982 largely reflected the pattern of trade with China, which accounted for 55 percent of the exports during 1978-82. Shipments to China, after averaging about 120 million pounds in both 1978 and 1979, climbed to 296 million pounds in 1980

and to 418 million pounds in 1981 before declining to 104 million pounds in 1982. Excessively large inventories of the fiber forced China to curtail its purchases from all sources, especially the United States.

U.S. exports to Canada and Hong Kong, the two countries selected for the econometric analysis, declined significantly during the 1980's. Exports to Canada decreased from 50 million pounds in 1979 to 29 million pounds in 1982, and those to Hong Kong fell from slightly more than 25 million to just under 2 million pounds during the period.

- o U.S. exports of polyester staple fiber to Canada and Hong Kong were influenced by factors other than changes in bilateral exchange rates.

The results of the econometric analysis show that changes in bilateral exchange rates did not adversely affect U.S. exports of polyester staple to Canada and Hong Kong during 1977-82. Trade flows were influenced primarily by factors that are indigenous to the two markets.

The sole Canadian producer of polyester staple fiber is owned by a U.S. producer. The types of polyester staple fiber exported to Canada generally complement, rather than displace, the production there, with export price and volume levels dictated by market needs rather than bilateral exchange-rate movements.

Hong Kong does not produce polyester staple, and, therefore, its yarn-spinning industry must use imported fiber. The industry has been in a state of decline for several years, because increasing production costs and labor shortages have undermined its price competitiveness vis-a-vis other Asian producers in its foreign and domestic markets; consequently, the industry has reduced its manmade-fiber purchases. This was exacerbated by the worldwide recession and the resultant decrease in demand for Hong Kong's textiles. At the same time, China sharply cut back its purchases of polyester staple fiber from all sources, resulting in widespread price cutting in Hong Kong, because Asian fiber producers, faced with excess production and production capacity, sought to protect their market share. Rather than reduce prices to unprofitable levels, U.S. producers chose not to service the Hong Kong market and withdrew from it.

U.S. exports of denim to Italy and the United Kingdom

- o The U.S. industry producing denim ranks among the lowest cost producers in the world, but its exports have declined significantly during the 1980's.

The U.S. denim-weaving industry is the world's largest, and possibly the most cost-efficient, producer of denim, accounting for about half the world's denim production in 1982. It not only supplied virtually all the denim consumed in the United States during 1977-82, but also shipped a significant, but declining, amount to foreign markets. U.S. denim exports fell from an annual average of 127 million square yards during 1977-79 to 96 million square yards in 1980, and to just under 45 million square yards in both 1981 and 1982. Exports' share of U.S. production, which also trended downward during the

period to a low of 515 million square yards in 1982, declined from more than 20 percent in both 1978 and 1979 to less than 10 percent in both 1981 and 1982.

Although the export decline during the 1980's was spread among several markets, the major part of the decrease came in shipments to several European Community (EC) nations, with the EC as a whole receiving more than two-thirds of the exports during 1978-82. Shipments to Italy, the largest single market, accounting for about 36 percent of U.S. exports during the period, declined from an annual average of 40 million square yards in 1978-80 to approximately 20 million square yards in 1982, and those to France, the second largest market, accounting for 19 percent of the total, dropped continuously during the period, from 39 million to 4 million square yards. Exports to the United Kingdom, which along with Italy was selected for the econometric model, also decreased significantly, from approximately 9 million square yards in 1979 to just under 1 million square yards in 1982.

Probably the most important factor causing the export decline during 1980-82 was that EC denim production caught up with demand, markedly reducing the need for imports. In addition, a large U.S.-owned denim plant was opened in Ireland in 1979 to produce fabrics previously imported from the United States. Other factors contributing to the export decline include stagnant consumption in traditional U.S. export markets and increased imports of denim jeans from Asian sources into these markets, which reduced demand for denim.

- o Changes in bilateral exchange rates were found to have significantly influenced U.S. exports of denim to Italy, but not those to the United Kingdom.

The results of the econometric analysis showed that exchange-rate changes significantly affected the price and quantity of denim exports to Italy. The results indicated that prices of denim exported to Italy were significantly influenced by U.S. wholesale prices, world cotton prices, and Italian denim production.

Additional factors found to have a significant effect on the quantity of U.S. denim exports to Italy were competitors' prices and Italian denim consumption (used as a proxy for Italian demand). Although not specifically included in the model, evidence was obtained that U.S. exports were also being displaced by denim produced in the EC, including that made in the U.S.-owned plant in Ireland.

The econometric analysis of U.S. denim exports to the United Kingdom revealed no specific factors that significantly affected either the price or the quantity of these shipments. However, the market forces which are believed to have influenced the exports, but are not sufficiently captured by the econometric model, include increased quantities of denim obtained from Ireland and elsewhere in the EC and increased imports of denim jeans, which reduced demand for denim.

U.S. exports of primary magnesium to the EC and Japan

- The United States is the world's largest producer of primary magnesium, supplying almost all the domestic market and exporting significant quantities.

The three U.S. producers of primary magnesium, together accounting for 45 percent of total world production, shipped 27 percent of their output to foreign markets during 1977-82. U.S. exports of primary magnesium, sent primarily to the EC and Japan, increased from 26,300 tons in 1977 to 49,600 tons in 1980, and then declined to less than 40,000 tons in both 1981 and 1982. U.S. production followed a similar pattern, reaching a high during the period of 169,500 tons in 1980 before declining to just under 100,000 tons in 1982.

The U.S. industry is highly competitive in world markets for primary magnesium in terms of both price and product quality. It ranks among the lowest cost producers in the world, because the economies of scale resulting from its high level of production allow the industry to offset much of its energy cost, as well as its labor cost, which is higher than that of Norway, its major foreign competitor. In addition, the industry enjoys ready access to an abundant supply of raw materials and uses technologically advanced production processes.

- Exchange-rate changes significantly affected U.S. exports of primary magnesium to the EC, whereas the growing dependence of Japan on imports from the United States minimized the effect of exchange rates on exports there.

The econometric analysis of U.S. exports of magnesium to the EC indicated that changes in bilateral exchange rates significantly influenced the price and quantity of U.S. exports to the EC. The results indicate that U.S. export prices increased as the dollar appreciated. Changes in U.S. production and production costs, here represented by U.S. wholesale prices, also influenced export prices. In addition, export prices, along with exchange-rate movements, significantly influenced the quantity of U.S. exports to the EC. However, the results indicated that exports to the EC increased as the dollar appreciated. Although the EC is highly dependent on imports, the United States faces significant competition from Norway, the second largest exporter after the United States and also a low-cost producer.

The econometric analysis showed that the price and quantity of U.S. exports of magnesium to Japan were not significantly affected by changes in the bilateral exchange rate. Among the factors considered, changes in competitors' prices in the Japanese market and U.S. production levels were found to significantly influence export prices; Japanese magnesium consumption and U.S. production were the only factors found to significantly affect export volume. The importance of these factors largely reflects the fact that Japan, whose competitiveness compared with that of the United States and other foreign producers has been undermined by rising production costs, is becoming highly dependent on imported magnesium to meet domestic demand. Foreign producers more than doubled their share of the Japanese market, from just

under 30 percent in 1977 to 74 percent in 1982. The United States alone supplied 53 percent of the total market in 1982.

U.S. imports of bicycles from Japan

- o U.S. consumption and producers' shipments of bicycles have been declining since 1979; imports, although falling significantly in 1982, showed steady growth through 1981.

U.S. consumption of bicycles, after increasing from 9.4 million units in both 1977 and 1978 to almost 10.9 million units in 1979, declined thereafter to 6.8 million units in 1982. U.S. producers' shipments followed a similar pattern, peaking at just over 9.0 million units in 1979, before declining annually to 5.2 million units in 1982. Imports, on the other hand, rose from an annual average of 1.9 million bicycles in 1977-79 to a high of 2.2 million bicycles in 1981, before declining to 1.7 million bicycles in 1982. Imports' share of the domestic market annually averaged about 20-25 percent in recent years.

The largest foreign supplier of bicycles was Taiwan, with 52 percent of total imports during 1978-82; Japan supplied an additional 24 percent. The bicycles from Taiwan are among the lowest priced imports, averaging $56 each, compared with about $99 for bicycles from all other sources. Those from Japan, which was selected for the econometric analysis, averaged nearly $113 each.

Imports supply the majority of the high-cost bicycles sold here. Unlike most domestic bicycles, which are sold through chain department and discount stores in standard frame sizes and with limited service, most imported lightweight bicycles are sold through bicycle specialty shops, often in custom-fitted frame sizes and with extensive service.

- o Exchange rates and competitors' prices significantly influenced U.S. imports of bicycles from Japan.

The econometric analysis of U.S. imports of bicycles from Japan indicates that the price and quantity of these shipments were particularly sensitive to changes in exchange rates and competitors' prices. This supports the hypothesis that Japanese exporters will raise yen prices as the dollar appreciates or as competitors' prices increase to improve profit margins, and lower yen prices as the dollar depreciates or as competitors' prices decrease to maintain their market share. In addition, changes in market demand significantly influenced the quantity of imports.

U.S. imports of brass strip from Japan and West Germany

- o U.S. consumption of brass strip has been trending downward since 1978; both U.S. producers' shipments and imports reach long-term lows in 1982.

U.S. consumption of brass strip has been declining continually since 1978, decreasing from nearly 564 million pounds that year to a low of

405 million pounds in 1982. U.S. producers' shipments, after increasing from 436 million pounds in 1977 to 478 million pounds in 1979, have trended downward during the 1980's, reaching a low of 340 million pounds in 1982. Imports have fluctuated widely since 1977, peaking at 100 million pounds in 1978; they totaled 66 million pounds in 1982. Imports' share of the market declined significantly from almost 18 percent in 1978 to just under 12 percent in 1980, before increasing to about 16 percent in 1982.

The major foreign suppliers of brass strip, primarily West Germany, Japan, the Netherlands, and Canada, generally compete in the U.S. marketplace by offering specialty products in which they possess a technological advantage and commodity products in which they are price competitive. Foreign producers import lower priced copper, the principal raw material in brass strip; U.S. producers use domestically produced copper, considered to be the world's costliest. However, duties and other costs associated with importing minimize price differences between domestic and imported brass strip, with domestic producers benefiting from market proximity, supply reliability, and support services.

- o Prices of brass strip imported from Japan and West Germany are sensitive to changes in several factors, including exchange rates.

The econometric analysis indicated that prices of brass strip from Japan and West Germany were significantly affected by bilateral exchange-rate changes. Import prices of Japanese products were also significantly influenced by competitors' prices in the U.S. market, copper prices, and Japanese production. The quantity of imports from Japan was not significantly affected by exchange-rate changes; however, the analysis shows U.S. consumption of brass strip, used here as a proxy for demand, was a significant factor affecting U.S. imports.

Analysis of brass strip from West Germany shows that, like Japan, exchange-rate changes significantly influenced U.S. import prices. Although exchange-rate movements affected the quantity of imports from West Germany, the result was not as expected.

The cost of producing brass strip, especially the cost of copper, is also an important factor influencing the price of imports from West Germany, which, in turn, affects the quantity of brass strip imported. Other significant factors affecting the trade flow were U.S. consumption, used as a proxy for domestic demand, and competitors' prices.

U.S. imports of pianos from Japan and West Germany

- o U.S. piano consumption and production have declined as imports from Japan and Korea have expanded their market share.

The U.S. piano-producing industry is the world's third largest, ranking behind Japan and the Soviet Union. U.S. piano consumption declined steadily from 229,000 units in 1977 to 186,000 in 1982. The decline was due to changing tastes in leisure time use, a reduction in school funding of music

programs, the combination of recession and high interest rates, and the decline in the number of children aged 5 to 14, which is the age range at which children start music lessons.

Although U.S. consumption of pianos declined during 1977-82, imports expanded, and their share of the domestic market increased from 11 to 20 percent during the period. Between 74 and 85 percent of the imports during 1978-82 came from Japan. However, the fastest growing supplier was the Republic of Korea (Korea), whose shipments accelerated from 1,440 units in 1980 to 7,939 units in 1982 and now account for 21 percent of the imports. Although the most expensive pianos are made domestically or imported from European countries, the Japanese and Korean pianos compete vigorously with U.S. pianos in the lower and middle price brackets and are attracting a steadily growing following.

- o Exchange rates were an important factor influencing prices of pianos imported from Japan and the quantity of imports from West Germany.

The econometric analysis suggests that Japanese piano exporters respond to changes in the bilateral exchange rate by raising their export prices as the dollar appreciates. The results suggest that exporters also adjust their export prices in response to changes in prices from competing sources of pianos. However, the analysis was able to isolate only nonprice factors in Japan as significantly affecting the quantity of pianos imported from Japan. This may reflect the overriding importance of consumer perception of quality and performance within a given price range in determining sales of Japanese pianos, factors not captured by the model.

The econometric analysis indicates that the quantity of pianos imported from West Germany is significantly affected by exchange-rate movements. West Germany supplies a very small number of high-priced pianos to the U.S. market, and the results indicate that imports are related to the change in the value of the dollar relative to the deutsche mark. More purchasers are able to afford the high-value, high-quality German product when the dollar appreciates relative to the deutsche mark.

Introduction

Exchange rates--the value of one currency in terms of another--have been receiving considerable attention in the Government, industry, and the media concerning their influence on the U.S. foreign trade balance and the competitiveness of U.S. industry in markets both here and abroad. Much of the discussion has involved the impact of exchange-rate fluctuations on U.S. trade and competitiveness at a highly aggregated level or, at the very least, on a broad sector basis. 1/ Because trade determinants differ considerably from product to product, the Commission instituted investigation No. 332-150 under section 332 of the Tariff Act of 1930 to determine the relative impact of changes in the foreign-exchange value of the U.S. dollar on trade with selected countries in six specific products.

Although aware of the growing concern that the stronger U.S. dollar may have reduced the price competitiveness of U.S. products vis-a-vis their foreign counterparts, the Commission found that the exchange rate is only one of many factors that influence international trade. The other factors, which may vary from industry to industry and from product to product, include relative price competitiveness of domestic and imported products in home-currency prices, income levels, competition from substitute products, supply constraints, market impediments, related-party transactions, and changes in product demand and consumer preferences. Many of the factors that can affect the relative prices of domestic and foreign producers, such as productivity gains, cost containment, and technological improvements, can be influenced by the firms involved in trade. However, because changes in price competitiveness resulting from exchange-rate fluctuations are beyond the control of any single business, firms are in a relatively more passive position with respect to this factor.

This study integrates the analytical techniques of the econometrician with those of the industry analyst to evaluate the importance of exchange rates in comparison with other causes of trade-flow changes. The products selected for analysis were equally divided between export and import items. The export products and markets are (1) polyester staple fiber exported to Canada and Hong Kong, (2) denim exported to Italy and the United Kingdom, and (3) primary magnesium exported to the European Community and Japan. The import items and sources are (1) bicycles from Japan, (2) brass strip from Japan and West Germany, and (3) pianos from Japan and West Germany.

The six products selected for analysis are highly competitive internationally, and trade in them is important to U.S. and foreign producers. In addition, they represent three distinct levels of manufacture--primary materials (polyester staple fiber and primary magnesium), intermediate goods (denim and brass strip), and consumer goods (bicycles and pianos)--allowing an analysis of whether prices of primary homogeneous products are more influenced by exchange-rate movements than are those of heterogeneous products. Unlike primary homogeneous products, heterogeneous goods (e.g., bicycles and pianos) typically possess distinctive features that

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1/ See Floating Exchange Rates and U.S. Competitiveness: Investigation No. 332-124 Under Section 332 of the Tariff Act of 1930, USITC Publication 1332, December 1982.

allow different markets to exist for similar items and, therefore, it has been generally contended that their prices may be less likely to be influenced by exchange-rate changes.

Given the selection of specific products for study, selection of countries for the bilateral trade analysis was based on (1) the existence of a currency which floats relative to the U.S. dollar, (2) a significant level of trade with the United States, (3) an absence of quotas or other significant trade-distorting restrictions, and (4) the availability of foreign data.

The report is structured to provide a separate review of each of the six products selected for analysis. For each product, a descriptive profile is given along with information on its uses, the manufacturing process, an industry profile, and conditions of competition in the U.S. and foreign markets. This is followed by an econometric analysis of product trade, which examines the relative importance of exchange rates and other variables on prices and trade levels. The econometric analysis considers such important trade determinants as production, consumption, U.S. and foreign prices, third-country competition, and raw-material costs. The data used to develop the econometric analysis for the six products are contained in appendix A, and a discussion of the methodology used is presented in appendix B, which contains tables showing the complete regression results for the six products.

To aid in the understanding of floating exchange rates and their impact on U.S. trade flows, the remainder of this section will provide a review of historical trends in exchange rates, an analysis of the relationship between exchange rates and trade flows, and a summary description of the econometric model used, variables examined, and assumptions made.

Bilateral exchange rates: 1977-82

From 1977 to 1982, several bilateral exchange rates, as well as the effective exchange rate of the dollar, exhibited sizable changes (fig. 1, app. C). 1/ The dollar increased approximately 17 percent relative to the value of the currencies of the United States' major trading partners during 1977-82. However, the period also witnessed large fluctuations in the dollar's value. From the first quarter of 1977 through 1978, the dollar fell approximately 14 percent relative to the currencies of the major trading partners. During 1979 and through the third quarter of 1980, the dollar was relatively stable. From the third quarter of 1980 through 1982, the dollar increased approximately 30 percent in value.

1/ The effective exchange rate of the dollar measures the value of the dollar relative to the weighted value of the currencies of the major trading partners of the United States. The International Monetary Fund computes the effective exchange rate with weights derived from its Multilateral Exchange Rate Model. These weights incorporate the size of trade flows and the relevant price elasticities and feedback effects of exchange-rate changes on domestic costs and prices.

Because the present study looks at trade in specific commodities with individual countries, the historical trends of the bilateral exchange rates between the dollar and the currencies of these countries are also examined (figs. 2-4). During 1977-82, these rates have followed trends similar to the trend of the effective exchange rate.

Generally, the dollar fell against these currencies between the first quarter of 1977 and the fourth quarter of 1978: the franc-dollar exchange rate declined 13 percent, the pound-dollar rate declined 14 percent, the mark-dollar rate declined 22 percent, the yen-dollar rate declined 36 percent, the lira-dollar rate declined 6 percent, the Hong Kong dollar-U.S. dollar rate increased 2 percent, and the European Currency Unit (ECU)-dollar rate declined 17 percent. 1/ The dollar was then relatively stable against most of these currencies (with the exception of the yen and the pound) until the third quarter of 1980, after which the dollar strengthened dramatically with only a slight interruption in the third quarter of 1981. During this time, the franc-dollar rate increased 60 percent, the mark-dollar rate increased 32 percent, the pound-dollar rate increased 32 percent, the yen-dollar rate increased 16 percent, the lira-dollar rate increased 67 percent, the Hong Kong dollar-U.S. dollar rate increased 36 percent, and the ECU-dollar rate increased 42 percent.

Since the first quarter of 1977, the U.S. dollar has slowly but steadily risen in value relative to the Canadian dollar, and by the third quarter of 1982, the U.S. dollar had risen 19 percent.

Trade flows and exchange rates

Changes in exchange rates are generally assumed to affect the prices of traded commodities, and changes in these prices are assumed to affect the volume of trade. For example, a decline in the value of the dollar is expected to increase the U.S. price of imports. The higher import price is expected to cause a decline in demand, and thus a reduction in the volume of actual imports. Similarly, a lower dollar value is expected to reduce the price of U.S. exports in foreign currencies, lower their prices to foreigners, increase the demand for U.S. exports, and increase the volume of actual U.S. exports.

Two related factors must be considered in addition to exchange-rate changes. First, exchange-rate changes do not always translate immediately into price changes; price adjustments often occur after a lag that may be as short as 1 month or as long as several years. Second, exchange-rate changes do not always cause prices to change by the full amount of the exchange-rate change. Because these factors affect the price changes that result from exchange-rate changes, they are expected to influence the relationship between exchange-rate changes and trade flows.

1/ The ECU is the common currency unit of the European Community. The exchange-rate index used here is based on the old European Unit of Account (EUA) and the ECU, which contains the same basket of currencies as the EUA and has been adjusted to obtain a consistent series.

Exchange-rate changes may not affect prices of imports and exports immediately for several reasons. The lags may be due to contracts between the trading parties that fix the price in dollar terms for a specific period of time, or they may result because producers view the exchange-rate change as only temporary. In the latter case, importers and exporters might be reluctant to change their prices, because short-run fluctuations would disrupt their markets. If, after a time, the exchange-rate change is viewed as more permanent, traders may be less reluctant to change prices.

Other considerations may cause importers and exporters to limit the extent to which they pass through the exchange-rate change to customers. If the dollar falls in value, foreign producers may not want to lose their U.S. market share to domestic producers. Thus, foreign producers would be reluctant to raise their dollar prices by the full amount of the exchange-rate change. If the dollar increases in value, foreign producers may prefer to raise their profit margins rather than reduce their dollar prices by the full amount of the exchange-rate change. The amount of pass-through also depends on the product's characteristics. If the product is fairly homogeneous across producers, the foreign producer will be less able to pass through an increase in the price of the foreign currency (a depreciation of the dollar), because customers would shift rapidly to competing products whose prices have not risen. Conversely, if the dollar were to appreciate, foreign producers of a homogeneous good would be less inclined to lower their prices if they were able to sell all they could produce at the U.S. price, since they would only lose profits by lowering their dollar price.

When the product is fairly heterogeneous across producers because it has distinguishing characteristics that set it apart from other products, the foreign producer may be more able to pass through the exchange-rate changes. If the dollar were to depreciate, the foreign producer could more easily raise the dollar price for its product, because fewer customers would shift to other suppliers. Conversely, if the dollar were to appreciate, the foreign producer might be more inclined to lower its dollar price, provided this action increases sales by enough to increase its profit.

Importers that act as intermediaries between foreign suppliers and U.S. consumers further complicate the influence of exchange rates on trade flows. For example, when foreign suppliers sell in the United States through importers, the dollar price is set by the U.S. importers. These importers may prevent the exchange-rate effects from reaching the U.S. customer, reduce the size of the exchange-rate effect, and cause the exchange-rate effect to reach the U.S. customer only after a lag.

A final problem concerns the response to expected exchange-rate changes. If the exchange rate is expected to decline, importers may increase imports today in anticipation of higher prices tomorrow. Exporters may be forced to delay exports today because their customers are waiting for lower prices tomorrow. Reverse effects would accompany expected exchange-rate appreciations. 1/

1/ The influence that anticipated exchange-rate changes may have on trade flows has been explored by Wilson and Takacs. See John F. Wilson and Wendy E. Takacs, Expectations and the Adjustment of Trade Flows Under Floating Exchange Rates: Leads, Lags, and the J-Curve, International Finance Discussion Papers, No. 160, April 1980, Board of Governors of the U.S. Federal Reserve System.

Once prices begin to change, trade flows may not immediately respond for several reasons: previously negotiated contracts may specify volume, customers may be reluctant to switch suppliers until price differences become large enough to overcome the costs of switching, or customers may be unable to obtain alternative supplies on short notice.

These issues are raised to point out the types of market behavior that the study attempts to capture. The lagged effects on trade flows of both exchange-rate changes and price changes are included in the model.

The econometric model 1/

To capture the effects of exchange-rate changes, the model must link the changing value of the dollar to the flows of exports and imports. As noted previously, many factors should be included in the model to correctly estimate the effects of exchange rates on trade flows. Furthermore, to avoid biases in the estimates of these effects, the other factors that may influence prices and trade flows, such as the costs of production, domestic prices and other foreign prices of competing products, demand conditions in the importing country, and other activity variables, should be included whenever possible.

The model used in the present study is adapted from economic models used to estimate the effects of exchange-rate changes on aggregate trade flows. 2/ These aggregate models first account for supply effects and price-setting behavior by estimating the determinants of import and export prices. The estimated prices are then used, along with other determinants, to estimate real imports and exports.

In place of aggregate trade flows, the adapted model used here concentrates on the six products chosen for closer study and the variables relevant to trade in those six products. The model was chosen because it was easily adapted to each of the products, it highlighted the exchange-rate effects, and it permitted reasonable control of other factors that also may affect trade flows, given the available data.

In the model, import and export prices in the currency of the country of origin were estimated as a function of exchange-rate changes, competitors' prices at destination, the costs of production, and nonprice factors that may

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1/ For the functional form of the model and the statistical results of the estimation, see app. B.

2/ For a representative selection of studies of exchange-rate effects on aggregate trade flows, see Robert M. Stern, Christopher F. Baum, and Mark N. Greene, "Evidence on Structural Change in the Demand for Aggregate U.S. Imports and Exports," Journal of Political Economy, vol. 87, No. 1, 1979; John F. Wilson and Wendy E. Takacs, op. cit.; and Kenneth Bernauer, "Effectiveness of Exchange-Rate Changes on the Trade Account: The Japanese Case," Economic Review, Federal Reserve Bank of San Francisco, Fall 1981, as well as the numerous studies referenced in these papers.

influence import and export prices. 1/ A variable often used to represent nonprice factors that affect price is inventories. 2/ Unfortunately, this variable was not available on a quarterly basis for the products considered. Instead, indexes of domestic and foreign production of the specific products were used to reflect these nonprice factors. Because a more appropriate variable was not available, wholesale prices were used as a proxy for domestic costs. This variable permits a more comprehensive measure of the costs to be included than does an index of wages or raw material costs. 3/ However, it may also reflect demand pressures. In either case, higher wholesale prices were expected to increase import and export prices.

Exporters, both foreign and domestic, were expected to react to changes in the dollar's value by altering their home-currency prices so as to maintain a relatively stable foreign-market price of their product. 4/ For example, U.S. exporters were expected to lower dollar prices of their exports as the dollar appreciated to remain competitive in foreign markets. Similarly, to remain competitive, exporters were expected to lower home-currency prices as competitors' prices at destination declined.

The model was able to explain 90 percent or more of the variation in the import or export price for 8 of the 11 bilateral trade flows examined. The amount of explanation ranged from 98 percent of the variation in the import price for brass strip imports from Japan to 53 percent of the variation in the import price for piano imports from West Germany.

Import and export volumes were estimated to respond to exchange-rate changes as well as estimated import and export prices, competitors' prices at destination, demand for the product at destination (represented by apparent consumption), and nonprice factors that may influence import and export volumes. Capacity utilization has often been used to represent nonprice factors that affect import and export volumes, but data were not available on a quarterly basis for the products considered. 5/ Instead, for the three exported products, indexes of domestic production were used to reflect nonprice factors and, for the three imported products, real gross national product or aggregate demand were used. Since the emphasis of the study is on the influence exerted by exchange rates, these variables for nonprice factors were not refined further. 6/

1/ Unit values were used for import and export prices.

2/ See, for example, Peter Hooper, Forecasting U.S. Export and Import Prices and Volumes in a Changing World Economy, International Finance Discussion Papers, No. 99, December 1976, Board of Governors of the Federal Reserve System.

3/ See Bernauer, op. cit.

4/ For an example of a similar approach, see Hooper, op. cit.

5/ For an example of the use of capacity utilization, see Hooper, op. cit.

6/ As is often done in the literature, no a priori assumptions were made about the expected effect of nonprice factors on trade volumes. See, for example, Wilson and Takacs, op. cit.

Imports were expected to increase and exports were expected to decrease as the dollar appreciated. To the extent that import and export prices were adjusted to maintain relatively constant foreign-market prices, the effect of the exchange rate on volume was expected to be reduced. Import and export volumes were expected to increase as competitors' prices at destination increased, but this effect was expected to be reduced if prices were adjusted to remain constant relative to competitors' prices.

Although the model did not explain the variation in import and export volumes as well as it explained the variation in import and export prices, it was able to explain between 80 and 90 percent of the variation in the import or export volumes for 4 of the 11 bilateral trade flows examined. The model explained 70 to 80 percent of the variation in 5 of the 11 flows. The amount of explanation ranged from 88 percent for brass strip imports from Japan to 56 percent for piano imports from Japan.

A major problem affecting the explanatory power of any model of trade in a specific product is the lack of time series data for the variables that determine trade. In this study, proxies were used in place of some variables for which data were not available. This procedure reduces the explanatory power of the model, particularly the volume estimates. In addition, in some cases, omitted variables appeared to be correlated with the exchange rate, thus biasing the results. Further efforts to collect more data and to more completely capture the relationships between the variables should yield models with greater explanatory power.

The results gleaned from the model suggest several avenues for further work. They suggest that exporters can respond to exchange-rate changes by changing the export price or by changing nonprice factors, such as quality. A more comprehensive modeling of this process may prove fruitful to an analysis of the effects of exchange rates on trade flows. In addition, the use of forward markets to diminish the immediate effects of exchange-rate fluctuations is apparently increasing, and the ability of traders in specific products to participate in these markets is another area worthy of additional research. The analysis also might be extended to include more products to see if different responses to exchange-rate changes exist within and between industries.

Polyester Staple Fiber

Product description

Polyester staple, 1/ first manufactured commercially in the United States in 1953, is produced from a petrochemical derivative through a process known as melt spinning. 2/ The petrochemical chips are heated and transformed into a thick, syrupy substance which is forced through the tiny holes of a device called a spinneret and extruded into filaments of indefinite length. These filaments are usually converted into continuous filament yarn or into staple (short fibers), with the former accounting for about 40 percent of U.S. filament production, and the latter, 60 percent. The continuous filament yarns are often textured or crimped to provide bulk and then woven or knitted into fabric. Staple is produced by cutting or breaking large bundles of filaments (called tow) into short lengths, usually 1 inch to 4 inches, for processing into spun yarn.

Properties such as length, dyeability, and luster vary in polyester staple, depending on the specific needs of textile producers. Only certain lengths, for example, are compatible with different yarn-spinning equipment or fiber combinations. Despite these differences, however, staple is a commodity-type product, 3/ sold in bulk, with both foreign and domestic producers using the same types of raw materials and equipment.

The major part of the polyester staple produced in the United States is spun into yarn, and the remainder is used as fiberfill in ski-type apparel, pillows, mattresses, and comforters. The spun yarns, used in more than three-fourths of the woven polyester fabric produced domestically, are more irregular and bulky than the filament yarns of the same weight. In addition, the short ends of the fibers projecting from the yarn surface produce a fuzzy effect so that they more closely simulate natural fibers. As a result, fabrics produced from spun yarns have a porous, textured surface and are used primarily in apparel and homefurnishings.

1/ Imports of this product are provided for in the Tariff Schedules of the United States Annotated (TSUSA) as follows:

Commodity	TSUSA item No.
Polyester tow, valued not over 80 cents per pound	309.3040
Polyester tow, valued over 80 cents per pound	309.3140
Polyester staple	309.4342

2/ Staple is also produced from regenerated polyester waste, but this type of staple accounts for less than 1 percent of total production and is not included in this study.

3/ Technical difficulties during the manufacturing process sometimes result in a "second quality" staple, which is not of standard or uniform quality and which is sold at discounted prices. Second quality polyester staple, however, accounts for less than 5 percent of total production and has little or no effect on overall prices or trade.

U.S. industry

The noncellulosic fiber industry (Standard Industrial Classification (SIC) 2824) 1/ accounts for over 90 percent of the manmade fibers produced domestically. Polyester is the major type of fiber produced, accounting for about half of total noncellulosic fiber output.

The U.S. noncellulosic fiber industry is the world's largest producer of noncellulosic fibers, accounting for 31 percent of world production in 1980, followed by the EC, with 16 percent of the total. The domestic industry consists of nearly 80 firms, many of which are large, publicly owned chemical companies. 2/ The four largest of these firms together account for about three-fourths of U.S. production of noncellulosic fibers, which took place in 148 plants in 1982, down from 166 plants in 1977. Polyester staple was produced by 7 firms in 18 plants in 1982, the same number of firms but 2 less plants than in 1977. It is estimated that industry concentration is even higher among polyester staple producers than the noncellulosic industry as a whole. Most of the plants in the industry are located in the Southern States.

The growth that characterized the U.S. noncellulosic fiber industry during the 1970's came to a halt in the 1980's, as stagnant textile consumption and, more recently, weak economic activity both here and abroad reduced demand for fibers. Moreover, the price of polyester staple climbed sharply during 1979-81, and, although it declined in 1982, it marked the first time since 1971 that it exceeded the price of cotton, a substitute for polyester in many end-use applications.

U.S. production of all noncellulosic fibers, after more than doubling during the 1970's to a record 8.4 billion pounds in 1979, declined somewhat in 1980 and 1981, and then decreased significantly in 1982 (table 2). As a result, the industry's capacity utilization rate in 1982 fell to 69 percent from more than 80 percent during 1978-81 and was the lowest since at least 1970. In addition, production capacity, which expanded annually during the 1970's to 9.8 billion pounds in 1979, contracted somewhat during the 1980's.

The industry's polyester staple operations fared somewhat better during the 1980's, with production continuing to increase in 1980 and 1981, before falling sharply in 1982 to its lowest level since 1976, as weak domestic demand and a substantial drop in exports to China adversely affected output. Consequently, the capacity utilization rate for polyester staple declined to 72 percent in 1982 from 92 percent in the years 1979-81.

1/ Includes all manmade fibers except those derived from cellulosic material such as rayon and acetate.

2/ Some of the larger firms produce a broad range of products from petrochemicals other than fibers for textile use. The share contributed by textile fibers to the total sales of each of these companies varies, ranging from 15 to 60 percent.

Table 2.--Noncellulosic fibers and polyester staple fiber: U.S. production and capacity utilization, 1977-82

Item	1977	1978	1979	1980	1981	1982
	Production (million pounds)					
Production:						
Noncellulosic fibers	7,312	7,768	8,418	7,874	7,982	6,449
Polyester staple fiber	2,050	2,236	2,462	2,527	2,607	1,955
Capacity:						
Noncellulosic fibers	9,368	9,571	9,804	9,647	9,716	9,364
Polyester staple fiber	2,470	2,554	2,673	2,759	2,839	2,700
	Share of total (percent)					
Capacity utilization:						
Noncellulosic fibers	78	81	86	82	82	69
Polyester staple fiber	83	83	92	92	92	72

Source: Textile Economics Bureau, Inc., Textile Organon, Roseland, N.J., January 1983, pp. 3, 4, and 6.

Employment in the noncellulosic fiber industry generally corresponded to production trends, peaking in 1979 and then declining significantly during the 1980's (table 3). Hourly wages of production workers are relatively high, averaging $9.10 compared with $8.40 for all manufacturing.

Table 3.--Average number of employees and hourly wages in the noncellulosic fiber industry (SIC 2824), 1977-82

Year	Number of employees	Hourly wages
1977	97,000	$5.83
1978	96,800	6.42
1979	98,300	7.00
1980	93,500	7.74
1981	83,000	8.53
1982	1/ 79,000	9.10

1/ Estimated by the staff of the U.S. International Trade Commission.

Source: Compiled from official statistics of the U.S. Bureau of Labor Statistics, except as noted.

Noncellulosic fiber production is capital intensive relative to other manufacturing industries. During 1977-81, payroll accounted for 33 percent of the value added in this industry, compared with 44 percent for all

manufacturing. In addition, annual capital expenditures averaged $4,600 per employee, compared with $2,900 for all manufacturing. Producers expected the consumption of manmade fibers to continue to grow and, as a result, increased capital expenditures even into 1980. Capital expenditures in the noncellulosic fiber industry increased 48 percent during 1977-80, totaling $503 million in 1980. Because of soft markets and excess production capacity, producers restricted capital outlays in 1981 and 1982.

Profits in the noncellulosic fiber industry are believed to have declined since 1980. Material costs have increased and utilization has declined, but producers found it difficult to pass on the resulting higher unit costs in the form of higher prices because of soft markets and increased competition from cotton.

U.S. market

Domestic consumption of polyester staple showed little or no growth in recent years, annually averaging 2.0 billion pounds during 1977-81 before declining significantly to 1.7 billion pounds in 1982 (table 4). Consumption was influenced by stagnant domestic consumption of textiles in general and, more recently, weak economic activity. U.S. mill consumption of manmade fibers, cotton, and wool used in textiles, after increasing slightly from 12.2 billion pounds in 1977 to 12.8 billion pounds in 1979, declined annually to 10.1 billion pounds in 1982.

Table 4.--Polyester staple fiber: 1/ U.S. production, exports of domestic merchandise, imports for consumption, and apparent consumption, 1977-82

(Quantity in millions of pounds; value in millions of dollars; unit value per pound)

Year	Production	Exports	Imports	Apparent consumption	Ratio (percent) of imports to consumption
	Quantity				
1977	2,050	125	5	1,930	0.2
1978	2,236	256	8	1,988	.4
1979	2,462	386	3	2,079	.1
1980	2,527	502	1	2,066	2/
1981	2,607	549	7	2,064	.3
1982	1,955	218	7	1,744	.4
	Value				
1977	3/ 1,066	61	3	1,008	0.2
1978	3/ 1,146	124	5	1,027	.5
1979	3/ 1,343	234	2	1,111	.2
1980	3/ 1,681	336	1	1,346	.1
1981	3/ 1,936	390	5	1,551	.3
1982	3/ 1,335	162	5	1,178	.4
	Unit value				
1977	3/ $0.52	$0.49	$0.60	-	-
1978	3/ .51	.48	.63	-	-
1979	3/ .54	.61	.67	-	-
1980	3/ .65	.67	1.00	-	-
1981	3/ .74	.71	.71	-	-
1982	3/ .68	.74	.71	-	-

1/ Contains a small amount of tow.
2/ Less than 0.05 percent.
3/ Estimated by the staff of the U.S. International Trade Commission.

Source: Production, compiled from data contained in Textile Organon, Textile Economics Bureau, Inc., except as noted; imports and exports, compiled from official statistics of the U.S. Department of Commerce.

The decline in consumption of polyester staple in 1982 also may have been influenced by the fact that its price, for the first time since 1971, exceeded that for cotton. Polyester staple and cotton are compatible fibers, with more than three-fourths of the fabrics containing spun polyester yarn also containing some cotton. The amount or relative predominance of the fibers used is dictated by fashion trends and prices. Official statistics of the U.S. Department of Agriculture show that during 1977-80, polyester staple prices remained well below cotton prices, but the gap narrowed considerably in 1981, and in 1982, prices of polyester staple rose above cotton prices, as shown in the following tabulation: 1/

	Cotton	Polyester staple
1977	$0.73	$0.58
1978	.71	.57
1979	.77	.63
1980	.98	.74
1981	.89	.88
1982	.76	.80

1/ Represents price for equivalent pounds accounting for waste.

Domestic consumption of polyester staple is supplied almost entirely by U.S. producers, as the economies of scale realized from their large-scale operations give them a price advantage over foreign producers. Also, most U.S. fiber-producing establishments are located in the Southern States near textile plants, the major polyester staple users, and can, with shorter delivery times, respond more quickly to changes in demand than can foreign suppliers.

Imports, primarily specialty fibers or spot sales to fill in for temporary shortfalls in domestic fiber availability, accounted for less than 0.5 percent of the U.S. market during 1977-82. Both the foreign sources and quantities imported fluctuated during this period, as shown in table 5.

Textile mills and independent yarn spinners usually purchase staple directly from producers, contracting for basic fiber needs and using spot purchases to fill in for shortages or upswings in demand for textiles. Payment is normally within 30 days of delivery. Since polyester staple is relatively homogeneous, sources can be diversified, and mills usually buy from more than one supplier.

International sales are also a mixture of contract and spot sales. Prices are usually quoted in U.S. dollars and are established at the time of order. Since overseas delivery can lag as much as 1 to 3 months, compared with 1 month or less for domestic deliveries, foreign importers often contract to buy U.S. dollars in advance, at a fixed exchange rate. Buyers are thus guaranteed a set price in their respective national currency at the time of delivery.

Table 5.--Polyester staple fiber: U.S. imports for consumption, by principal sources, 1978-82

Source	1978	1979	1980	1981	1982
	Quantity (1,000 pounds)				
Canada	991	351	331	1,050	3,376
Japan	666	94	103	50	1,419
Mexico	21	5	3	3,396	1,353
Romania	2,974	1,680	558	628	411
Netherlands	0	3	1	78	169
Italy	641	658	245	67	117
Taiwan	657	148	111	258	369
West Germany	2,150	104	70	182	23
All other	73	97	40	1,245	78
Total	8,174	3,140	1,462	6,954	7,316
	Value (1,000 dollars)				
Canada	446	270	302	725	1,771
Japan	502	119	126	67	1,502
Mexico	20	6	4	1,682	575
Romania	1,445	853	384	479	334
Netherlands	-	5	2	99	214
Italy	818	629	292	108	205
Taiwan	239	79	66	141	195
West Germany	1,085	69	88	314	88
All other	99	81	73	1,168	104
Total	4,654	2,111	1,337	4,782	4,989

Source: Compiled from official statistics of the U.S. Department of Commerce.

In addition to normal exporting costs such as overseas transport, U.S. producers often adjust fiber prices on a case-by-case basis to cover certain additional costs. For example, in Latin American countries, payment is usually not made for 90 to 180 days after delivery, and sales prices are set to cover interest charges for the delayed payment.

Commodity prices in the U.S. market

Polyester staple prices remained fairly stable from January-March 1977 through January-June 1979. However, prices then began to trend upward, increasing 36 percent by April-June 1981, before beginning to decline, decreasing 10 percent by the end of 1982 (table 6).

Table 6.--Polyester staple fiber: Average U.S. wholesale prices, by quarters, 1977-82

(In cents per pound)

Year	January-March	April-June	July-September	October-December
1977	52	52	52	52
1978	51	52	51	51
1979	50	53	56	59
1980	61	65	70	70
1981	76	76	74	71
1982	69	68	68	68

Source: Estimated by the staff of the U.S. International Trade Commission.

Most of the increase in prices can be attributed to higher raw material costs (primarily petrochemical feedstock), which account for approximately 60 percent of the value of shipments of the noncellulosic fiber industry, and labor costs, which account for an additional 15 percent. As a percentage of the value of industry shipments, labor costs remained fairly stable during this period; material costs increased from 57 percent of the value of industry shipments in 1977 to approximately 61 percent in 1981. The refinery acquisition cost of crude petroleum rose from $12 per barrel in 1977 to $35 per barrel in 1981, before declining to $32 in 1982. It is estimated that an increase of $1 in the price of crude oil, if returns to intermediate refineries are included, would raise the cost of polyester production about 1 cent per pound.

Polyester staple producers offset a large part of the higher material costs through economies of scale in production and energy conservation. Because of improved production methods, industry sources estimate that U.S. polyester staple producers reduced the energy required to produce a pound of manmade fibers by 35 percent during the 1970's.

Polyester producers were able to adopt relatively strong pricing postures because of strong and increasing demand during most of 1977-81, particularly as prices for cotton, the major fiber substitute, were higher. U.S. price competitiveness facilitated polyester staple exports, and, more importantly, China became a major U.S. export market during this period, buying significant quantities of U.S. staple. During most of the period, domestic producers were utilizing capacity at a rate in excess of 90 percent.

In 1982, however, capacity utilization rates declined significantly as the world recession cut into demand, cotton prices softened, and China severely curtailed polyester staple imports from the United States. As demand weakened, U.S. polyester staple prices began to decline.

U.S. production costs were lower than those of most other foreign producers, particularly during 1977-81, due in part to greater worker productivity, economies of scale, and high capacity utilization. In 1980, U.S. industry sources stated that output per worker in U.S. manmade-fiber plants was about twice that of EC facilities. These sources also stated that

the average polyester plant in EC countries has about one-half the 112-million-pound annual capacity of the average U.S. polyester plant, and, as a result, a considerable cost saving accrues to U.S. producers.

Moreover, to some degree, U.S. manmade-fiber producers had access to lower cost energy and feedstock sources during 1977-81 than producers in countries that paid world Organization of Petroleum Exporting Countries (OPEC) prices. However, by 1982, most of the advantage had dissipated with the rise in U.S. petroleum and natural gas prices and stabilization of OPEC prices. This factor, coupled with a significant decline in U.S. capacity utilization, reduced the relative cost advantage enjoyed by U.S. producers in 1982.

Individual polyester staple producers enjoy little price leadership, as general supply and demand conditions dictate price levels. Any discount from list price offered by one producer is usually also provided by the others, and therefore, prices for polyester staple are fairly uniform throughout the industry. As a result, producers compete by providing nonprice services such as research and development of new fiber uses and technical assistance with textile production difficulties. In addition, they have developed and promoted brand names for their fibers at both the manufacturing and consumer levels depicting quality and styling features.

Foreign markets

The United States is the world's major producer of polyester staple, accounting for 38 percent of the nearly 7 billion pounds of polyester staple produced worldwide in 1981. This compares with 14 percent contributed by all of Western Europe and 10 percent by Japan. The United States also exports a significant share of its production, with that share having increased from 6 percent in 1977 to 21 percent in 1981, before decreasing to 11 percent in 1982.

U.S. exports of polyester staple entered a period of rapid growth during 1977-81, when shipments to China escalated (table 7). U.S. exports then declined significantly in 1982 when shipments to China fell substantially. Exports to all markets more than tripled from 125 million pounds in 1977 to 549 million pounds in 1981, before declining 60 percent to 218 million pounds in 1982. The rapid growth and decline in exports were influenced largely by purchases of China, which began importing significant quantities of polyester staple since the late 1970's, when textiles and apparel were earmarked for intensive export promotion to acquire much-needed foreign exchange. Although China continued to increase its exports of textiles and apparel during the 1980's, its inventories of imported polyester staple mounted quickly. This was exacerbated by the expansion of its own fiber production capacity during the same period. Consequently, China significantly cut back its purchases of polyester staple from the United States and other sources during 1982. 1/

1/ China announced in early 1983 that it would limit its imports of manmade fibers (including polyester staple), cotton, and soybeans from the United States, because the U.S. Government unilaterally imposed quotas on most textiles and apparel from China effective Jan. 1, 1983, following unsuccessful efforts to renew the 3-year bilateral agreement that expired at the end of 1982 providing for U.S. import controls on Chinese textiles and apparel. A new 5-year bilateral textile and apparel agreement was reached in August 1983, retroactive to Jan. 1, 1983.

Table 7.--Polyester staple fiber: U.S. exports of domestic merchandise, by principal markets, 1978-82

Market	1978	1979	1980	1981	1982
	Quantity (1,000 pounds)				
China	120,469	119,782	295,744	417,572	104,364
Canada	38,414	50,299	39,895	34,770	29,299
Denmark	2,810	7,044	8,886	6,762	6,871
El Salvador	3,798	6,450	6,853	6,579	6,779
Argentina	16	10,210	8,810	9,167	6,699
Australia	5,504	8,702	8,224	9,201	4,077
Ecuador	3,813	7,965	5,710	4,790	5,039
Hong Kong	15,530	25,738	18,220	12,221	1,613
All other	64,674	132,425	97,187	46,721	49,383
Total	256,464	385,813	502,171	549,458	217,717
	Value (1,000 dollars)				
China	44,299	56,777	182,918	282,269	69,919
Canada	21,542	31,252	26,954	27,212	24,105
Denmark	1,903	5,386	7,750	6,286	6,532
El Salvador	2,623	4,599	6,251	5,728	6,095
Argentina	16	6,975	6,486	7,488	4,865
Australia	2,823	6,392	7,352	8,866	4,038
Ecuador	2,107	4,499	3,935	3,538	3,862
Hong Kong	6,658	13,940	11,306	8,480	1,347
All other	40,862	89,830	73,538	38,169	37,757
Total	123,862	234,350	335,984	389,554	162,148

Source: Compiled from official statistics of the U.S. Department of Commerce.

China's cutback in polyester staple purchases, coming at a time when world demand for the fiber was weak, further added to the excess production and production capacity in Asia. As a result, to maintain market share, Taiwan and other Asian producers rolled back prices considerably in major Asian markets, especially Hong Kong, the largest exporter of textiles and apparel there. According to trade sources, the widespread price cutting taking place drove fiber prices down to levels unprofitable for U.S. producers, which elected to temporarily withdraw from the Hong Kong market rather than reduce prices further. Thus, U.S. exports of polyester staple to Hong Kong, after peaking at nearly 26 million pounds in 1979, declined to slightly less than 2 million pounds in 1982.

U.S. exports of polyester staple to Canada have declined since 1979. These consist largely of types of fiber not manufactured by the single Canadian polyester staple producer, which is owned by a U.S. firm. Thus, varying market demand for polyester types not produced in Canada is the major determinant for U.S. exports.

U.S. exports of polyester staple to the EC, after rising from 23 million pounds in 1978 to a high of 61 million pounds in 1979, declined to 16 million pounds in 1982. Trade sources indicated that a significant part of the buildup in shipments in 1979 may have taken place in anticipation of restrictions on U.S. shipments following EC allegations that U.S. producers' price advantage compared with EC producers stemmed from lower energy prices as a result of U.S. price and export controls on petroleum products. However, the price controls on petroleum products were lifted in early 1981, and by 1982, some of the cost advantage enjoyed by U.S. producers diminished with the rise in U.S. petroleum and natural gas prices and the stabilization of OPEC prices. In addition, any cost advantage enjoyed by U.S. producers was largely negated by EC import duties and other costs associated with exporting, plus the appreciation of the U.S. dollar against major foreign currencies.

Canada.--Approximately 14 establishments, employing 4,600 workers, produce manmade fibers in Canada. Their total production increased 8 percent during 1977-80, but declined to 206,700 tons in 1981, the same level of output as in 1977. The value of industry shipments increased 92 percent during 1977-81, with a 25-percent increase in 1981 alone, when shipments were valued at $579 million.

Much of the increase in the value of industry shipments during this period can be attributed to higher production costs. Material costs, accounting for over half the industry's value of shipments, increased 97 percent during 1977-81. Also, wages, which account for an additional 15 percent of the value, increased 58 percent (table 8).

Table 8.--Manmade fibers and filament yarns: Canadian shipments, costs of materials, and wages, 1977-81

(In millions of dollars)

Year	Shipments	Materials	Wages
1977	339	176	59
1978	373	188	59
1979	436	219	61
1980	473	237	68
1981	579	307	82

Source: Man-made Fibre, Yarn and Cloth Mills, Statistics Canada, Standard Industrial Classification No. 1831.

As in the United States, relatively capital-intensive production methods are used which require large-volume production runs. As a result, value added per Canadian production worker averaged $57,000 in 1981 compared with about $38,000 for all Canadian manufacturing.

Only one company (an affiliate of a U.S. producer) produces polyester staple, and its output of this fiber increased 27 percent during 1977-81, before decreasing 8 percent in 1982. Considerable capital investment took

place during 1977-82 and, as a result, a 60 million-pound capacity, continuous-process installation is replacing a less efficient, 15 million-pound processing system. In addition to increasing capacity, the continuous process allows better quality control.

Much of the polyester staple consumed in Canada is used in either manmade-fiber fabrics, such as for apparel, or homefurnishings, such as carpeting. As in the United States, manmade-fiber products became more popular during the 1970's. Consequently, polyester staple consumption increased during 1977-80 before declining to lower levels in 1981 and 1982 (table 9). The United States provided virtually all the polyester staple imported by Canada during the period.

Table 9.--Polyester staple fiber: Canadian production, imports, exports, and apparent consumption, 1977-82

Year	Production 1/	Exports	Imports	Apparent consumption	Ratio of imports to consumption
	Tons				Percent
1977	47,900	10,150	13,918	51,668	26.9
1978	56,100	15,559	16,041	56,582	28.4
1979	53,500	14,689	20,959	59,770	35.1
1980	52,900	6,964	15,746	61,682	25.5
1981	44,100	8,287	15,035	50,848	29.6
1982	49,600	7,615	11,905	53,890	22.1

1/ Data include polyester staple and all other noncellulosic staple fibers (except olefin); data based on statistics published in the June 1983 Textile Organon, a publication of the Textile Economics Bureau, Inc., Roseland, N.J. Because polyester staple is produced only by one firm, the data are confidential.

Source: Compiled from data contained in Statistics Canada, except as noted.

Hong Kong.--Hong Kong is a major textile manufacturing center, ranking as the world's largest apparel exporter and the second largest importer of textile materials after the EC in 1981. Its textile industry, predominantly cotton based, is heavily dependent on imported textile fibers, manmade-fiber yarns, and manmade-fiber fabrics.

Hong Kong imports all its polyester staple fiber, although about 15 to 40 percent of the shipments in recent years have been reexported, primarily to China and the Democratic People's Republic of Korea. A decrease in the reexports and high prices of polyester staple fiber relative to cotton, an important substitute in many end-use applications, contributed to the significant decline in Hong Hong's imports of polyester staple fiber during

1981 and 1982, following several years of growth, according to data from Hong Kong Trade Statistics shown in the following tabulation (in tons):

Year	Imports	Apparent consumption
1977----------	19,245	18,382
1978----------	37,308	37,143
1979----------	42,921	36,685
1980----------	43,888	25,334
1981----------	37,973	29,965
1982----------	21,102	17,004

Polyester staple prices in Hong Kong increased from an average of 45 cents per pound in 1977 to a high of 76 cents per pound in July-September 1981. However, prices declined thereafter, reaching 60 cents per pound by October-December 1982, as the world recession reduced demand for Hong Kong's textiles and apparel which, in turn, led to reduced purchases of polyester staple fiber. In addition, China significantly curtailed its purchases of the fiber, forcing Asian fiber producers, faced with excess output and production capacity, to significantly reduce prices to maintain their market share.

The decline in Hong Kong's consumption of polyester staple fiber from approximately 37,000 tons in both 1978 and 1979 to about 17,000 tons in 1982 largely reflected the contraction of its spinning industry, in which the number of spindles decreased from 827,000 in 1977 to 621,000 in 1982. The industry's production of yarn containing manmade fibers (including polyester staple) fell from slightly more than 100 million pounds in the years 1978-80 to just under 60 million pounds in 1982. At the same time, Hong Kong's imports of manmade-fiber yarn climbed from approximately $35 million in 1977 to almost $360 million in 1981 before declining significantly to $238 million in 1982. In addition, its imports of manmade-fiber fabric rose from $128 million in 1977 to slightly more than $1 billion in 1981 and 1982. These imports displaced Hong Kong's yarn production and further reduced its demand for polyester staple fiber.

The competitiveness of Hong Kong's spinning industry in markets at home and abroad has been eroding in recent years, as escalating electricity costs, high labor costs, and labor shortages have undermined its price competitiveness vis-a-vis Taiwan and other Asian producers. Several of these Asian manufacturers have invested heavily in the production of yarn and fabric, producing yarn which is cheaper than that produced in Hong Kong, though its quality is lower.

Factors affecting U.S. export prices

In determining a final selling price for polyester staple in the foreign market, the cost of transportation to the foreign port, insurance, inland transportation to the final destination, customs duties, and relevant taxes and sales commissions must be added to the U.S. f.o.b. export price.

Most polyester staple is shipped to Canada by rail. The average cost of transporting staple to Canada, including inland freight to buyers' plant and

insurance, averages 6 cents per pound. A tariff duty of 9.8 percent is assessed on the f.o.b. value. Ocean freight rates to Hong Kong average approximately 5.1 cents per pound, and another 2 cents is added for unloading and inland transportation. U.S. producers which export through foreign representatives usually pay a sales commission of 3 percent of the f.o.b. price. Hong Kong is a free port, and, consequently, no tariffs are assessed. Although import licenses are required by Hong Kong, they are granted automatically.

U.S. producers accounted for virtually all the polyester staple imported into Canada during 1978-82. Twenty-four percent of Hong Kong's polyester staple imports in 1981 came from the United States, compared with 5 percent in 1977. The U.S. share declined to 5 percent, however, in 1982. Other major polyester staple suppliers to Hong Kong were Japan, Taiwan, Malaysia, and the Republic of Korea.

Analysis of exchange rates and other factors influencing U.S. trade 1/

An econometric analysis of polyester staple exports was done to determine the importance of exchange-rate changes relative to various other factors that were hypothesized to influence the price and quantity of U.S. exports to Canada and Hong Kong. The export price of polyester staple was related to (1) the unit value (in the foreign currency) of competing sources of polyester staple in the foreign market, (2) the U.S. wholesale price of polyester staple, (3) production of polyester staple in the U.S. and Canadian markets, 2/ and (4) the bilateral exchange rate in units of foreign currency per U.S. dollar.

The hypothesis is that U.S. export prices will increase as competitors' prices of polyester staple increase in the foreign market and as U.S. domestic prices increase, and that increases in the levels of production of polyester staple in the United States and Canada will cause U.S. export prices to decrease. U.S. exporters were expected to lower U.S. dollar prices as the dollar appreciates.

The volume of exports was related to (1) U.S. production of polyester staple, (2) apparent consumption of polyester staple and competitors' prices in the foreign markets, (3) the estimated export price from the price model, (4) the world price of cotton, and (5) the exchange rate. The hypothesis is that the quantity of U.S. exports of polyester staple will increase as foreign demand for polyester staple increases, as prices of polyester staple from competing sources increase, and as the price of cotton increases, and that export volume will decrease as the export price of polyester staple increases and as the dollar appreciates. No prior assumption was made about the effect of supply-side nonprice factors (here represented by the U.S. production index for polyester staple).

1/ Data used in the development of the econometric model for the six commodities studied are contained in app. A. App. B contains a discussion of the methodology used and tables B-1 through B-6, showing the complete regression results.

2/ There is no production of polyester staple in Hong Kong.

Canada.--The econometric analysis showed that prices of U.S.-produced polyester staple exported to Canada were not significantly affected by changes in the bilateral exchange rate. 1/ The coefficient on competitors' prices in the Canadian market was both statistically significant and related as expected to export prices. The results suggest that U.S. exporters will respond to changes in competitors' prices by increasing or decreasing their export prices to match the increase or decrease, respectively, in competitors' prices. The results also indicate that increases in U.S. production led to higher export prices, contrary to the expected result.

As shown in table 11, the results of the econometric analysis reveal no specific factor which was both statistically significant and logically related to the quantity of U.S. exports of polyester staple to Canada. Although the results indicate that exchange-rate changes were significantly correlated to the quantity of the exports to Canada, the result is contrary to the hypothesis that the appreciation of the U.S. dollar results in a decline in export volume.

A factor which is known to affect both export prices and quantities is the close tie between the U.S. and Canadian industries. The sole Canadian producer of polyester staple is owned by a U.S. producer. U.S. exporters, according to industry sources, export polyester staple types which complement rather than displace the Canadian production. Decisions on export pricing and levels tend to be based on specific Canadian market needs not captured by the model rather than more general factors such as exchange-rate levels and U.S. production.

1/ As indicated in table 10, the variables that have a significant or demonstrable effect on export prices are those with a t-ratio (the figure in parentheses) of more than 2.160. When variables have a t-ratio this large or larger, then the analyst is 95 percent certain that the estimate is different from zero, or a result that shows no relationship between the variables. Since the t-ratio for exchange-rate changes is only 0.63, this variable is not considered significant.

Table 10.--Polyester staple fiber: The effects of movements in specified indicators on unit values of U.S. exports to Canada and Hong Kong, based on quarterly data for 1977-82 1/

Country	Percentage change in export unit value resulting from a 1-percent change in--				
	Exchange rate 2/	U.S. production	Production in foreign market	U.S. price	Competitors' price at destination
Canada	0.2894	0.2507	3/	0.0238	3/
	(0.63)	(2.56)	3/	(0.09)	3/
Hong Kong	2.1035	0.2703	4/	-0.0305	5/ 0.4600
	(2.44)	(0.92)		(-0.11)	(1.83)

1/ The figures in parentheses are t-ratios. The coefficient is significant at the 1-percent level if the t-ratio exceeds 3.012 for Canada and 2.977 for Hong Kong, and at the 5-percent level if it exceeds 2.160 for Canada and 2.145 for Hong Kong.

2/ Units of foreign currency per U.S. dollar.

3/ Data suppressed because of business confidentiality.

4/ There is no production of polyester staple in Hong Kong.

5/ The Hong Kong price used was the unit value of imports from non-U.S. sources.

Source: Based on data in table B-4.

Table 11.--Polyester staple fiber: The effects of movements in specified indicators on the quantity of U.S. exports to Canada and Hong Kong, based on quarterly data for 1977-82 1/

Country	Percentage change in export quantity resulting from a 1-percent change in--					
	Exchange rate 2/	U.S. production	Competitors' price at destination	Estimated export price	Consumption in foreign market	World cotton price
Canada	8.4649	0.7173	3/	-2.4749	3/	0.0926
	(4.16)	(1.45)	3/	(-1.98)	3/	(0.34)
Hong Kong	-0.5393	1.4141	-2.1516	-3.8831	0.9779	6.8009
	(-0.08)	(0.70)	(-1.48)	(-2.43)	(2.11)	(4.26)

1/ The figures in parentheses are t-ratios. The coefficient is significant at the 1-percent level if the t-ratio exceeds 3.055, and at the 5-percent level if it exceeds 2.179.

2/ Units of foreign currency per U.S. dollar.

3/ Data suppressed because of business confidentiality.

Source: Based on data in table B-4.

Hong Kong.--The results of the econometric analysis for Hong Kong indicate that the exchange rate was significantly correlated to the price of U.S. polyester staple exports to Hong Kong (table 10). 1/ However, the result is again contrary to the hypothesis that a stronger dollar will result in lower export prices. Industry sources have stated that the rise in U.S. export prices during 1977-82, from 43 to about 84 cents a pound, resulted more from rising raw material costs than exchange rates. 2/

The analysis indicates that U.S. exporters do not change export prices in response to changes in competitors' prices. The market was marked by widespread price cutting during the early 1980's, as Taiwan and other low-cost producers, faced with excess production and production capacity brought about by the worldwide recession and China's rollback of its purchases of the fiber, sought to protect their market share in the face of declining demand worldwide. Hong Kong does not produce polyester staple and was able to take advantage of declining prices from other sources. As noted above, rather than reduce prices to unprofitable levels, U.S. producers decided not to compete and withdrew from the Hong Kong market.

As shown in table 11, exchange-rate changes were not a significant factor influencing the quantity of exports to Hong Kong. 3/ Factors found to be significant were world prices of cotton, a major substitute for polyester staple in many end-use applications, and prices of U.S. exports. 4/ The estimated relationship between cotton prices and the quantity of U.S. exports to Hong Kong suggests that a 1-percent increase or decrease in world cotton prices would lead to a corresponding increase or decrease in polyester staple exports to Hong Kong of 6.8 percent. This supports the hypothesis that cotton is an important substitute for polyester staple in Hong Kong.

Hong Kong's predominantly cotton-based yarn-spinning industry has been in a state of decline since 1979, thereby reducing demand for polyester staple. Escalating electricity costs, labor shortages, and high wages have undermined its price competitiveness compared with that of Taiwan and other low-cost Asian producers in markets at home and abroad. More recently, the worldwide recession and the resultant decrease in export demand for Hong Kong's textiles and apparel (Hong Kong in 1981 was the world's largest exporter of apparel and the second largest importer of yarn and fabric after the EC) led to reduced purchases of polyester staple, particularly from the United States. This was exacerbated by China's scaling back its purchases of polyester staple from all sources in 1982, resulting in widespread price cutting in Hong Kong. Unable to operate profitably at the depressed price levels, U.S. producers withdrew from the Hong Kong market.

1/ The t-ratio for exchange rates was 2.44.

2/ The proxy for production costs, U.S. price, has apparently not captured this effect of rising raw material costs. The concurrent increase of the exchange rate and raw material costs may indicate that the exchange rate is explaining more than the effect of exchange-rate changes in this case.

3/ The t-ratio for exchange rates was -0.08.

4/ The t-ratios for cotton prices and U.S. export prices were 4.26 and -2.43, respectively. The exchange rate was found to significantly affect U.S. export prices, so it may indirectly affect export volume through the export price.

Denim

Product description

Denim 1/ is a medium- to heavyweight durable cotton fabric used extensively in jeans and other apparel and, to a lesser degree, in nonapparel items such as handbags and luggage. Prior to the 1970's, it was considered a utilitarian fabric associated primarily with work clothes or other apparel for which durability was paramount and appearance of little or no importance. However, in the 1970's, the "denim look" became an important fashion trend both here and abroad, and that factor, combined with denim's practicality, its relatively low cost, and innovative fashion treatment, resulted in its wide use. Currently, this fabric accounts for about one-fourth of all cotton fabrics used in apparel.

Denim is woven from unbleached gray yarns and indigo blue dyed yarns. The unbleached filling yarns run the width of the fabric, generally crossing over two and then under one blue warp yarn, resulting in a twill fabric which is blue on the face 2/ and grayish on the back, with a smooth surface which resists snags and tears. With wear, the fabric softens and the blue color fades, often unevenly.

The average width of denim fabric produced prior to the 1970's was 28 inches, with 30 inches generally the widest, but modern looms now produce up to 60-inch widths. The two most popular denim weights are the 10 ounce and the 14 ounce (per yard). The heavier fabrics are higher priced, but these fabrics are also more durable. The lighter fabrics are used in sportswear such as women's wrap skirts, and the heavier fabrics are used for jeans, work clothing, and most of the nonapparel products made from denim.

U.S. industry

Establishments producing broadwoven cotton fabrics, including denim, are classified in the SIC system as cotton-weaving mills (SIC 2211). This industry includes about 200 firms, operating 300 mills in 1982, 14 fewer mills than in 1977. Eleven of these firms manufacture denim in 23 mills. The South is the major region producing broadwoven cotton fabric, employing nearly 90 percent of the work force overall and virtually all that for denim production.

1/ Imports of this product are provided for in the Tariff Schedules of the United States Annotated (TSUSA) as follows:

Commodity	TSUSA item No.
Denim, wholly of cotton	322.01-.98
Not combed	56
Combed	62
Denim, in chief value, but not wholly of cotton	328.01-.98
Not combed	56
Combed	62

2/ Although most denim is indigo blue, some lighter weight fabrics have been produced in other colors as a fashion treatment.

About 40 percent of cotton-weaving industry shipments is accounted for by four companies; eight companies account for 60 percent of the total. Similarly, denim shipments are concentrated among a relatively small number of firms, with six firms accounting for 60 percent of domestic output, according to industry sources. The major producers are vertically integrated, spinning yarns from fibers, weaving the yarn into fabric, and dyeing and finishing the fabric. Some cotton-weaving mills, however, buy all or part of their yarn from spinning firms and have their fabrics finished by firms specializing in that process.

The cotton-weaving mills have been experiencing declining demand for their fabrics, including denim, since at least 1977, partly as a result of the displacement of these fabrics by polyester and polyester/cotton blended fabrics and, more recently, stagnant consumption. U.S. production of all broadwoven cotton fabrics, particularly low-cost fabrics, declined annually during 1977-82, falling 31 percent to just under 3.8 million square yards (table 12). This decline was accompanied by a decrease in employment from about 160,000 persons in 1977 to 150,000 in 1978-80, and to an estimated 130,000 in 1982. At the same time, U.S. imports of broadwoven cotton fabrics, consisting mostly of low-cost and low-quality fabrics, after declining from 929 million square yards in 1978 to 687 million square yards in 1979, rose to 723 million square yards in 1980 and accelerated to nearly 1.1 billion square yards in 1981, before falling to 836 million in 1982.

Table 12.--Broadwoven cotton fabrics and denim: U.S. production, 1977-82

(In millions of square yards)

Year	Broadwoven cotton fabrics	Denim
1977	5,445	749
1978	5,085	558
1979	4,867	568
1980	4,457	637
1981	3,856	590
1982	3,773	515

Source: Compiled from official statistics of the U.S. Department of Commerce.

To increase their competitiveness and comply with Government directives regarding occupational and environmental standards, the cotton-weaving-mill industry increased capital expenditures from $187 million in 1977 to an estimated $220 million, approximately 5 percent of industry shipments, in 1981. It installed the more cost-efficient shuttleless looms, 1/ and

1/ In these looms, the shuttle--a container carrying a bobbin of yarn across the width of the fabric to form the filling or weft of the fabric--has been replaced by other techniques for inserting the filling yarns. Only the end of the yarn is taken across the fabric in shuttleless looms, rather than carrying a bobbin, resulting in yarns being inserted at a higher rate than shuttle looms. Shuttleless looms, in general, also weave wider fabrics.

organized plants to specialize in production of certain fabrics. As a result, domestic manufacturers of denim increased capacity during 1977-81 by 23 percent to over 800 million square yards, despite the fact that the number of operating looms was reduced by one-third. Also, in general, production processes became more efficient. For example, after a 7-year investment program, a major denim producer was able to reduce its output of second-quality fabrics in its denim plants from 10 to 12 percent of output to less than 3 percent.

As a result of capital improvements, producers were able to hold down production costs somewhat, despite rising prices during 1979-81 of cotton, the major material input in broadwoven cotton fabrics. When comparing the ratio of material costs to the value of industry shipments, materials accounted for 58 percent of the value of shipments in 1977, compared with approximately 56 percent in 1981.

The profits of cotton-textile-weaving mills often fluctuate widely from year to year, especially for individual companies specializing in a narrow range of fabrics. Data compiled by the American Textile Manufacturers Institute (ATMI) for 11 weaving mills, including major denim producers, show the mills' return on stockholders' equity declining from slightly more than 9 percent during 1977-80 to 8.0 percent in 1981, and to 5.8 percent in 1982.

U.S. market

U.S. consumption of denim, after declining from 657 million square yards in 1977 to 446 million square yards in 1978, increased annually during 1979-81, reaching 579 million square yards in 1981 (table 13). However, consumption fell 16 percent to 484 million square yards in 1982, largely as a result of weak demand and continued high levels of imports of denim jeans. Denim consumption is significantly influenced by demand for jeans, which is estimated to account for more than 80 percent of U.S. denim production. U.S. production of jeans (including dungarees), after declining slightly from an estimated 23,500 dozen in 1977 to 23,000 dozen in 1978, increased to 26,900 dozen in 1979 and to 29,000 dozen in 1980 before decreasing to 28,800 dozen in 1981. Denim consumption was also favorably affected by demand for denim jackets, skirts, and homefurnishings and by the introduction of stretch denims.

Table 13.--Denim: U.S. production, exports of domestic merchandise, imports for consumption, and apparent consumption, 1977-82

(Quantity in millions of square yards; value in millions of dollars; unit value per square yard)

Year	Production	Exports	Imports	Apparent consumption	Ratio (percent) of imports to consumption
	Quantity				
1977	749	129	37	657	5.6
1978	558	130	18	446	4.4
1979	568	124	16	460	3.5
1980	637	96	25	566	4.4
1981	590	44	33	579	5.7
1982	515	43	12	484	2.5
	Value				
1977	1/ 1,135	199	38	974	3.9
1978	1/ 802	189	18	631	2.9
1979	1/ 908	199	17	726	2.3
1980	1/ 1,159	175	30	1,014	3.0
1981	1/ 1,163	90	40	1,113	3.6
1982	1/ 832	69	15	778	1.9
	Unit value				
1977	$1.52	$1.54	$1.04	-	-
1978	1.44	1.46	1.03	-	-
1979	1.60	1.60	1.08	-	-
1980	1.82	1.83	1.21	-	-
1981	1.97	2.04	1.22	-	-
1982	1.62	1.63	1.24	-	-

1/ Estimated by the staff of the U.S. International Trade Commission.

Source: Compiled from official statistics of the U.S. Department of Commerce, except as noted.

Because U.S. denim consumption is supplied almost entirely by U.S. producers, the year-to-year fluctuations in consumption levels are also explained in part by changing U.S. production levels, as they are influenced by inventories. To maximize the economic benefit of the specialized equipment geared to weave fabrics in large quantities, the mills try to operate at optimum levels despite short-term changes in demand. However, production is sharply curtailed when inventories reach unacceptably high levels.

As a result of changes in inventory levels and demand both here and abroad, U.S. production of denim fluctuated widely during 1977-82; production fell to its lowest level during the period in 1982. Two producers stopped producing denim, and a third producer closed two plants that year.

U.S. firms not only supply virtually all the denim consumed domestically, but also export an appreciable but declining share of their production. Cost-effective production methods resulting from plant specialization and large-scale runs contribute to the competitiveness of U.S. producers, both here and abroad. Nevertheless, major European denim producers have the advantage of close geographic proximity to the major EC markets. Far Eastern producers, such as Hong Kong, and some European producers, such as Ireland, enjoy relatively low wage rates, as seen in table 14.

Table 14.--Average hourly labor cost per operator in the spinning and weaving industries, by specified countries, autumn, 1982 1/

Country	Average labor costs
United States	$7.53
United Kingdom	5.39
Italy	7.06
Ireland	4.28
Switzerland	9.44
West Germany	8.38
France	6.36
Hong Kong	1.40
Japan	5.64

1/ Based on exchange rates effective Dec. 29, 1982. U.S. dollar value of average labor costs will fluctuate with changes in the exchange rate.

Source: Compiled from statistics published by Werner International, Spinning and Weaving Labor Cost Comparisons, Autumn 1982.

On the average, imports supplied approximately 4 percent of the market during 1977-82. The only significant foreign supplier in recent years was Hong Kong, which accounted for 77 percent of the imports during 1978-82, but more than 90 percent of the total in 1981 and 1982 following the rapid decline of Mexico as a major source (table 15). Nevertheless, Hong Kong shipments, after nearly tripling between 1978 and 1981, fell sharply in 1982, largely as a result of weak demand.

The average unit price of U.S. imports of denim was 23 percent below the average domestic wholesale price of $1.62 in 1982. However, the imports tended to be less expensive, lighter weight fabrics; U.S. production was primarily higher quality, heavier weight fabrics. In 1982, 85 percent of the denim produced domestically was 14 ounces or heavier.

Table 15.--Denim: U.S. imports for consumption, by principal sources, 1978-82

Source	1978	1979	1980	1981	1982
	Quantity (1,000 square yards)				
Hong Kong	10,190	9,475	18,745	29,759	11,734
Japan	65	74	315	124	233
Mexico	5,839	6,079	4,090	571	85
West Germany	14	1/	0	211	91
Taiwan	0	0	1/	0	105
Canada	40	0	17	14	27
France	1/	0	1	30	25
Australia	0	0	0	0	13
Italy	57	38	0	1	4
United Kingdom	1/	1	1	16	1/
All other	1,542	82	1,639	1,850	1
Total	17,749	15,750	24,808	32,576	12,317
	Value (1,000 dollars)				
Hong Kong	9,744	9,626	22,353	35,153	14,243
Japan	97	161	696	335	455
Mexico	6,338	7,022	5,124	969	156
West Germany	26	2/	-	226	132
Taiwan	-	-	2/	-	121
Canada	51	-	23	28	84
France	1	-	10	65	72
Australia	-	-	-	-	16
Italy	152	33	-	8	12
United Kingdom	2/	1	5	56	2
All other	1,853	106	1,920	3,041	1
Total	18,263	16,950	30,129	39,880	15,294

1/ Less than 500 square yards.
2/ Less than $500.

Source: Compiled from official statistics of the U.S. Department of Commerce.

Most denim producers maintain sales or merchandising departments which sell directly to apparel firms and international sales offices to promote exports abroad. Also, one major firm sold to an exporting company which specialized in overseas sales. Wholesalers or converters also buy denim from mills for resale in smaller lots to medium- and small-size firms.

For both domestic and international shipments, initial orders must be placed from 6 to 12 months before the end product is scheduled for sale. Denim producers, however, also use accumulated inventories to fill spot orders. Contracts are written specifying quantity and price. Export prices are usually quoted in the respective foreign currency. For most European countries, U.S. price quotes represent the landed, duty-paid value; quotes to

United Kingdom buyers are usually f.o.b. at a U.S. port. Because of the time lag between placing an order and actual delivery overseas, exporters often purchase U.S. dollars forward to guarantee a set delivery price in terms of their respective national currencies.

Prior to 1980, one large domestic denim producer set prices at the beginning of each quarter, establishing trends for the industry as a whole, and there was little price discounting, as demand conditions pushed prices up. However, by 1980, production was more diversified, and by 1982, with a soft market, producers began discounting, and actual selling prices were often 15 to 20 percent off the 1981 highs.

Commodity prices in the U.S. market

The wholesale price of denim, after averaging $1.50 a square yard or less during 1978, moved upward during 1979-81, peaking at $1.99 a square yard during January-June 1981 (table 16). Weak demand forced prices lower, reaching $1.56 a square yard during July-December 1982, the lowest since January-March 1979.

Table 16.--Denim: Average U.S. wholesale prices, 1977-82

Year	January-March	April-June	July-September	October-December
1977	$1.50	$1.52	$1.55	$1.50
1978	1.50	1.40	1.40	1.43
1979	1.56	1.59	1.60	1.65
1980	1.70	1.81	1.88	1.89
1981	1.99	1.99	1.96	1.93
1982	1.69	1.59	1.56	1.56

Source: Estimated by the staff of the U.S. International Trade Commission.

Material costs, which account for slightly more than half the value of industry shipments, are an important price-determining factor, and cotton is the major raw material input. Because of the importance of material costs, and also labor costs, which account for nearly one-fourth of the value of industry shipments, cost-effective production methods are essential for price competitiveness. According to industry sources, efficient production flows and the ability to respond to fluctuations in demand without the costs associated with changes in product mixes are the major benefits of specialization. In addition, U.S. producers benefit from the economies of scale in production associated with large-volume production runs.

Supply and demand conditions were also important price-determining factors during 1977-82. The popularity of higher priced fashion jeans during January 1978-March 1981 increased demand for heavier weight fabrics, and denim producers adopted strong pricing postures, enabling them to recover rising cotton costs. However, during the remainder of the period, denim prices declined as the recession cut into consumer expenditures both domestically and overseas, and denim mills faced unused capacity.

Foreign markets

It is estimated that world denim production exceeded 1 billion square yards in 1982, with about half that produced in the United States. Far Eastern producers, particularly Japan and Hong Kong, contributed approximately one-fifth of the world's denim supply. Most of the remainder was manufactured in Europe, primarily Ireland, Italy, West Germany, Switzerland, France, and the United Kingdom.

U.S. denim producers found a ready market abroad for their fabric during the 1970's, as demand generally exceeded supply. U.S. exports of denim, after annually averaging 127 million square yards in 1977-79, declined sharply to 96 million square yards in 1980 and to slightly less than 45 million square yards in 1981 and 1982 (table 13). Although the decline was widespread among markets, the major part of the decrease came in shipments to the EC, which accounted for more than two-thirds of U.S. exports during 1978-82. Italy and France, the two largest single markets, with about 36 and 19 percent, respectively, of U.S. exports during 1978-82, generated a large part of the decline (table 17). U.S. exports to Italy dropped from an annual average of 40 million square yards in 1978-80 to just under 15 million square yards in 1981, before partially recovering to slightly more than 20 million square yards in 1982. Shipments to France declined annually during 1978-82, falling 90 percent from 39 million to 4 million square yards. Significant declines were also registered in exports to Canada, the third largest market, with 12 percent of U.S. exports during 1978-82, Belgium, and the United Kingdom.

Several factors caused the significant decline in U.S. denim exports during 1980-82, the most important of which was that by 1979, European production increased sufficiently to satisfy consumption and markedly reduced the need for imports. European producers increased their production, and, in addition, a large U.S.-owned denim plant was established in Ireland in 1979. This plant produces high-quality fabrics and has satisfied the needs of many denim users which formerly imported from the United States. The Irish plant benefits from its proximity to the European market and wage rates that are 43 percent lower than those in the United States. Also, denim produced in EC countries (including Ireland) and exported to other EC countries enter duty free, but imports from the United States are assessed a duty of 13.3 percent ad valorem. In addition, jeans produced in the EC from denim manufactured in the EC which are exported to a European Free Trade Association (EFTA) 1/ country are assessed a lower rate of duty than jeans made of U.S. fabric.

1/ EFTA countries are Austria, Norway, Portugal, Sweden, and Switzerland.

Table 17.--Denim: U.S. exports of domestic merchandise, by principal markets, 1978-82

Market	1978	1979	1980	1981	1982
	Quantity (1,000 square yards)				
Italy	37,934	43,007	39,132	14,910	20,538
Canada	12,945	13,970	13,349	7,603	4,617
Belgium	9,076	11,185	6,325	4,249	4,114
France	39,153	20,770	13,724	5,260	3,993
United Kingdom	6,842	8,942	4,776	1,196	988
Costa Rica	414	419	1,017	467	1,040
Philippines	11	196	1,260	629	683
Japan	1,274	1,528	1,915	1,136	552
All other	22,039	23,996	14,401	8,831	6,012
Total	129,688	124,013	95,900	44,281	42,538
	Value (1,000 dollars)				
Italy	57,861	65,792	71,200	30,075	31,141
Canada	15,680	20,380	23,429	15,096	8,378
Belgium	13,831	20,570	11,779	8,748	6,995
France	63,021	32,999	25,761	10,204	6,406
United Kingdom	10,428	16,782	8,288	2,909	1,947
Costa Rica	441	448	1,695	823	1,815
Philippines	17	499	2,533	1,178	1,241
Japan	1,785	3,168	4,320	2,492	1,027
All other	26,251	37,937	26,212	18,591	10,304
Total	189,315	198,574	175,219	90,116	69,255

Source: Compiled from official statistics of the U.S. Department of Commerce.

Other factors contributing to the decline in U.S. exports were stagnant consumption in traditional U.S. markets and increased imports of denim jeans (supplied primarily by Asian suppliers) into the export markets, which reduce denim fabric consumption.

Italy.--Relatively high rates of inflation in the economy as a whole and rising wages pushed up production costs in the Italian cotton textile industry. Consumer prices increased, on the average, about 20 percent a year during 1977-82 and capital costs were high, with interest rates averaging 16 percent a year. In addition, hourly wage rates in the cotton textile industry more than doubled. The Italian cotton textile industry employs approximately 70,000 workers, with half of these employees weaving fabric.

Still, Italy's cotton textile industry experienced moderate growth, with woven cotton fabric production increasing 30 percent during 1977-82. Some of the major Italian textile manufacturers sought to compensate for rising costs and to compete with low-value imports by improving the utilization of capital

equipment, going to a 6-day shift, 4-shift work week, and by concentrating production on high value-added fabrics.

Italy is the major manufacturing center for European jeans. With the resurgence in demand for jeans during the latter half of the 1970's, denim consumption in Italy more than doubled from 36 million square yards in 1977 to 84 million square yards in 1980. However, with the onset of the recession in 1980 and the resulting soft market for apparel products in general, denim consumption declined to 66 million square yards in 1982 (table 18).

Table. 18--Denim: Italian production, exports, imports, and apparent consumption, 1977-82

(In millions of square yards)

Year	Production 1/	Exports	Imports	Apparent consumption
1977	14	17	39	36
1978	17	7	38	48
1979	20	5	69	85
1980	25	10	69	84
1981	24	6	41	59
1982	28	10	48	66

1/ Estimated by the staff of the U.S. International Trade Commission.

Source: Compiled from data contained in Statistica del Commercio Con L' Estero, Italy, except as noted.

Italian denim production doubled during 1977-82, totaling 28 million square yards in 1982. Denim imports, similar to consumption trends, peaked at 69 million square yards in 1979 and 1980, and then declined to 48 million square yards in 1982. A large part of the decline resulted from smaller shipments from the United States, Italy's major foreign denim supplier, whose share of the import market fell from about 60 percent in 1980 to less than 40 percent in 1982. However, Italy's imports from other sources, primarily Belgium, Switzerland, and Ireland, remained fairly stable.

United Kingdom.--The cotton woven fabric sector in the United Kingdom experienced considerable consolidation during 1977-82. Employment was nearly halved, from 28,000 employees in 1977 to 13,100 in 1982, and domestic production decreased by 29 percent.

According to British trade sources, the overall downturn in the United Kingdom economy contributed to the decline in that country's textile industry. United Kingdom cotton fabric consumption declined 18 percent during 1977-82, as shown in table 19.

Table 19.--Cotton woven fabrics: United Kingdom production, exports, imports, and apparent consumption, 1977-82

(In millions of square yards)

Year	Production	Exports	Imports	Apparent consumption
1977	661	141	578	1,098
1978	683	147	694	1,230
1979	657	160	708	1,205
1980	565	172	518	911
1981	500	152	536	884
1982	469	157	593	905

Source: Compiled from statistics published by the Textile Statistics Bureau, Quarterly Statistical Review.

Imports increased their share of the United Kingdom cotton woven fabric market from 53 percent in 1977 to 66 percent in 1982. The high value of the pound sterling relative to other foreign currencies, coupled with rising production costs in the United Kingdom, 1/ contributed to the competitiveness of imports and their increase in market share.

There is only one denim producer in the United Kingdom. Despite the installation of all new looms, higher labor costs and cotton prices contributed to a 32-percent increase in denim wholesale prices in the United Kingdom during 1977-82. Its denim production decreased 70 percent during the period, declining to approximately 10 million square yards in 1982 (table 20).

Table 20.--Denim: United Kingdom production, exports, imports, and apparent consumption, 1977-82

(In millions of square yards)

Year	Production	Exports	Imports	Apparent consumption
1977	33	4	13	42
1978	19	5	10	24
1979	17	4	14	27
1980	16	5	20	31
1981	8	4	16	20
1982	10	5	20	25

Source: Compiled from data published by the Textile Statistics Bureau, Quarterly Statistical Review.

1/ It is estimated that labor costs, which in the cotton fabric sector increased 60 percent during 1977-81, account for one-third of the value of production and over 65 percent of the value added in the United Kingdom cotton textile industry.

Imports, on the other hand, increased 54 percent during 1977-82, to 20 million square yards. In addition, imports of denim jeans rose from 25.8 million pairs in 1977 to 30.7 million pairs in 1982. The United States has been a major denim supplier, although its share of the United Kingdom market declined from approximately 80 percent in 1977 to less than 5 percent in 1982.

Factors affecting U.S. export prices

Export prices quoted f.o.b. a U.S. port generally reflect the wholesale price plus the costs of placing the goods on board a craft for transport overseas. The cost to the foreign importer, however, includes the cost of transporting the fabric to the foreign port, import duties, and sundry fees and taxes levied by individual countries. For example, in exporting a yard of denim to an EC country, assuming an average U.S. wholesale price of $1.60, transportation and insurance would cost approximately 8 cents, increasing the U.S. f.o.b. price about 5 percent. In addition, a 13.3-percent import duty is assessed on the f.o.b. value, about 22 cents per yard, and another 5 cents is added for unloading and storing the fabric in the foreign port. Exporters also pay overseas representatives a sales commission of 2 or 3 percent of the f.o.b. price. In all, the price of U.S. denim in Europe is generally about 20 percent higher than the U.S. wholesale price. Since U.S. denim producers can sell denim at about 20 percent less than European producers due to manufacturing efficiencies, U.S. denim and European produced denim is generally price competitive in Europe.

Another factor affecting the competitiveness of U.S. denim exports to Europe is the "rules of origin," maintained since 1973 by the EC in its preferential trade agreements and by the EFTA. The rules, which apply to trade between the EC and its preferential trading partners or EFTA and between EFTA countries, provide that preferential tariff treatment be extended by the EC or EFTA to goods from the preferential country which have been wholly produced, or imported and substantially processed, within that country. To qualify for the preferential treatment, imported materials must be processed sufficiently within a preferential country so as to pass through two separate four-digit classifications of its tariff nomenclature (i.e., two levels of processing). Thus, jeans made in the EC from U.S.-produced denim would not qualify for preferential status upon entering EFTA, because they would have passed through only one level of processing--from fabric to apparel. Often, producers in these preferential countries will not know the final destination of their products and, therefore, may be influenced by the rules to purchase fabric only from preferential members to assure themselves of the preferential rate were they to export their products to another preferential country.

Analysis of exchange rates and other factors influencing U.S. trade 1/

An econometric analysis of denim exports was done to determine the importance of exchange-rate changes relative to various other factors that

1/ Data used in the development of the econometric model for the six commodities are contained in app. A. App. B contains a discussion of the methodology used and tables B-1 through B-6, showing the complete regression results.

were hypothesized to influence the price and quantity of U.S. exports to Italy and the United Kingdom. The export price of denim was related to (1) the unit value (in the foreign currency) of competing sources of denim in the foreign market, (2) the U.S. wholesale price of denim, (3) production of denim in the United States, Italy, and the United Kingdom, (4) the world price of cotton, and (5) the bilateral exchange rate in units of foreign currency per U.S. dollar.

The hypothesis is that U.S. export prices will increase as competitors' prices of denim in the foreign market increase, as U.S. prices increase, which are included as a proxy for U.S. production costs, and as cotton prices increase. Export prices are expected to decrease as the levels of production of denim in the United States and the two EC countries increase and as the dollar appreciates.

The quantity of exports was related to (1) U.S. denim production, (2) apparent foreign consumption of denim, (3) competitors' price in the foreign markets, (4) the estimated export price from the price model, and (5) the exchange rate. The hypothesis is that the quantity of U.S. exports of denim will increase as foreign demand for denim increases and as prices of denim from competing sources increase. The export quantity is expected to decrease as the export price of denim increases and as the dollar appreciates. No prior assumption was made about the effect of supply-side nonprice factors in the United States on exports (here represented by the production index for denim).

Italy.--The results of the econometric analysis for Italy show that the exchange rate was significantly correlated to the price of U.S. denim exports to Italy (table 21) and to the quantity (table 22). 1/ However, the results suggest that export prices will increase as the value of the U.S. dollar relative to the Italian lira increases. This runs counter to the hypothesis that the appreciation of the dollar leads to a decline in export prices in U.S. dollars. 2/

Factors found to be both statistically significant and related to the price of denim exports to Italy as hypothesized include U.S. prices, world cotton prices, and U.S. and Italian denim production. The estimated relationship between U.S. domestic prices, used here as a proxy for U.S. production costs, and U.S. export prices indicates that an increase in U.S. prices would lead to a corresponding increase in export prices. The effect of competitors' prices was not as expected. Industry sources have indicated that U.S.-produced denim was being displaced by EC-produced denim, as EC denim production increased sufficiently to satisfy local demand and markedly reduce

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1/ As indicated in table 21, the variables that have a significant or demonstrable effect on export prices are those with a t-ratio (the figure in parentheses) of more than 2.201. When variables have a t-ratio this large or larger, then the analyst is 95 percent certain that the estimate is different from zero, or a result that shows no relationship between the variables. The t-ratio for exchange-rate changes is 3.67.

2/ The exchange-rate variable may be reflecting more than the influence of exchange rates on prices. These other influences were not capable of measurement by the available data and were not captured by the other terms included in the model.

Table 21.--Denim: The effects of movements in specified factors on unit values of U.S. exports to Italy and the United Kingdom, based on quarterly data for 1977-82 1/

Country	Percentage change in export unit value resulting from a 1-percent change in--					
	Exchange rate 2/	U.S. production	U.S. price	World cotton price	Production in foreign market	Competitors' price at destination
Italy	1.4526	-0.2507	1.4854	1.3244	-0.9536	3/ -0.6814
	(3.67)	(-4.44)	(11.49)	(5.15)	(-5.99)	(-2.83)
United Kingdom	-1.1803	-0.1517	0.2769	-0.3966	0.0774	4/ 0.4774
	(-1.89)	(-0.64)	(0.50)	(-1.50)	(0.71)	(1.43)

1/ Figures in parentheses are t-ratios. The coefficient is significant at the 1-percent level if the t-ratio exceeds 3.106 for Italy and 2.947 for the United Kingdom, and at the 5-percent level if it exceeds 2.201 for Italy and 2.131 for the United Kingdom.

2/ Units of foreign currency per U.S. dollar.

3/ The Italian price used was a weighted average of the Italian price for domestic and other foreign sources of denim.

4/ The United Kingdom price used was the wholesale price of denim in that country; quarterly data on the unit value of imports of the United Kingdom from sources other than the United States were not available.

Source: Based on data in table B-1.

Table 22.--Denim: The effects of movements in specified factors on the quantity of U.S. exports to Italy and the United Kingdom, based on quarterly data for 1977-82 1/

Country	Percentage change in export quantity resulting from a 1-percent change in--				
	Exchange rate 2/	U.S. production	Competitors' price at destination	Estimated U.S. export price	Apparent consumption at destination
Italy	-4.5269	0.4070	3/ 4.1004	-1.8249	0.5909
	(-3.06)	(0.56)	(2.26)	(-1.83)	(3.16)
United Kingdom	7.6305	6.0560	4/ -7.3381	1.9132	-0.1929
	(1.26)	(2.10)	(-2.00)	(0.34)	(-1.42)

1/ Figures in parentheses are t-ratios. The coefficient is significant at the 1-percent level if the t-ratio exceeds 3.106 for Italy and 3.055 for the United Kingdom, and at the 5-percent level if it exceeds 2.201 for Italy and 2.179 for the United Kingdom.

2/ Units of foreign currency per U.S. dollar.

3/ The Italian price used was a weighted average of the Italian price for domestic and other foreign sources of denim.

4/ The United Kingdom price was the wholesale price of denim in the United Kingdom.

Source: Based on data in table B-1.

the need for imports, especially from the United States. Also, a large, U.S.-owned denim plant opened in Ireland in 1979 which met the needs of many denim users in Europe that previously imported the fabric from the United States. U.S. exporters may have been forced to lower their prices to compete with these new suppliers, and this effect may have carried over into the competitors' price variable.

The econometric analysis also shows that U.S. exporters alter prices of their denim exports to Italy in response to changes in cotton prices by increasing their prices as cotton prices increased. U.S. denim prices, of which cotton is a major input, closely paralleled cotton prices during 1977-82.

As shown in table 22, the results of the econometric analysis indicate that the exchange rate was significantly correlated to the quantity of U.S. denim exports to Italy. 1/ The results suggest that the quantity of the exports will decrease about 4.5 percent following a 1-percent increase in the value of the U.S. dollar relative to the Italian lira. This is consistent with the hypothesis that the appreciation of the U.S. dollar results in a decline in the quantity of U.S. exports.

Other factors found to have a significant effect on the quantity of U.S. denim exports to Italy were competitors' prices in the Italian market and Italian denim consumption, used as a proxy for demand. The results show that a 1-percent increase in competitors' prices will result in an increase in the quantity of U.S. exports of approximately 4 percent.

United Kingdom.--The results of the econometric analysis show no factor significantly affecting either the price (table 21) or the quantity (table 22) of U.S. denim exports to the United Kingdom. However, the model of denim exports to the United Kingdom may not adequately capture all the market forces that influence the exports. These market forces include increased denim acquisitions from Ireland and elsewhere in the EC and increased imports of finished denim jeans, which reduced demand for denim, but may not have been adequately captured by the proxy for demand, apparent consumption.

1/ The t-ratio for exchange rates was -3.06.

Primary Magnesium

Product description

Magnesium is the lightest of all commonly used metals, weighing about two-thirds as much as aluminum and one-fourth as much as steel per unit volume. It is ductile, easily machinable, and has good shock- and vibration-absorption properties. Since pure magnesium is low in strength, it is rarely used in structural applications without being alloyed, heat treated, or worked.

Magnesium 1/ is an abundant structural element, with approximately 70 percent of domestic supplies being extracted from sea water. The remainder is obtained from well and lake brines, dolomite, and a number of other magnesium-containing minerals. Magnesium reserves are considered to be inexhaustible due to the vast potential for extracting magnesium from the oceans.

Currently, two principal processes are used for the production of primary magnesium (as opposed to secondary or recycled magnesium), depending largely on the volume of magnesium to be produced. If a large volume of primary magnesium is required, the electrolytic method, in which sea water is reduced in electrolytic cells, is the most cost-effective production method and accounts for the largest part of domestic primary magnesium output. If a small volume of magnesium is required, the thermal method, in which raw materials (primarily dolomite and ferrosilicon) are reduced in large reactors, is most cost effective. More recently, the "Magnetherm process" was developed, which allows the reduction of the dolomite to proceed more rapidly than under the original thermal process.

The end uses for primary magnesium can be divided into four principal categories: metallurgical, structural, chemical, and electrochemical. In 1981, metallurgical applications accounted for 70 percent of all uses for primary magnesium consumption; structural applications, 18 percent; and chemical and electrochemical applications together, 12 percent. The most important metallurgical application for primary magnesium metal is for alloying with aluminum to enhance the resulting alloys' strength, formability, and corrosion resistance. The major end-use market for these alloys is the

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1/ Imports and exports of this product are provided for in the Tariff Schedules of the United States Annotated and the Schedule B, respectively, are as follows:

Commodity	TSUSA item No.
Unwrought magnesium, other than alloys	628.5520
	Schedule B No.
Unwrought magnesium	630.3540

aluminum can market. Other metallurgical applications for primary magnesium metal include the production of nodular or ductile cast iron, principally used to make underground pipe for water systems, and in the reduction of titanium and zirconium compounds.

Primary magnesium is used to form magnesium alloys in a number of structural applications because of its low density and its superior resistance to buckling. Structural applications include pressure die castings for use in the production of crankcase and transmission housings, jet aircraft housings, aircraft landing wheels, chain saw housings, and lawnmower decks. Additional applications include use in wrought mill products (such as wire extrusions), and sheet and plate for use in materials-handling ramps, handtrucks, ladders, garden tools, and luggage.

Chemical applications include use in fireworks, military flares, and the production of tetramethyl lead (an antiknock additive to gasoline). Electrochemical applications include use as anodes (to prevent corrosion of steel in such items as underground pipelines), in storage tanks, and in domestic water heaters.

In general, all primary magnesium produced using the electrolytic or thermal process is similar in nature and does not differ in quality, whether manufactured domestically or by foreign producers. In addition, primary magnesium is similar to secondary magnesium and competes with it in most applications. However, since secondary magnesium is obtained by recycling products containing the metal, the quality of the metal, and therefore its price and end uses, may differ somewhat from those for the primary metal. In 1981, U.S. production of secondary magnesium accounted for about 25 percent of total magnesium production.

U.S. industry

The primary magnesium industry in the United States consists of 3 firms, which together annually employed about 600 persons in magnesium operations during 1977-82. U.S. producers accounted for 45 percent of total world magnesium production during 1977-82. However, given that the largest producer is a diversified petrochemical producer and the others are subsidiaries of large metals producers, the magnesium operations represent only a small part of the firms' overall business (2 percent of their combined sales of $17.7 billion in 1981). Secondary magnesium is produced principally by end users of magnesium, especially aluminum alloyers, which buy scrap on the open market and remelt it.

The largest U.S. primary magnesium manufacturer, with approximately 64 percent of total U.S. capacity, is a diversified petrochemical producer with its sole manufacturing facility located in Freeport, Tex., where it produces numerous petrochemical products in addition to magnesium. Sea water for its electrolytic production process comes from the Gulf of Mexico, and dolomite is brought from a company-owned quarry in central Texas. The company's dolomite deposits are estimated to be sufficient to meet its needs for over 100 years at current production rates. Annual production capacity is currently 125,000 tons of primary magnesium, with plans to increase capacity by another 10,000 tons by the end of the 1980's.

The second largest U.S. primary magnesium manufacturer, with about 23 percent of total U.S. capacity, has produced magnesium since the early 1970's, and since October 1980, has been a wholly owned subsidiary of a major U.S. metals producer. The firm's only plant, located on the Great Salt Lake in Rowley, Utah, produces primary magnesium ingot from brine using the electrolytic method. Brine reserves in the Great Salt Lake are sufficient to meet company needs for the foreseeable future, as are dolomite supplies, which are also acquired domestically. The plant's present annual production capacity is 45,000 tons of primary magnesium, with current plans calling for a doubling of plant capacity over the next 7 years.

The third U.S. primary magnesium producer, located in Addy, Wash., is a wholly owned subsidiary of an aluminum company. It began production in 1976, using the Magnetherm thermal reduction process and currently has a rated capacity of 24,000 tons of primary magnesium per year. Almost all the output is consumed by the parent company in the production of aluminum alloys, with some of the output being sold on the open market since 1981, when captive use decreased as a result of weak economic activity in general and the growing use of secondary magnesium in particular. The plant is located near large beds of dolomite and quartzite, which are essential in the production of primary magnesium using the thermal reduction process. Reserves of these two critical materials are estimated to be sufficient to meet the company's needs for about 45 years.

The primary magnesium industry can be characterized as capital intensive, with relatively large capital expenditures required in equipment and state-of-the-art technology. Although the electrolytic process was pioneered in the early part of the century, it has been modified significantly over the years to produce magnesium more efficiently. The Magnetherm process, developed in the early 1970's, is the latest technological development in thermal processing, requiring less energy and causing less environmental pollution than existing methods. It is unlikely that new technology will soon replace existing processes because of the amount of capital that each firm has committed to existing methods and because most of the equipment is not interchangeable among the different processes. However, it is likely that modifications and improvements to existing technology will continue to be made in an effort to improve efficiency.

Industry sources indicate that magnesium producers incurred declining profits in 1981 and 1982, due largely to depressed demand for aluminum alloys caused by the economic recession, following strong demand for aluminum alloy and structural applications during 1977-80. U.S. producers' sales of primary magnesium increased from approximately $250 million in 1977 to a peak of $390 million in 1980, before declining to about $335 million in 1982.

U.S. market

U.S. consumption of primary magnesium, supplied almost entirely by U.S. producers, grew annually between 1977 and 1980, but in 1981 and 1982, reduced demand for magnesium in major markets, especially for use as aluminum alloys, resulted in a significant decline in sales. After increasing 19 percent from 101,400 tons in 1977 to 120,800 tons in 1980, U.S. consumption declined 7 percent to 112,900 tons in 1981 and an additional 43 percent, to 64,400 tons in 1982 (table 23).

Table 23.--Primary magnesium: U.S. production, exports of domestic merchandise, imports for consumption, and apparent consumption, 1977-82

(Quantity in tons; value in thousands of dollars)

Year	U.S. production 1/	Exports	Imports	Apparent consumption	Ratio (percent) of imports to consumption
	Quantity				
1977	125,958	26,309	1,770	101,419	1.7
1978	149,463	37,082	1,271	113,652	1.1
1979	162,464	47,455	1,460	116,469	1.3
1980	169,477	49,584	940	120,833	.8
1981	142,887	32,910	2,897	112,874	2.6
1982	99,900	37,281	1,779	64,398	2.8
	Value				
1977	250,000	44,907	2,850	207,943	1.4
1978	300,000	63,008	2,149	239,141	.9
1979	350,000	90,787	3,127	262,340	1.2
1980	390,000	104,086	2,242	288,156	.8
1981	380,000	81,116	6,844	305,728	2.2
1982	335,000	92,554	3,713	246,159	1.5

1/ Quantity data for 1977-82, compiled from official statistics of the U.S. Bureau of Mines; value data, estimated by the staff of that agency.

Source: Compiled from official statistics of the U.S. Department of Commerce, except as noted.

U.S. imports of primary magnesium fluctuated widely during 1977-82, constituting a small, but growing, domestic market share. A large part of the imports in recent years came from France, which emerged as a supplier in 1981 and displaced Canada and Norway, historically the only significant suppliers (table 24).

Table 24.--Primary magnesium: U.S. imports for consumption, by principal sources, 1977-82

(In tons)

Source	1977	1978	1979	1980	1981	1982
France	0	0	0	0	748	1,084
Canada	595	375	778	502	1,369	325
Norway	1,175	799	663	403	681	265
All other	0	97	19	35	99	105
Total	1,770	1,271	1,460	940	2,897	1,779

Source: Compiled from official statistics of the U.S. Department of Commerce.

Industry sources estimate that 57 percent of the primary magnesium consumed in the United States in 1982 was used by large aluminum-producing firms in the production of aluminum alloys. There are about 12 principal producers of aluminum alloys, with approximately 32 plants located throughout the United States. Approximately 18 percent of primary magnesium was sold to machine shops which make die-castings, mill products, and a variety of parts largely for the automotive and aerospace industries. Although die-casting applications in the United States are relatively small, almost all magnesium produced for this purpose is sold to a Michigan-based firm which produces magnesium castings for automobiles. Approximately 13 percent of primary magnesium was sold to nonaluminum metals firms for use in the reduction of titanium and zirconium compounds, and in the production of nodular iron. Another 7 percent was sold directly to chemical firms for use in the production of chemicals.

Since there are no real substitutes for magnesium in aluminum alloys, price levels do not significantly influence demand in the U.S. market. Rather, demand is derived from consumption of final products, the most important of which is aluminum cans. This is in contrast to demand for magnesium used in castings, in which magnesium is alloyed with aluminum. The relative proportions of magnesium versus aluminum used in castings can be adjusted according to the comparative price of each material. Generally, magnesium (for castings) must sell at a price less than 50 percent higher per pound than the price for aluminum to be preferred by end users (the largest of which is the automobile industry).

The dominance of the U.S. industry in the domestic market compared with the strength of foreign competitors largely reflects the fact that U.S. producers rank among the lowest cost producers in the world. With the two largest U.S. producers ranking first and third in the world in terms of production capacity, the economies of scale resulting from the much greater level of production here than abroad allow them to offset U.S. energy and labor costs, which are higher than those of some foreign producers. U.S. producers' ability to produce in sufficient quantities to meet contract and spot demands of the large-volume purchasers which dominate the market and their proximity to the U.S. market give them an additional competitive edge. These factors play a key role in limiting imports, which incur additional costs such as duties, amounting to 16.5 percent ad valorem in 1982, and transportation costs, averaging 3 to 4 cents a pound for magnesium ingot from Norway, the world's third largest producer, and France, the major foreign supplier to the United States in 1982.

Commodity prices in the U.S. market

List prices of primary magnesium in the U.S. market are closely related to the costs of production, which differ according to the production process used. The electrolytic process when operated at high levels of production results in lower total production costs than does the thermal process, due to lower average energy costs. 1/ Costs such as labor, taxes, and insurance do not differ greatly between the two processes.

1/ U.S. Department of Energy, Division of Industrial Energy Conservation, An Assessment of Magnesium Primary Production Technology, Feb. 1, 1981, p. 167.

Energy constitutes the largest component of U.S. production costs of primary magnesium, accounting for an estimated 35 to 40 percent of the total. Consequently, any change in the price of energy is eventually reflected in magnesium prices. Following the sharp rise in energy prices from an average of $12 per barrel in 1978 to $35 per barrel in 1981, 1/ the list price of primary magnesium increased 35 percent from $0.99 per pound during January-March 1978 to $1.34 during January-March 1981. 2/ As a result, magnesium producers stepped up efforts to improve the energy efficiency of their operations. The U.S. Department of Energy estimated that the energy requirements of the electrolytic process have declined by 45 percent over the last three decades, with the greatest gains coming in the last 3 years.

The cost of raw materials represents about 20 percent of total U.S. production costs. It does not differ significantly between the types of production processes used since the raw materials used in each process are abundant and extraction costs tend to be similar.

Labor generally accounts for approximately 20 percent of total U.S. production costs, although the skill and pay levels of these labor inputs differ between the two production processes. In the thermal process, in which the equipment and processes tend to be less sophisticated, a comparatively large number of unskilled workers are employed primarily for transferring material to and from production reactors. In the electrolytic process, a relatively small number of higher paid engineers manage plant operations.

Total costs for primary magnesium production vary according to the type of production process used. Research indicates that at lower levels of production (below 30,000 tons of annual capacity), the thermal process produces magnesium at the lowest average total cost, owing to the relative simplicity and ease of operation of the equipment. For larger scale production, the electrolytic process possesses certain economies of scale which make its average total cost the lowest. In addition, relatively inexpensive electrolytic cells can be added to the original cells to increase production, whereas costly new reactors would be needed to increase production using the thermal process. Total cost for an electrolytic plant with an annual capacity of 30,000 to 70,000 tons is estimated at $3,000 per ton of annual capacity; the cost for a 25,000-ton thermal plant is about $2,500 per ton.

U.S. prices of primary magnesium increased 40 percent from $0.96 per pound during January-March 1977 to $1.34 per pound during October-December 1982 (table 25). Prices increased 10 percent from $0.96 per pound in 1977 to $1.06 per pound during January-June 1979, reflecting increasing demand for magnesium for use in aluminum alloys and in automotive castings, and cost increases in energy, raw material, and labor costs. Prices increased 26 percent from $1.06 per pound in 1979 to $1.34 per pound in 1981, and remained unchanged in 1982. However, in both 1981 and 1982, discounts of 2 to 3 cents per pound were often offered, as producers and purchasers renegotiated contracts in light of falling demand.

1/ The energy costs represent average annual refiner composite acquisition cost of crude petroleum.

2/ During the same period, the price index for all industrial commodities in the United States increased nearly 30 percent.

Table 25.--Primary magnesium ingot: U.S. producers' list prices, by quarters, 1977-82

(Per pound)

Year	January-March	April-June	July-September	October-December
1977	$0.96	$0.96	$0.99	$0.99
1978	.99	1.01	1.01	1.01
1979	1.06	1.06	1.06	1.09
1980	1.07	1.16	1.16	1.25
1981	1.34	1.34	1.34	1.34
1982	1.34	1.34	1.34	1.34

Source: Metal Bulletin Journals, Ltd., Metal Bulletin.

U.S. producers' domestic prices are typically quoted on an f.o.b. (free on board), point-of-shipment basis, with the point of shipment being the producers' terminals located near principal markets in the East and Midwest. The primary magnesium, usually sold directly to the end users, is shipped to the terminals from the manufacturing plants by barge, truck, or rail, and upon sale, is transported to the end user by truck or rail. None of the modes of transport used are owned by the producers.

Foreign markets

U.S. exports of primary magnesium grew from 26,300 tons in 1977 to 49,600 tons in 1980, but in 1981 and 1982, the worldwide recession resulted in significantly lower shipments of 32,900 and 37,300 tons, respectively. On the average, exports represented 26 percent of U.S. production during 1977-82. The principal export markets were the EC, Japan, and Brazil (table 26), with magnesium usually shipped by water to centrally located, company-rented warehouses, rather than directly to end users.

Table 26.--Primary magnesium: U.S. exports of domestic merchandise, by selected markets, 1978-82

(In tons)

Market	1978	1979	1980	1981	1982
EC countries:					
Netherlands 1/	12,029	13,188	10,215	9,205	12,992
West Germany	2,467	2,260	2,153	1,243	677
United Kingdom	43	25	261	342	275
France	-	-	42	143	58
Belgium	92	83	-	130	1
Italy	430	48	227	140	37
All other	10	4	18	12	47
Subtotal	15,071	15,608	12,916	11,215	14,087
Japan	6,849	8,045	9,329	7,976	10,781
Brazil	6,621	9,885	10,120	2,887	2,970
Canada	2,197	2,655	3,386	3,937	2,537
Mexico	1,127	1,571	2,787	2,197	2,420
Australia	1,381	677	1,597	1,374	1,680
Saudi Arabia	0	103	65	228	877
Republic of South Africa	657	589	732	437	390
All other	3,179	8,238	8,652	2,659	1,539
Total	37,082	47,455	49,584	32,910	37,281

1/ Although the Netherlands is listed as the principal destination for U.S. exports, it actually consumes very little magnesium. Instead, the Dutch port city of Rotterdam is used by the largest U.S. producer as a terminus for later transshipment of primary magnesium to West Germany and France.

Source: Compiled from official statistics of the U.S. Department of Commerce.

The United States is the world's largest producer of primary magnesium, and its principal competitor is Norway, the world's third largest producer, with about 13 percent of world production in 1982 (table 27). Japan accounted for about 2 percent of world production in 1982; however, its production has been declining steadily since 1979 and is used almost entirely to meet local demand. France and Italy, accounting for a combined 6 percent of world production in 1982, compete with the United States in the EC. Although the U.S.S.R. is the world's second largest producer, with approximately 30 percent of total world production in 1982, much of the output is of low quality and is used primarily for domestic consumption rather than for export.

Table 27.--Primary magnesium: World production, by principal producing countries, 1977-82

(In tons)

Country	1977	1978	1979	1980	1981	1982 1/
United States	125,958	149,463	162,464	169,477	142,887	99,900
U.S.S.R. 1/	72,000	77,000	79,000	83,000	86,000	81,000
Norway	42,070	43,166	48,697	48,943	52,910	35,581
France	9,570	9,370	9,968	10,282	9,600	8,925
Italy	9,663	10,668	9,653	8,693	8,500	7,365
Japan	10,357	12,279	12,505	10,177	6,233	5,355
All other	13,936	15,784	16,563	19,021	21,987	34,543
Total	283,554	317,730	338,850	349,593	328,117	272,669

1/ Estimated by the staff of the U.S. Bureau of Mines.

Source: U.S. Bureau of Mines, Minerals Yearbook, 1981, except as noted.

European Community.--There are only two producers of primary magnesium in the EC, accounting for 8 percent of total world production capacity (excluding Communist countries) in 1981. One producer is located in Italy and has an annual production capacity of 12,700 tons. The average annual capacity utilization of this producer, which uses the thermal method for processing magnesium, dropped to an estimated 60 percent in 1982, from a high of 84 percent in 1978. The other EC producer, located in France, has an annual production capacity of 12,200 tons and also uses the thermal production method. Its average capacity utilization dropped to 70 percent in 1982 from a high of 84 percent in 1980.

EC consumption of primary magnesium, which is significantly less than that of the United States, peaked at just under 46,200 tons in 1979, declined slightly in 1980 to 45,200 tons, and declined again in 1981 to 38,200 tons (table 28). Consumption is believed to have declined further in 1982, as local production fell an estimated 10 percent, although exports from the United States, a major foreign supplier, to the EC market rose 26 percent. The downward trend in consumption largely reflects declining demand for magnesium by aluminum alloyers for use in aluminum cans and by the automotive industry in Western Europe, which uses more magnesium than do U.S. automakers.

Table 28.--Primary magnesium: EC production, exports of domestic merchandise, imports for consumption, and apparent consumption, 1977-82

Year	Production	Exports	Imports	Apparent consumption	Ratio of imports to consumption
	Tons				Percent
1977	19,233	1,339	19,952	37,846	52.7
1978	20,038	1,617	23,736	42,157	56.3
1979	19,621	2,265	28,846	46,202	62.4
1980	18,975	1,563	27,826	45,238	61.5
1981	18,100	3,820	23,880	38,160	62.7
1982	1/ 16,290	2/	2/	2/	2/

1/ Estimated by the staff of the U.S. Bureau of Mines.
2/ Not available.

Source: Production statistics, from U.S. Bureau of Mines, Minerals Yearbook; imports and exports, compiled from Eurostat, Analytical Tables of Foreign Trade.

The EC is heavily dependent on imports, which supplied about 60 percent of EC consumption of primary magnesium in recent years. Its major foreign suppliers are the United States and Norway, which together provided between 70 and 87 percent of the EC imports during 1977-81 (table 29). Almost all the magnesium exported from the United States to the EC is done through Domestic International Sales Corporations, which provide for deferral of export income from taxation to U.S. exporters of products manufactured preponderantly in the United States.

EC production of primary magnesium fell 19 percent from a high of 20,038 tons in 1978 to an estimated 16,290 tons in 1982 (table 28). As is the case with producers in the United States, producers in the EC sell magnesium directly to aluminum alloyers or automotive parts fabricators without the merchandise coming into possession of a middleman.

Table 29.--Primary magnesium metal: EC imports, by principal sources, 1977-81

(In tons)

Year	United States	Norway	All other	Total
1977	4,485	9,513	5,954	19,952
1978	7,780	10,684	5,272	23,736
1979	13,235	11,948	3,663	28,846
1980	13,221	11,118	3,487	27,826
1981	8,731	8,858	6,291	23,880

Source: Eurostat, Analytical Tables of Foreign Trade.

The decline in EC consumption of primary magnesium during 1980-82 was accompanied by an increase in the price of the metal, which had remained stable during the late 1970's. After amounting to F5.3 (francs) to F5.4 per pound throughout most of 1977-79, the EC price increased to F5.9 per pound during the second half of 1980 and on up to F7.2 in 1982. However, when converted into U.S. dollars, prices showed a significant decline, reflecting an appreciating dollar (table 30). Generally, producers both in the EC and elsewhere resort to cutting back production rather than prices in response to declining demand, since there essentially is no substitute for magnesium in aluminum alloys, its most important end use.

Table 30.--EC primary magnesium prices, by quarters, 1977-82

(Per pound)

Year	January-March	April-June	July-September	October-December
1977	$1.08	$1.10	$1.12	$1.10
1978	1.13	1.16	1.23	1.26
1979	1.26	1.23	1.29	1.34
1980	1.34	1.31	1.44	1.34
1981	1.33	1.30	1.21	1.25
1982	1.19	1.16	1.04	1.01

Source: Metal Bulletin Journals, Ltd., Metal Bulletin.

Japan.--Two producers together account for virtually all of Japan's production of primary magnesium. Each firm has an annual production capacity of 7,200 tons, which amounts to less than 5 percent of total world non-Communist capacity. Their average annual capacity utilization dropped to a low of 37 percent in 1982 from a high of 87 percent in 1979. Both firms use the thermal production process and obtain their dolomite and ferrosilicon from domestic sources and from the Philippines, the United States, and the Republic of Korea.

Japan's consumption of primary magnesium peaked in 1979 at almost 26,000 tons, more than double the 1977 level of 12,700 tons (table 31). It then declined 8 percent in 1980 and another 23 percent in 1981 to 18,235 tons, as magnesium was being displaced by lower cost aluminum in such end uses as titanium and zirconium smelting and metal rolling. Consumption rose 12 percent to 20,376 tons in 1982.

Japanese production fell from more than 12,000 tons in 1978 and 1979 to slightly less than 5,400 in 1982. Rising production costs in Japan stemming primarily from higher energy prices adversely affected the competitiveness of the Japanese industry compared with that of foreign producers, leading to a growing dependence on foreign producers, particularly the United States. Japan's imports of primary magnesium increased from 2,700 tons in 1977 to 13,700 tons in 1980, before declining to 12,000 tons in 1981. Imports rose to 15,100 tons in 1982, and their market share reached a high of 74 percent compared with 29 percent in 1977. All but a small part of the import growth

during 1977-82 was generated by the United States, whose shipments accelerated from 1,646 tons in 1977 to 9,540 tons in 1980, before decreasing to 7,620 in 1981. Imports from the United States reached 10,813 tons in 1982 (table 32).

Table 31.--Primary magnesium: Japanese production, exports of domestic merchandise, imports for consumption, and apparent consumption, 1977-82

Year	Production	Exports	Imports	Apparent consumption	Ratio of imports to consumption
	Tons				Percent
1977	10,357	357	2,737	12,737	29.3
1978	12,279	321	9,702	21,660	44.8
1979	12,505	90	13,444	25,859	52.0
1980	10,177	99	13,724	23,802	57.7
1981	6,233	45	12,047	18,235	66.1
1982	5,355	60	15,081	20,376	74.0

Source: Imports and exports compiled from Japan Tariff Association, Japanese Exports & Imports, Commodity by Country; production, compiled from Yearbook of Mining, Non-ferrous Metals, and Product Statistics, Ministry of International Trade and Industry, Japan.

Table 32.--Primary magnesium: Japanese imports, by principal sources, 1977-82

(In tons)

Year	United States	Norway	All other	Total
1977	1,646	1,026	65	2,737
1978	6,241	1,728	1,733	9,702
1979	9,128	1,954	2,062	13,444
1980	9,540	1,977	2,207	13,724
1981	7,620	2,783	1,644	12,047
1982	10,813	2,053	2,215	15,081

Source: Japan Tariff Association, Japanese Exports & Imports, Commodity by Country.

Japanese primary magnesium producers typically sell their merchandise directly to titanium smelters or aluminum alloyers. Typically, the goods are sold on an f.o.b. basis, with almost all Japanese primary magnesium being shipped by rail.

The list price of primary magnesium sold in the Japanese domestic market is typically based on the price quoted by the world's largest magnesium producer, located in the United States. Much like U.S. list prices, the list price in Japan has remained stable in recent years, as producers responded to

declining demand by cutting production rather than prices. Although the list price in terms of yen has remained stable since July-September 1980 at 345 yen per pound, the price in terms of the U.S. dollar has fluctuated, as shown in table 33.

Table 33.--Japanese primary magnesium prices, by quarters, 1977-82

(Per pound)

Year	January-March	April-June	July-September	October-December
1977	$0.99	$1.03	$1.04	$1.11
1978	1.15	1.26	1.44	1.48
1979	1.40	1.30	1.29	1.20
1980	1.21	1.27	1.57	1.64
1981	1.68	1.57	1.49	1.54
1982	1.48	1.41	1.34	1.33

Source: Japan Aluminum Federation, Light Metal Statistics in Japan.

Brazil.--Brazil began producing primary magnesium in 1982 in a thermal plant with an annual capacity of 6,000 tons. However, production in 1982 was negligible. Brazil has met its needs for magnesium through imports from the United States and Norway; in 1981, almost all of its imports came from these nations. U.S. exports to Brazil, after increasing from 6,621 tons in 1978 to a high of 10,120 tons in 1980, declined to 2,970 tons in 1982. Primary magnesium is used by Brazil principally for the production of aluminum alloys. It is also widely used in the production of automotive parts for lightweight automobiles.

Norway.--There is one producer of primary magnesium in Norway, and its electrolytic production facility is the second largest in the world, with a total annual capacity in 1981 of 55,000 tons (18 percent of total world non-Communist capacity).

The Norwegian producer is highly influenced by economic conditions in world markets, since 85 percent of its output during 1977-81 was exported. Its production closely followed exports during 1977-80, but in 1981, it increased to its highest level, whereas exports fell significantly to their lowest level during the period (table 34). The production increase in 1981, coming in the face of declining demand worldwide, was in part due to a buildup in inventories from which to export, because part of the facility was closed during 1982 to replace certain obsolete equipment. Production subsequently declined that year, as did its capacity utilization, which amounted to 65 percent, compared with 78 percent in 1978.

Table 34.--Primary magnesium: Norwegian production, exports of domestic merchandise, imports for consumption, and apparent consumption, 1977-82

Year	Production	Exports	Imports	Apparent consumption	Ratio of imports to consumption
	Tons				Percent
1977	42,070	1/ 37,600	302	4,772	6.3
1978	43,166	1/ 36,500	1,099	7,765	14.2
1979	48,697	1/ 45,700	425	3,422	12.4
1980	48,943	1/ 46,000	403	3,346	12.0
1981	52,910	1/ 34,800	332	18,442	1.8
1982	35,581	2/	2/	2/	2/

1/ Estimated by the staff of the U.S. Bureau of Mines.
2/ Not available.

Source: U.S. Bureau of Mines, Minerals Yearbook, 1981.

In terms of U.S. currency, prices of Norwegian primary magnesium moved irregularly higher during 1977-80, but declined sharply during 1981 and 1982 (table 35). However, in terms of Norwegian currency, prices leveled off at 5.8 kronas per pound in 1981 and 1982, following a significant increase from 5.3 kronas per pound or less during 1977-79 to 5.9 kronas in 1980 (table 35). The higher price levels recorded since the end of the 1970's, coming at a time when world demand has been weak, appears consistent with pricing trends of other world producers.

Table 35.--Norwegian primary magnesium prices, by quarters, 1977-82

(Per pound)

Year	January-March	April-June	July-September	October-December
1977	$1.02	$1.00	$1.00	$0.98
1978	.96	.93	.96	1.00
1979	1.06	1.04	1.06	1.08
1980	1.20	1.20	1.23	1.18
1981	1.09	1.04	.96	1.00
1982	.98	.96	.88	.82

Source: Estimated from data contained in annual reports of the Norwegian producer.

Factors affecting U.S. export prices

U.S.-produced magnesium is highly competitive in major foreign markets due to the efficiency and low costs of U.S. operations and due to the ability of U.S. producers to produce in large volume. The list price of U.S.-produced primary magnesium is currently $1.34 per pound, with discounts of 2 to 3 cents reportedly being offered. Although discounting is reportedly offered by all major producers, this is generally not a major factor in determining competitive advantage. Discussed below are the principal costs which, when added to ex-factory prices, help determine the level of delivered prices in foreign markets.

Industry sources estimate that the transportation and insurance costs of shipping magnesium to the Japanese market add 8 cents per pound to the price; transportation and insurance costs to Western European markets add 2 to 3 cents per pound to the price.

Foreign tariff rates are another important cost to consider in determining final prices in the European and Japanese markets. The current rate of duty on U.S. primary magnesium exports to the European Community is 6.7 percent ad valorem. This puts the United States at a competitive disadvantage against Western European producers which sell within the EC. Moreover, Norway, the principal competitor to the United States in Western Europe, is allowed to export primary magnesium duty free into the EC because of its membership in the European Free Trade Association (EFTA). 1/ Although the rate of duty on U.S. primary magnesium into Japan is currently 12.9 percent, the U.S. industry is more competitive in this market, since Japanese capacity to produce primary magnesium is limited, and Norwegian magnesium exported to Japan is also dutiable at the 12.9-percent rate.

Magnesium export contracts are written either in the foreign currency of the country to which the exports are destined or in U.S. dollars. If a forward market for a foreign currency exists, U.S. companies typically quote their sales in the foreign currency and guard against currency fluctuations by simultaneously engaging in a forward foreign exchange contract. If forward markets do not exist, U.S. exporters typically write contracts requiring payment in U.S. dollars. Because it exports a number of products in great volume, the largest U.S. producer of primary magnesium has its own banking subsidiary located in Switzerland, responsible for intervening in the exchange markets to help assure the most favorable exchange value for its merchandise, including magnesium.

U.S. and foreign magnesium prices remained stable in 1981 and 1982, despite weak demand due to actions taken by major producing firms to limit production in order to maintain profit margins and avert a price war.

1/ Tariffs have been eliminated on most industrial goods traded between EFTA countries and the EC.

Analysis of exchange rates and other factors influencing U.S. trade 1/

An econometric analysis of magnesium exports was done to determine the importance of exchange-rate changes relative to various other factors that were hypothesized to influence the price and quantity of U.S. exports to the EC and Japan. The export price of magnesium was related to (1) the unit value (in the foreign currency) of competing sources of magnesium in the foreign market, (2) the U.S. wholesale price of magnesium, (3) production of magnesium in the United States, the EC, and Japan, and (4) the bilateral exchange rate in units of foreign currency per U.S. dollar.

The hypothesis is that U.S. export prices will increase as competitors' prices of magnesium in the foreign market increase and as U.S. prices increase, which are included as a proxy for U.S. production costs, and that export prices will decrease as the levels of production of magnesium in the United States, the EC, and Japan increase and as the dollar appreciates.

The quantity of U.S. exports was related to (1) U.S. production of magnesium, (2) consumption and competitors' prices of magnesium in the EC and Japan, (3) the estimated export price from the price model, and (4) the exchange rate. The hypothesis is that the quantity of U.S. exports of magnesium will increase as foreign demand for magnesium increases and as prices of magnesium from competing sources increase and that export volume will decrease as the export price of magnesium increases and as the dollar appreciates. No prior assumption was made about the effect of supply-side nonprice factors in the United States (here represented by the production index for magnesium) on exports.

EC.--The results of the econometric analysis indicate that the exchange rate significantly influenced the price of U.S. exports of magnesium to the EC (table 36). 2/ However, they show that if the U.S. dollar appreciates, U.S. exporters will increase dollar prices of exports to the EC, contrary to the expected effect. Thus, export prices are not adjusted to offset the effect of changes in the dollar's value on exports to the EC.

Other factors found to significantly affect prices of U.S. exports of magnesium to the EC were U.S. production and U.S. wholesale prices, used here as a proxy for U.S. production costs. The results of the econometric analysis show that an increase in U.S. production will lead to a decrease in export prices. In addition, the results indicate that U.S. exporters pass through any increase or decrease in U.S. wholesale prices to the EC, which is dependent on imports for about 60 percent of its needs.

1/ Data used in the development of the econometric model for the six commodities are contained in app. A. App. B contains a discussion of the methodology used and tables B-1 through B-6, showing the complete regression results.

2/ As indicated in table 36, the variables that have a significant or demonstrable effect on export prices are those with a t-ratio (the figure in parentheses) of more than 2.16. When variables have a t-ratio this large or larger, then the analyst is 95 percent certain that the estimate is different from zero, or a result that shows no relationship between the variables. Since the t-ratio for exchange-rate changes is 3.54, this variable is considered significant.

Table 36.--Magnesium: The effects of movements in specified indicators on unit values of U.S. exports to the EC and Japan, based on quarterly data for 1977-82 1/

Country or area	Percentage change in export unit value resulting from a 1-percent change in--				
	Exchange rate 2/	Competitors' price at destination 3/	Production in importing country	U.S. production	U.S. price
EC	1.4945	-0.0535	-0.4488	-1.0911	0.7523
	(3.54)	(-0.27)	(-2.09)	(-4.44)	(2.67)
Japan	-0.8473	1.4837	0.5737	-0.5851	0.9746
	(-1.96)	(2.89)	(2.59)	(-2.19)	(1.87)

1/ Figures in parentheses are t-ratios. The coefficient is significant at the 1-percent level if the t-ratio exceeds 3.01 for the EC and 2.947 for Japan, and at the 5-percent level if it exceeds 2.16 for the EC and 2.131 for Japan.

2/ Units of foreign currency per U.S. dollar.

3/ The price used was based on the currency of the importing country.

Source: Based on data in table B-3.

Table 37.--Magnesium: The effects of movements in specified indicators on the quantity of U.S. exports to the EC and Japan, based on quarterly data for 1977-82 1/

Country or area	Percentage change in export quantity resulting from a 1-percent change in--				
	Exchange rate 2/	Competitors' price at destination	U.S. production	U.S. export price	Apparent consumption in foreign market
EC	15.7045	0.3053	-11.1899	-4.2350	-0.7854
	(4.25)	(0.39)	(-4.63)	(-4.43)	(-1.00)
Japan	-4.9604	2.1994	-2.1123	-0.7662	1.8007
	(-1.55)	(0.86)	(-2.81)	(-0.30)	(6.72)

1/ Figures in parentheses are t-ratios. The coefficient is significant at the 1-percent level if the t-ratio exceeds 3.06 for the EC and 2.947 for Japan, and at the 5-percent level if it exceeds 2.18 for the EC and 2.131 for Japan.

2/ Units of foreign currency per U.S. dollar.

Source: Based on data in table B-3.

The econometric analysis shows that the quantity of U.S. exports of magnesium to the EC was significantly influenced by the bilateral exchange rate (table 37). It shows that if the dollar appreciates 1 percent, the quantity of magnesium exported to the EC will increase by almost 16 percent. Again, the results differ from the hypothesis that exports are negatively related to exchange-rate changes, and the magnitude of the coefficient appears to be unusually large.

The factor affecting the quantity of U.S. exports to the EC which was both statistically significant and related to export volume as hypothesized was U.S. export prices. The results indicate that a 1-percent increase in U.S. export prices will result in a 4.2-percent decline in the quantity of exports to the EC. Although the EC is heavily dependent on imports, U.S. producers must compete in this market with Norway, the second largest magnesium exporter after the United States and also a low-cost producer.

The results for the EC are confusing, and suggest that a more elaborate model is in order for several reasons. Nonprice factors appeared to have played a significant role in exports to the EC. Also, trade data showed a fall in EC imports from the United States during the period when the dollar showed substantial appreciation. Further, U.S. exports appeared to be sensitive to the U.S. export price in the expected way, suggesting that exchange-rate effects should also behave as expected. A variable omitted from the model may be positively correlated with the exchange rate and with U.S. exports and thus be causing the unusual result.

Japan.--The econometric analysis shows that prices of U.S.-produced magnesium exported to Japan were not significantly affected by changes in the bilateral exchange rate. 1/ Factors affecting export prices which were both statistically significant and related in the expected way to export prices were competitors' prices in the Japanese market and U.S. production. 2/ As shown in table 36, the model results indicate that a 1-percent increase or decrease in competitors' prices would result in a corresponding increase or decrease in U.S. export prices of almost 1.5 percent. 3/ The results also show that an increase in U.S. production would result in a decrease in U.S. export prices. Japanese production had a significant effect on U.S. prices, but it was contrary to the expected result. Because Japanese production accounted for such a small share of total Japanese demand, increases in Japanese production might not influence prices as expected.

As shown in table 37, the results of the econometric analysis indicate that the bilateral exchange rate also did not significantly influence the quantity of U.S. exports of magnesium to Japan. 4/ The coefficient on Japanese consumption was both statistically significant and related as expected to export volume, 5/ and was used here as a proxy for demand. The estimated relationship between Japanese consumption and the quantity of U.S. exports to Japan shows that an increase in Japanese demand would result in a

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1/ The t-ratio for exchange rates was -1.96.

2/ The t-ratio for competitors' prices is 2.89 and for U.S. production, -2.19.

3/ The coefficient on the competitors' price term was not significantly different from 1 at the 95-percent confidence level.

4/ The t-ratio for exchange rates is -1.55.

5/ It had a t-ratio of 6.72.

corresponding increase in the quantity of U.S. exports. Supply-side nonprice factors, represented by U.S. production, were found to inhibit exports of magnesium to Japan.

These results reflect the fact that Japan, buffeted by rising production costs stemming primarily from higher energy costs, has become highly dependent on foreign producers, especially the United States, for magnesium. Foreign producers have significantly increased their share of the Japanese market, from just under 30 percent in 1977 to 74 percent in 1982. The U.S. market share amounted to 53 percent in 1982.

Bicycles

Product description

Bicycles 1/ come in a wide variety of types, styles, and sizes. Bicycles which account for most sales are classified by the trade in two categories--lightweight and juvenile models. These classifications reflect differences in wheel size, as well as in design and equipment; the two most important identifying characteristics are the cross-sectional diameter of the tires and the shape of the frame. 2/

The lightweight models include 10-speed bicycles, having wheels with 27-inch, 26-inch, and 24-inch diameters, and either 1-1/4-inch, 1-3/8-inch, or, occasionally, 2-1/8-inch tires. Lightweights were the most important category sold in the U.S. market during 1977-82, averaging about 56 percent of total bicycle sales. Adults (generally defined in the industry as anyone old enough to legally operate an automobile) constituted a large part of the market for these bicycles.

The juvenile bicycles, which accounted for 37 percent of U.S. bicycle sales in 1982, were marked by growing sales during 1977-82, largely as a result of the popular BMX (bicycle motocross) and the "high riser," both 20-inch models. The former has 2-1/8-inch knobby tires, and the latter, 1-3/4-inch tires. The fastest growing style in recent years has been the BMX, which is made to look like the motorcycle used in motocross racing. With the sport of BMX racing rapidly gaining popularity, "competition certified" and "look alike" types were produced.

The major domestic producers manufacture bicycles using similar processes. However, the quality of components, grade of steel for tubing, and the care in welding and finishing operations vary from manufacturer to manufacturer, depending on the model and on the market being served. Although the number of bicycle parts produced (as opposed to purchased) by each bicycle manufacturer varies considerably, each manufacturer generally has a highly automated "tube mill" in which to produce steel tubing from U.S.-made steel sheets to be used in the frame, seat post, forks, handlebar stem, and handlebar. 3/

Domestic manufacturers also rely heavily upon other manufacturers, both domestic and foreign, for many parts of bicycles. Some parts, such as

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1/ Imports of this product are provided for in the Tariff Schedules of the United States (TSUS) as follows:

Commodity	TSUS item Nos.
Bicycles	732.02-732.26

2/ For tariff classification purposes "the diameter of each wheel is the diameter measured to the outer circumference of the tire which is mounted thereon or, if none is mounted thereon, of the usual tire for such wheel" (see headnote 1, subpart C, pt. 5, schedule 7, of the TSUS).

3/ To be a "manufacturer" of bicycles, U.S. industry representatives have generally taken the position that the firm must produce at least the frame.

three-piece cotterless crank sets and coaster brakes designed for single-speed bicycles, are no longer produced in the United States. Certain parts of bicycles enter free of duty under TSUS item 912.10, which was created by temporary legislation. None of the articles covered by this provision currently, except for caliper brakes, are produced in commercial quantities in the United States.

Various welding processes are used, including furnace brazing and electro-welding (also known as flashing welding) and brazing with lugs. Lugs, small metal sleeves which are fitted to the tubes prior to brazing, act as braces where the tubes are fitted together. 1/ Only a small portion of U.S.-made bicycles are lugged, but nearly all imported lightweight bicycles are lugged. Lugged bicycles are generally higher quality and more expensive than nonlugged bicycles.

Both domestic and imported bicycles are subject to extensive safety standards issued by the U.S. Consumer Product Safety Commission, covering such areas as wet and dry stop braking distances, strength of frame, and reflectors.

U.S. industry

Eight firms manufacturing a full line of bicycles in a total of 11 establishments located in Ohio, Oklahoma, Tennessee, Illinois, Massachusetts, Pennsylvania, California, Mississippi, and Wisconsin accounted for virtually all of the domestic output of bicycles in 1982. 2/ According to recent annual public reports, the two largest producers estimated that they accounted for 40 and 33 percent, respectively, of U.S. producers' shipments of bicycles. During 1981 and 1982, total employment in the industry was probably in the range of 6,000 to 8,000 employees.

Using SIC 3751 data, which include bicycles, parts of bicycles, and motorcycles and parts, certain characteristics of the bicycle industry emerge. During 1977-81, the ratio of production workers to total employees averaged about 84 percent, compared with 73 percent for all manufacturing industries, suggesting that the bicycle industry is relatively labor intensive. In addition, the ratio of payroll of all employees to value added by manufacture ranged from 46 to 52 percent for bicycles, compared with 40 to 44 percent for all manufacturing. Expenditures per production worker for new plant and equipment averaged $1,967 for the bicycle industry during 1977-81, compared with $4,486 for all manufacturing.

Value added by manufacture per production worker man-hour in the bicycle industry for 1977-81 averaged $17.35, or 65 percent of the all manufacturing average of $26.59. Moreover, value added by manufacture per employee during 1977-81 averaged $27,486 per year for the bicycle industry and $37,589 for all manufacturing industries, i.e., the bicycle industry value added averaged 73

1/ Consumer Guide, Bicycle Buyer's Guide 1980, Publications International, Ltd., 1980, p. 15ff.

2/ On Apr. 14, 1983, the largest domestic manufacturer announced that it will close and sell its facility in Oklahoma and will consolidate its operations in Ohio. The Oklahoma plant was closed on July 15, 1983.

percent of that for all manufacturing. These lower levels reflect the relative labor intensity of the production process and lower levels of capital expenditures compared with all manufacturing industries. This appears to be true despite expenditures by several firms in the industry in recent years for plant expansion and equipment modernization. Part of the basic technology for the industry is standard to industries involved in metal fabrication processes such as stamping and bending. Thus, the processing technology does not change rapidly, and the equipment is readily available worldwide.

In addition, a fairly substantial proportion of parts of bicycles, especially many of those required in making multispeed, lightweight bicycles, are imported, primarily from Japan. Since Japan is also a major supplier of bicycles to the U.S. market as well as parts to Taiwan, domestic producers of multispeed, lightweight bicycles must be especially responsive not only to consumer styling preferences and changes in demand among types of bicycles, which can be fairly rapid, but also to price competition from Taiwan and Japan.

Certain financial information for 1977-82 from the annual public reports on all operations of the two major bicycle producers are shown in the following tabulation:

Year	Net sales	Net profit	Return on net sales	Return on shareholders' equity
	1,000 dollars		Percent	
1977	342,925	12,386	3.6	15.1
1978	426,778	12,567	2.9	13.6
1979	528,878	16,245	3.1	15.7
1980	532,258	17,387	3.3	15.0
1981	564,261	15,157	2.7	12.0
1982	510,987	8,148	1.6	6.3

U.S. market

Estimated apparent U.S. consumption of bicycles increased from 9.4 million units, valued at $534 million, in 1977 to 10.9 million units, valued at $723 million, in 1979 (table 38), when gasoline prices increased sharply and gasoline shortages caused long lines at the pumps. However, mainly because of the recession, such consumption decreased to 6.8 million units, valued at $580 million, in 1982.

U.S. producers' shipments followed a similar trend, peaking at an estimated 9.0 million units, valued at $620 million, in 1979 before decreasing to 5.2 million units, valued at $460 million, in 1982. U.S. exports of bicycles have been small.

U.S. imports of bicycles increased irregularly from 2.0 million units, valued at $102 million, in 1977 to 2.2 million units, valued at $185 million, in 1981, before decreasing to 1.7 million units, valued at $123 million, in

1982. Imports' share of the domestic market remained fairly steady in recent years, annually averaging about 25 percent in 1980-82, up from 17 percent in 1979 and 21 percent in 1977 and 1978.

Table 38.--Bicycles: U.S. producers' shipments, exports of domestic merchandise, imports for consumption, and apparent consumption, 1977-82

(Quantity in thousands of units; value in thousands of dollars)

Year	Producers' shipments	Exports	Imports	Apparent consumption	Ratio (percent) of imports to consumption
	Quantity				
1977	1/ 7,484	39	1,968	9,413	21
1978	1/ 7,492	73	1,960	9,379	21
1979	1/ 9,038	52	1,867	10,853	17
1980	1/ 6,942	92	2,155	9,005	24
1981	1/ 6,832	91	2,224	8,965	25
1982	1/ 5,170	50	1,726	6,846	25
	Value				
1977	2/ 434,000	1,696	102,008	534,312	19
1978	2/ 455,000	3,237	109,557	561,320	20
1979	2/ 620,000	3,440	106,380	722,940	15
1980	2/ 535,000	5,326	150,677	680,351	22
1981	2/ 560,000	5,934	184,632	738,698	25
1982	2/ 460,000	3,690	123,285	579,595	21

1/ Estimated by the Bicycle Manufacturers Association of America, Inc., and does not include data on sidewalk bicycles (smaller than 20-inch bicycles).
2/ Estimated by the staff of the U.S. International Trade Commission.

Source: Compiled from official statistics of the U.S. Department of Commerce, except as noted.

Taiwan and Japan were the principal foreign suppliers during 1978-82 (table 39). Whereas most of the bicycles imported from Japan are larger lightweight bicycles, Taiwan also supplied the smaller juvenile bicycles in substantial amounts. In 1982, almost half the bicycles from Taiwan consisted of bicycles with wheels having a diameter under 25 inches, compared with 13 percent for those from Japan. Moreover, Taiwan accounted for 78 percent of total imports of these bicycles in 1982, up from 73 percent in 1981, but the unit value of Taiwan's bicycles is about half that of the imports from Japan. These proportions reflect the change in product mix toward juvenile styles, especially BMX, which occurred in 1982, as the smaller bicycles accounted for 42 percent of imports from Taiwan and only 6 percent of imports from Japan in 1981. In addition, the lightweight styles from Japan were generally higher priced, reflecting better quality componentry and metal for the frame.

Table 39.--Bicycles: U.S. imports for consumption, by principal sources, 1978-82

Source	1978	1979	1980	1981	1982
	Quantity (1,000 units)				
Taiwan	825	1,007	1,074	1,193	1,105
Japan	476	293	620	661	341
France	120	63	77	62	74
Republic of Korea	198	178	123	131	113
Italy	1	3	3	14	10
China	0	0	1/	2	22
Poland	174	181	161	111	40
Austria	15	14	6	7	4
United Kingdom	91	99	58	14	2
West Germany	6	3	4	6	2
All other	55	26	28	24	14
Total	1,960	1,866	2,155	2,224	1,726
	Value (1,000 dollars)				
Taiwan	32,669	47,698	58,239	73,405	61,897
Japan	39,170	24,398	59,581	81,430	38,437
France	12,365	7,627	11,076	10,860	9,657
Republic of Korea	7,451	7,269	5,609	7,483	6,090
Italy	119	365	657	1,353	2,081
China	-	-	22	148	1,831
Poland	4,173	4,439	4,289	3,369	1,227
Austria	1,455	2,384	1,068	1,043	789
United Kingdom	8,085	9,966	7,068	2,249	288
West Germany	259	94	194	594	206
All other	3,811	2,140	2,874	2,698	782
Total	109,557	106,380	150,677	184,632	123,285
	Unit value				
Taiwan	$39.61	$47.35	$54.22	$61.55	$56.01
Japan	82.25	83.20	96.08	123.17	112.75
France	103.12	121.48	144.43	174.50	131.22
Republic of Korea	37.66	40.87	45.61	56.93	53.83
Italy	175.04	142.37	206.35	100.10	215.52
China	-	-	58.61	62.58	81.93
Poland	23.93	24.56	26.57	30.40	30.68
Austria	100.33	172.56	176.68	152.43	185.15
United Kingdom	88.50	100.41	122.73	164.76	161.01
West Germany	45.58	33.20	48.32	104.77	133.46
All other	69.91	81.97	101.10	111.94	57.54
Average	55.90	57.00	69.92	83.01	71.43

1/ Less than 500 units.

Source: Compiled from official statistics of the U.S. Department of Commerce.

The Bicycle Manufacturers Association of America (BMA) estimated that in 1982, approximately 65 million bicycles were in use in the United States and that there were about 105 million riders. The BMA estimates a potential market of 90 million bicycles. Because the absolute number of births have been up in each year since 1975, industry sources believe that demand will grow in the 1980's. The majority of the riders are in the age group of 5 to 21 years, but increased interest in bicycles beginning in the early 1970's in the age group of 18 to 34 resulted in this group accounting for about 25 percent of purchases in recent years prior to the recession. Adults have decreased their purchases during the recession, reflecting the fact that demand for such bicycles is closely related to the availability of discretionary income. However, demand for children's and teenagers' bicycles, especially BMX bicycles, has changed little.

Bicycles are sold in the United States primarily through two types of retail outlets: national and regional chain department and discount stores and about 7,000 independent bicycle dealers or bicycle specialty stores. About 70 to 75 percent of the bicycles are sold through the chain stores, which offer a wide product line, but focus on 26-inch lightweights, high risers, and BMX "lock alikes." The bicycle specialty stores, except for those representing a major U.S. producer, focus on 27-inch, multispeed lightweights and competition BMX's. Almost all bicycles sold to the chain stores are sold to them directly; bicycles for the specialty stores are sold both directly to them and indirectly through bicycle wholesale distributors.

There is significant competition among U.S. producers of bicycles despite a fairly high degree of concentration; two producers account for about 73 percent of U.S. producers' shipments. Efforts to increase market share, pressure on prices caused by efforts to liquidate excess inventory during the recession, and competition from imports all contribute to price competition.

Most bicycles manufactured by U.S. producers do not have lugged frames and are sold mostly through chain department and discount stores in standard frame sizes, with limited service in the retail price range of approximately $70 to $200. In contrast, most imported lightweight bicycles have lugged frames and are sold primarily through independent bicycle dealer outlets, often in custom-fitted frame sizes and with extensive service in a retail price range of approximately $150 to several hundred dollars, and in some cases even thousands of dollars. It should be noted that some U.S. producers do specialize in supplying the dealer market with both lugged and nonlugged bicycles, and many imported bicycles, such as those from the Republic of Korea (Korea), Poland, and, to a limited degree, Taiwan, are sold through the chain stores. A lugged bicycle requires more labor than a nonlugged bicycle, and the lower wages paid by the foreign suppliers give them a competitive advantage in this type of bicycle. Total hourly compensation costs for production workers in the United States and other major bicycle-supplying countries are shown in the following tabulation:

Country	1980	1981 1/	1982 2/
United States	US$9.91	US$10.96	US$11.79
Taiwan	1.27	1.51	1.57
Japan	5.61	6.18	5.82
France	9.24	8.32	8.15
Republic of Korea	1.08	1.15	1.22

1/ Preliminary.
2/ Provisional.

Sales of high-priced bicycles from France and Italy, and more recently Japan, in the U.S. market are also helped significantly by the quality connotation associated with them.

The most intense competition between imported and domestic bicycles often occurs with regard to a particular style popular in the market at a given time. For example, the competition model BMX 20-inch bicycles range in retail price from $80 to $400; "look alikes" are priced from $48 to $145. Both are sold by chain department and discount stores, but independent bicycle dealers favor competition models. Domestic and imported BMX bicycles compete with each other on the basis of price in chain stores and in dealer outlets, where prices overlap between the two types.

With the exception of certain bicycles sold by two domestic producers, almost all sales by bicycle dealers are competition-type BMX models or imported, lugged-frame, 27-inch, multispeed lightweights. Except for competition-type BMX models and those made by one U.S. manufacturer, almost all juvenile bicycles are sold through the chain department and discount stores. Most lightweights sold through the chain stores have 26-inch wheels.

In an effort to penetrate the independent bicycle dealer market, the largest U.S. producer in 1982 licensed the rights to the Raleigh line of bicycles and trademarks in the U.S. market for a 10-year period. It plans to supply these bicycles both from imports and from its U.S. facilities.

Competition will also be affected by an agreement signed in September 1982 between the second largest U.S. producer and a smaller U.S. producer, under which the latter will supply the former with frames and various components for the assembly of primarily 20-inch and 26-inch 3-speeds. This is an indirect way for the larger producer to enter the dealer market.

Commodity prices in the U.S. market

There are many important factors which affect the level of prices in the U.S. market. The highly price competitive nature of the product reflects the close relationship to basic supply and demand factors. Most purchases of bicycles (other than those bought for basic transportation) are made with discretionary income, and, thus, the decision to purchase a bicycle faces competition from other leisure time and health/exercise activities and from

products used in the participation or observation of such activities. For example, it is believed that large sales of video games contributed to the decrease in sales of bicycles during 1982. With purchases dependent on discretionary income, the level of sales of bicycles is closely related to swings in the business cycle. The increasing popularity of competing products and the recent recession provided downward pressure on bicycle prices. In addition, during the recession, adults have postponed purchases of bicycles, but overall demand for smaller juvenile bicycles has been fairly steady, causing the product mix to shift to smaller, less expensive bicycles.

On the basis of demographic analysis, as well as sales trends, each manufacturer and importer projects style and frame and wheel size mixes for the coming year's models. Market projections might include sales estimates for categories such as commuting, shopping, and around-town bikes; touring; road and track racing; bicycle motocross; as well as styles for various age groups. 1/ For a given size and style, the costs can vary significantly, depending on the quality of the component parts. The manufacturer makes specifications listing all the parts that he plans to purchase and prices them with foreign and domestic suppliers. Price is also a function of all the other cost factors involved in producing and marketing a bicycle, such as own-produced components, overhead, distribution, and promotion; profits; the size of market projected for the particular bike; and anticipated selling prices of competitors.

A factor affecting the size of the projected market is the type of distribution channel through which the bike will be sold. The better quality, higher priced bicycles, generally with lugged frames for lightweights, are sold primarily through independent bicycle dealers, and less expensive bicycles are sold primarily through the chain department and discount stores. However, both types of bicycles may be sold in both types of outlets and it is here that imported and domestic bicycles encounter the most intense price competition.

In addition to competition with imports, price competition exists among U.S. producers. Competitive pressures and assessments of the market size in the 1980's caused several U.S. producers to build new facilities, increasing capacity, within the past several years. At the same time older less efficient facilities were closed. According to the 1982 annual reports of the two largest U.S. producers, which supply almost exclusively the mass-merchandiser market, each has the capacity of producing about 4 million bicycles annually.

Certain specific costs on imported bicycles affect price levels. These include general overhead involved in overseas buying, tariff rates, use of letters of credit, longer lead times (increasing risk of inaccurate market projections), extra inventory and handling costs, and possible unsatisfactory parts supply.

A final factor affecting the level of prices, which applies equally to U.S.-produced and imported bicycles, is the existence of consumer product safety standards for bicycles and parts.

1/ Eugene A. Sloane, The All New Complete Book of Cycling, third edition, 1980, p. 35.

Table 40 shows the Producer Price Index data for bicycles, by quarters, during 1977-82. Overall, the index increased from 94.453 in January-March 1977 to 145.880 in October-December 1982, or by 54 percent. The data reflect the general pricing pattern of the industry in which prices are set about the first of the year and again at midyear in anticipation of the major selling seasons. The most notable price increases took place in 1979 and 1980, with the 1979 increase related to the gasoline crisis. With the onset of the recession in 1981, price increases slowed considerably, and there was a price decrease in October-December 1982.

Table 40.--Bicycles: Index of U.S. producer prices, by quarters, 1977-82

(January 1978=100)

Year	January-March	April-June	July-September	October-December
1977	94.453	94.830	94.830	96.177
1978	100.000	100.000	100.000	100.485
1979	108.078	112.547	114.414	115.455
1980	121.953	123.999	129.510	129.510
1981	130.246	131.556	137.013	137.085
1982	143.619	143.619	146.778	145.880

Source: Compiled from official statistics of the U.S. Department of Labor.

Foreign industries

Estimated world production of bicycles in recent years ranged from 50 million to 60 million units. The largest producing countries are China, the United States, and Japan.

Because this study deals with the effects of changes in the relative value of currencies on the demand for foreign-produced bicycles in the U.S. market, this section will focus on the two major developed country sources, Japan and France, whose currencies have been allowed to float against the dollar.

Japan.--In recent years, Japan has been the second leading supplier of bicycles to the U.S. market, topped only by Taiwan. There are reportedly 85 manufacturers of completed bicycles in Japan, with the majority of factories centered around the three large cities of Tokyo, Osaka, and Nagoya. 1/ 2/ The latest data available show that in 1979, 30 industrial-type makers (those which manufacture some of their parts) accounted for 60 percent of total Japanese production of bicycles; the remainder of production was accounted for by commercial-type makers (those which purchase all parts outside the

1/ Data supplied to the U.S. International Trade Commission by the Japan Trade Center/Bicycle Section, New York, N.Y.

2/ Bicycle Journal, September 1979, p. 20. The article summarized a report by the Japan Bicycle Promotion Institute.

firm). 1/ Only about 20 of these firms exported complete bicycles. A 1979 study performed by the Ministry of International Trade and Industry of firms producing bicycles and parts of bicycles which employed 20 or more employees revealed that the 186 manufacturers in this category together employed 20,301 workers, including administrators. Current employment is believed close to this figure.

Since the late 1960's, the bicycle industry in Japan made a significant effort to increase the quality of its products, partly by developing uniform product standards. By 1979, 40 Japan Industrial Standards had been developed for bicycles. It was reported that quality was so improved, the need for export inspections decreased sharply for most parts and accessories. In addition, manufacturers invested substantial sums in equipment and in research and development to improve the production process and quality of the bicycle. 2/

Purchasing bicycles imported from Japan is generally transacted in yen, with one of the parties hedging by purchasing a contract in the forward market for yen to reduce the risk associated with currency fluctuations. Data in table 41 supplied to the Commission by the Japan Trade Center/Bicycle Section show indexes of producers' and wholesalers' prices in Japan, by quarters, 1977-82. The data show that during the period, although the index for wholesalers' prices fluctuated, there was little change in its level at the end of the period compared with that in the beginning, decreasing from 98.8 in January-March 1977 to 98.4 in October-December 1982. The producers' price index increased modestly from 98.8 in January-March 1977 to 107.4 in July-September 1982, or by 9 percent. In the Japanese market, the role of wholesalers is to supply a large number of very small bicycle specialty shops. Because their prices would be a step removed from the factory price, it would appear that the producer price index would more closely reflect prices charged by producers to overseas purchasers.

1/ Ibid., p. 22.
2/ Ibid.

Table 41.--Domestic price indexes for bicycles in Japan, by quarters, 1977-82

(1975=100)

Period	Producers' price	Wholesalers' price
1977:		
January-March	98.8	98.8
April-June	97.2	97.2
July-September	96.4	96.4
October-December	97.3	97.1
1978:		
January-March	97.3	97.1
April-June	97.3	97.1
July-September	97.4	97.1
October-December	96.9	92.7
1979:		
January-March	93.7	92.7
April-June	93.7	95.1
July-September	93.7	106.8
October-December	101.9	95.4
1980:		
January-March	104.1	97.4
April-June	105.8	97.3
July-September	105.3	98.8
October-December	105.3	98.5
1981:		
January-March	106.0	98.2
April-June	106.3	98.3
July-September	106.3	98.4
October-December	106.7	98.4
1982:		
January-March	106.9	98.4
April-June	107.4	98.4
July-September	107.4	98.4
October-December	1/	98.4

1/ Not available.

Source: Compiled from Official Price Index for Bicycles by the Bank of Japan.

Japanese bicycles marketed in the United States consist almost entirely of high-quality and high-priced (over $180) bicycles sold at retail through independent bicycle dealers. 1/ A variety of methods are used to get the bicycles from the plant in Japan to the dealer in the United States. Some Japanese manufacturers have their own distribution network established in the United States where they import the bicycles and distribute them either directly to the dealer or through bicycle wholesale distributors. The latter appears to be the most common method. Other Japanese manufacturers utilize

1/ The Wall Street Journal, Nov. 4, 1980.

Japanese export trading companies, which are not involved in the manufacturing process. Some bicycle wholesale distributors import directly and sell the bicycles to dealers. Two U.S. bicycle manufacturers import bicycles from Japan, one for sale through its captive dealer network and the other for resale to dealers.

Data in table 42 show the importance of bicycle exports to Japanese manufacturers. Such exports during 1977-82 ranged from 9 percent of Japanese production in 1979 to 17 percent in 1977. Most of the changes in Japanese producers' shipments resulted from changes in demand for exports. Apparent Japanese consumption increased gradually from 5.3 million bicycles in 1977 to 6.0 million bicycles in 1980, and then decreased to 5.6 million bicycles in 1981. It returned to 6.0 million bicycles in 1982. However, the shifts in Japanese exports were more abrupt, decreasing from 1.1 million units in 1977 to 570,000 units in 1979. Such exports then increased to 1.1 million units both in 1980 and in 1981, but decreased to 674,000 units in 1982.

Table 42.--Bicycles: Japanese producers' shipments, exports, imports, apparent consumption, and production, 1977-82

Year	Producers' shipments	Exports 1/	Imports 1/	Apparent consumption	Production	Ratio of exports to production
	1,000 units					Percent
1977	6,337	1,103	6	5,240	6,334	17.4
1978	5,887	640	8	5,255	5,869	10.9
1979	6,411	570	21	5,862	6,268	9.1
1980	7,105	1,128	1	5,978	7,083	15.9
1981	6,648	1,058	1	5,591	6,601	16.0
1982	6,624	674	13	5,963	6,533	10.3

1/ Includes a limited number of other cycles (including delivery tricycles) not motorized.

Source: Japan Bicycle Promotion Institute. Supplied to the U.S. International Trade Commission by the Japan Trade Center/Bicycle Section, New York, N.Y.

The United States was the principal market for Japanese exports of bicycles during 1977-82, accounting for much of the fluctuation in demand for such exports (table 43).

Table 43.--Bicycles: 1/ Japanese exports to the United States and all other markets, 1977-82

(Quantity in thousands of units; value in thousands of yen, f.o.b.)

Year	United States	All other	Total	Ratio (percent) of exports to the United States to the World
	Quantity			
1977	642	461	1,103	58.2
1978	399	241	640	62.3
1979	323	247	570	56.7
1980	624	504	1,128	55.3
1981	614	444	1,058	58.1
1982	342	332	674	50.7
	Value			
1977	12,591,516	7,129,063	19,720,579	63.8
1978	7,546,572	3,794,617	11,341,189	66.5
1979	6,087,722	4,185,540	10,273,262	59.3
1980	14,068,399	9,414,360	23,482,759	59.9
1981	16,394,233	10,174,092	26,568,325	61.7
1982	9,390,065	6,683,390	16,073,455	58.4
	Unit value			
1977	Y19,612.95	Y15,464.34	Y17,879.04	-
1978	18,913.71	15,745.30	17,720.61	-
1979	18,847.44	16,945.51	18,023.27	-
1980	22,545.51	18,679.29	20,818.05	-
1981	26,700.71	22,914.62	25,111.84	-
1982	27,456.33	20,130.69	23,847.86	-

1/ Includes a limited number of other cycles (including delivery tricycles) not motorized.

Source: Japan Tariff Association, Japan Exports & Imports: Commodity by Country.

The following tabulation shows the value and unit value of Japanese exports of bicycles to the United States during 1977-82 based on the annual average yen per U.S. dollar exchange rate, calculated by the International Monetary Fund: 1/

1/ IMF, International Financial Statistics.

Year	Value 1/ 1,000 dollars	Unit value 1/
1977----------	46,894	$73.04
1978----------	35,861	89.88
1979----------	27,780	86.01
1980----------	62,046	99.43
1981----------	74,337	121.07
1982----------	37,704	110.24

1/ Calculations are based on the following annual average yen per U.S. dollar exchange rate: 1977, 268.51; 1978, 210.44; 1979, 219.14; 1980, 226.74; 1981, 220.54; and 1982, 249.05.

The most notable point about these data, when compared with those in table 43, is that although the unit value of such bicycles decreased in yen from 1977 to 1978, it increased significantly in dollars. At the same time, such exports of bicycles to the United States decreased sharply. In 1982, when the unit value increased in yen, it decreased in dollars.

Demand for bicycles in the United States increased sharply in 1979. Data on U.S. producers' shipments show the surge starting in April-June 1979; Japanese statistics show that the surge in exports of bicycles from Japan to the United States did not begin until October-December 1979 and continued until April-June 1981. This information is consistent with the normal 5- to 6-month lead time required for delivery of imports of bicycles following orders.

France.--France has been a comparatively small supplier of bicycles to the U.S. market in recent years, accounting for only 4 percent of U.S. imports of bicycles in 1982. However, France was the fourth largest supplier of bicycles overall and the second largest developed country supplier.

It is believed that at least 20 to 25 firms manufacture or assemble bicycles in France, 1/ with 3 of the largest producers accounting for virtually all the exports of French bicycles to the United States. Their factories are located in Pantin Cedex, a suburb of Paris; Machecoul, in the West of France, near Nantes; and Valentigney, in the East near where the Swiss and German borders meet. An official of one of these firms was recently reported to have said that his "company has the leading production facility for bicycles in Europe, with a heavy emphasis on robotics." 2/

French bicycles, sold through independent bicycle dealers, have a reputation for quality and retail in the U.S. market from about $175 each to over $1,000. Many of the components are French made. French producers have specialized in lightweight, multispeed models for adults and juveniles. However, emphasis in 1983 product lines has shifted toward servicing all

1/ Schwinn Reporter, "A Compilation of World Manufacturers, Builders, Makers and Assemblers of Bicycles," March 1979.
2/ Bicycle Journal, March 1983, p. 62A.

sectors of the market, including BMX. One firm has even introduced three lightweight, lugless frame models.

Distribution of French bicycles in the U.S. market has been restructured considerably within the past year. One of the three major exporters to the United States which has not changed maintains a U.S. corporation and warehouses on the east and west coasts to control the flow of bicycles both to bicycle wholesale distributors and directly to dealers. Another firm recently formed a new sales division in the United States to establish an independent regional distributor network. It plans no changes in the actual dealer network, hoping to improve the efficiency in getting bicycles and parts to the dealers. The third firm formerly distributed bicycles in the United States through regional distributors. In early 1983, it announced that it signed an agreement with a small U.S. producer of high-quality bicycles and frame sets to have it distribute its bicycles across the United States directly to the dealer (except for two areas covered by subdistributors).

Exports of bicycles from France are important to the bicycle industry (table 44). During 1977-81, such exports ranged from 18.8 percent of producers' shipments in 1979 to 30.1 percent in 1981. These data show further that although French exports of bicycles were substantial and usually exceeded imports, the amount of imports of bicycles into France was also large, ranging from 17.9 percent of apparent consumption in 1978 to 25.9 percent in 1981. This contrasts markedly with Japan, which has virtually no imports of bicycles.

Table 44.--Bicycles: French producers' shipments, exports, imports, and apparent consumption, 1977-82

Year	Producers' shipments	Exports 1/	Imports 1/	Apparent consumption	Ratio of exports to shipments	Ratio of imports to consumption
	1,000 units				Percent	
1977	2,066	465	447	2,048	22.5	21.8
1978	2,183	451	378	2,110	20.7	17.9
1979	2,277	427	466	2,316	18.8	20.1
1980	2,704	631	508	2,581	23.3	19.7
1981	2,140	644	523	2,019	30.1	25.9
1982	2/	505	589	2/	2/	2/

1/ Includes a limited number of other nonmotorized cycles, including delivery tricycles.
2/ Not available.

Source: Producers' shipments, supplied by Chambre syndicale nationale du CYCLE et du motocycle and reported in Annuaire 1982 de Statistique Industrielle, Ministere de la Recherche et de l'industrie. Import and export data for 1977-81, compiled from various issues of Statistic Du Commerce Exterieur de la France, Importations-Exportations NGP, Ministere du Budget Direction Generale des Douanes et Droits Indirects. Import and export data for 1982, supplied by CiSinetwork Corp.

Apparent French consumption of bicycles increased from 2.0 million bicycles in 1977 to 2.6 million bicycles in 1980, and then dropped to 2.0 million bicycles in 1981 with the onset of the recession. French producers' shipments of bicycles followed a similar trend, increasing from 2.1 million units in 1977 to 2.7 million in 1980, and then decreasing sharply to 2.1 million in 1981.

By contrast, French imports of bicycles, after decreasing from 447,000 bicycles in 1977 to 378,000 in 1978, increased without interruption to 589,000 units in 1982.

Exports of bicycles from France decreased from 465,000 units in 1977 to 427,000 units in 1979, and then increased to 631,000 units in 1980 and 644,000 units in 1981. The following year, such exports dropped to 505,000 bicycles. The largest market for French bicycles was the European Community. It was reported that demand in Europe in 1980 for the quality lightweight-type bicycle produced by the French was strong, just as in the United States, and that this is why the Japanese had little European competition in the U.S. market. 1/

Exports of French bicycles to the United States decreased from 114,000 units in 1977 to 63,000 units in 1979, increased to 83,000 units in 1980, decreased to 56,000 units in 1981, and then increased to 82,000 units in 1982 (table 45). Such exports of bicycles as a share of total exports of French bicycles, on a quantity basis, decreased from 24.5 percent in 1977 to 8.7 percent in 1981, and then increased to 16.2 percent in 1982.

1/ The Wall Street Journal, Nov. 4, 1980.

Table 45.--Bicycles: 1/ French exports to the United States and all other markets, 1977-82

(Quantity in thousands of units; value in thousands of francs)

Year	United States	All other	Total	Ratio (percent) of exports to the United States to the world
		Quantity		
1977	114	351	465	24.5
1978	110	341	451	24.4
1979	63	364	427	14.8
1980	83	548	631	13.2
1981	56	588	644	8.7
1982	82	423	505	16.2
		Value		
1977	53,756	155,149	208,905	25.7
1978	55,888	171,976	227,864	24.5
1979	33,034	191,336	224,370	14.7
1980	52,273	318,632	370,905	14.1
1981	47,817	364,896	412,713	11.6
1982	64,339	290,333	354,672	18.1
		Unit value		
1977	F471.54	F442.02	F449.26	-
1978	508.07	504.33	505.24	-
1979	524.35	525.65	525.46	-
1980	629.80	581.45	587.81	-
1981	853.88	620.57	640.86	-
1982	784.62	686.37	702.32	-

1/ Includes a limited number of other nonmotorized cycles, including delivery tricycles.

Source: 1977-81 data compiled from Statistic Du Commerce Exterieur de la France, Importations- Exportations NGP, Ministere du Budget Direction Generale des Douanes et Droits Indirects. 1982 data, supplied by CiSinetwork Corp.

The following tabulation shows the dollar value and unit value of exports of French bicycles to the United States during 1977-82 using the annual average franc per U.S. dollar exchange rate calculated by the International Monetary Fund: 1/

Year	Value 1/ 1,000 dollars	Unit value 1/
1977--------	10,948	$96.04
1978--------	12,392	112.65
1979--------	7,773	123.38
1980--------	12,358	148.89
1981--------	8,806	157.25
1982--------	9,793	119.43

1/ Calculations are based on the following annual average franc per U.S. dollar exchange rate: 1977, 4.91; 1978, 4.51; 1979, 4.25; 1980, 4.23; 1981, 5.43; and 1982, 6.57.

Analysis of exchange rates and other factors influencing U.S. trade 2/

An econometric analysis of bicycle imports was done to determine the importance of exchange-rate changes relative to various other factors that were hypothesized to influence the price and quantity of U.S. imports from Japan. The import price was related to (1) the unit value (in U.S. dollars) of competing sources of bicycles, (2) producer prices for bicycles in Japan, (3) production of bicycles in the United States and Japan, and (4) the exchange rate in units of foreign currency per U.S. dollar.

It was expected that U.S. import prices (in yen) will increase as prices of competing sources of bicycles increase, as the cost of producing bicycles in Japan increases, and as the dollar appreciates and that increases in the levels of bicycle production in the United States and Japan will cause import prices to decrease. The Japanese exporters were expected to raise yen prices as the U.S. dollar appreciates.

The quantity of imports was related to (1) apparent U.S. consumption of bicycles, (2) the U.S. price of bicycles from domestic and foreign sources other than Japan, (3) the estimated import price from the price model, (4) aggregate demand in Japan, and (5) the exchange rate. The hypothesis is that the quantity of bicycles imported from Japan will increase as U.S. demand for bicycles increases, as prices of bicycles from competing sources increase, and as the dollar appreciates and that imports will decrease as the import price of bicycles increases. No prior assumption was made about the effect of nonprice factors in Japan, here represented by Japanese aggregate demand, on U.S. imports.

1/ IMF, International Financial Statistics.

2/ Data used in the development of the econometric model for the six commodities are contained in app. A. App. B contains a discussion of the methodology used and tables B-1 throught B-6, showing the complete regression results.

The econometric analysis indicated that Japanese exporters respond to an appreciation of the U.S. dollar by raising the yen prices of bicycles. 1/ The estimates suggest that if the U.S. dollar appreciates 1 percent, yen prices will rise about 1.4 percent (table 46). 2/ Thus, Japanese exporters appear to change yen prices of bicycles following an exchange-rate change to maintain a relatively stable U.S. price.

The results also suggest that Japanese exporters of bicycles adjust their export prices in response to changes in competitors' prices. A 1-percent increase in competitors' prices leads to approximately a 2-percent increase in Japanese export prices. 3/

These results imply that efforts by the Japanese exporters to promote an image of exclusivity for their bicycles, which sell in the middle to upper price segments of the market, have not made them immune from price competition. The exporters limit their retail distribution, selling them primarily through independent bicycle specialty shops, which offer extensive service to consumers. Moreover, these bicycles often come in custom-fitted frame sizes and with brand names that connote a relatively high level of styling, performance, quality, and individuality which are as important, if not more so, as price. Nevertheless, the results suggest that although the Japanese are able to maintain a relatively constant dollar price for bicycles when exchange rates change, they still adjust their dollar prices when competitors' prices change.

Changes in the yen/dollar exchange rate also significantly affected the quantity of bicycles imported from Japan. The results of the econometric analysis reveal that if the U.S. dollar appreciates by 1 percent, the quantity of bicycles from Japan will increase about 6.9 percent; if the dollar depreciates 1 percent, the quantity will decrease by 6.9 percent (table 47). Although the results support the hypothesis that imports of bicycles are positively related to exchange-rate changes, they appear to be inconsistent with the result from the price equation, which suggests that the Japanese neutralize the effects of the exchange rate on the dollar price of Japanese bicycles. The apparent inconsistency between the results of the effects of the exchange rate on price and quantity may reflect the influence of nonprice factors not captured by variables included in the model. As the U.S. dollar appreciates, Japanese producers may maintain a relatively stable U.S. price, but increase U.S. sales through such nonprice factors as increased advertising, service, and higher quality. Similar factors may also be responsible for the effect of competitors' prices (discussed below) on import prices and volume.

1/ As indicated in table 46, the variables that have a significant or demonstrable effect on export prices are those with a t-ratio (the figure in parentheses) of more than 2.131. When variables have a t-ratio this large or larger, the analyst is 95 percent certain that the estimate is different from zero, or a result that shows no relationship between the variables. The t-ratio for exchange-rate changes is 4.68.

2/ The coefficient on the exchange-rate term was not significantly different from 1 at the 95-percent confidence level.

3/ The coefficient on the competitors' price term was significantly different from 1 at the 95-percent confidence level.

Table 46.--Bicycles: The effects of movements in specified indicators on unit values of U.S. imports from Japan, based on quarterly data for 1977-82 1/

Country	Percentage change in import unit value resulting from a 1-percent change in--				
	Exchange rate 2/	Competitors' price in U.S. market 3/	Japanese producers' price	U.S. production	Japanese production
Japan	1.4488	2.0740	-0.1502	0.2103	-0.0212
	(4.68)	(5.73)	(-0.23)	(1.76)	(-0.45)

1/ The unit values were based on the currency of the country of origin. Figures in parentheses are t-ratios. The coefficient is significant at the 1-percent level if the t-ratio exceeds 2.947, and at the 5-percent level if it exceeds 2.131.

2/ Units of foreign currency per U.S. dollar.

3/ The price used in the estimates is a weighted average of U.S. prices of domestic and other foreign sources of bicycles.

Source: Based on data in table B-6.

Table 47.--Bicycles: The effects of movements in specified indicators on the quantity of U.S. imports from Japan, based on quarterly data for 1977-82 1/

Country	Percentage change in the quantity of imports resulting from a 1-percent change in--				
	Exchange rate 2/	Competitors' prices in U.S. market 3/	Estimated U.S. import price 4/	Apparent U.S. consumption	Japanese domestic demand
Japan	6.8867	6.4707	-1.8217	2.5795	-5.3064
	(3.94)	(2.20)	(-0.95)	(6.95)	(-1.20)

1/ Figures in parentheses are t-ratios. The coefficient is significant at the 1-percent level if the t-ratio exceeds 3.055, and at the 5-percent level if it exceeds 2.179.

2/ Units of foreign currency per U.S. dollar.

3/ The price used in the estimates is a weighted average of U.S. prices of domestic and other foreign sources of bicycles.

4/ Based on yen prices.

Source: Based on data in table B-6.

The results for the response of imports to changes in competitors' prices were as expected, i.e., if the bicycle market is competitive, imports should increase in response to an increase in competitors' prices. Imports from Japan were significantly affected by changes in competitors' prices; a 1-percent increase in competitors' prices caused a 6.5-percent increase in imports from Japan. The results indicate that imports were not significantly affected by changes in import prices. However, because the competitors' prices and exchange-rate changes were important determinants of the import price, they may also partially explain the influence of import price on import volume in the import equation.

The quantity of bicycles imported from Japan was also significantly affected by apparent U.S. consumption, used as a proxy for U.S. demand for bicycles. The results suggest that the quantity of imports from Japan increased by 2.6 percent for every 1-percent increase in U.S. demand.

Brass Strip

Product description

Brass strip 1/ is a semimanufactured or wrought copper product produced by the brass mill industry. Brass is a metal in which the copper content is, by weight, less than 99.3 percent, and in which zinc is the principal alloying element, possibly with small quantities of aluminum, iron, manganese, nickel, tin, and lead. Strip is a product of solid rectangular cross section not over 0.188 inch but over 0.006 inch in thickness, in coils or cut to length, and not over 20 inches in width. Approximately 90 percent of brass strip is composed of 70 percent copper and 30 percent zinc, and the majority is .020 inch to .040 inch in thickness and 1 to 7 inches in width. Although its properties vary with the chemical composition, brass strip, like other copper products, is noted for its ease of fabrication, tensile strength, ductility, thermal conductivity, and superior resistance to corrosion.

The production of brass strip involves several stages, including casting, rolling, annealing, and finishing. The manufacturing process begins with the reception and segregation of scrap brass (which can account for up to 70 percent of the metallic input). The scrap metal is segregated by alloy composition. The scrap is then sized, cleaned, and prepared for mixture with enough virgin metals (e.g. copper, zinc, nickel, and tin) to achieve the desired alloy characteristics. Mixing is accomplished by melting these metals together in electric induction furnaces, although carbon arc and gas-fired reverberatory furnaces are sometimes used.

Casting is accomplished by pouring the molten metal from the furnace into a stationary water-cooled mold or by continuous casting. The stationary mold forms a thick, flat slab normally 4 to 7 inches thick, 18 to 28 inches wide, and 6 to 10 feet long. The slabs produced in stationary molds are "cropped" (usually by sawing) on each end, to remove unsound metal in the casting. The slabs are then cut into lengths for the next step in the process, rolling. In continuous casting, the molten metal is poured from the melting furnace into holding furnaces from which metal is withdrawn continuously into short, vertically oscillating molds equipped with rapid-metal-cooling systems. The slabs resulting from continuous casting are normally not cropped, since this casting method does not produce imperfections which require such treatment. Production yield and quality are normally higher for continuously cast products, compared with those produced by stationary mold casting, with the higher yields resulting in lower production costs. Slabs may then be cut into usable lengths before transfer to sheet or plate mills for further processing.

1/ Imports of this product are provided for in the Tariff Schedules of the United States (TSUS) as follows:

Commodity	TSUS item No.
Brass strips under 1/16 inch in thickness	612.3982
Other brass strips	612.3986

The second major production step is breakdown rolling, which involves heating and hot-rolling the slabs from the casting shop, although occasionally castings are cold-rolled. After rolling, the surfaces of the metal are overhauled by milling, grinding, or wire brushing to remove casting imperfections and any other surface flaws. The rolling and overhauling operations are followed by intermediate cold-rolling and finished cold-rolling to achieve desired product thicknesses, widths, and lengths.

During the rolling process, the metal is annealed (i.e., heated and then cooled) to restore ductility to the metal and impart the desired physical properties to the finished product. The brass strip is then flattened, straightened, slit, cut to length, and subsequently tested, marked, packed, and weighed for shipment.

Brass strip has unique applications for use in heat exchangers, radiators, convectors, and evaporators. Major end-use applications of products produced from brass strip include builders' hardware items, such as locksets; keys and key blanks; switches and circuits used in many household and automotive products; motors and generators; clothing fasteners, such as zippers; timing devices; and jewelry.

U.S. industry

The industry which produces brass strip is normally referred to as the brass mill industry, a part of the copper-fabricating industry which produces copper and copper alloy plate, sheet, strip, rod, wire, and tube. Many brass mills produce several types of copper alloy strip in addition to brass, such as bronze, nickel silver, phosphor copper, and cupronickel strip. Brass strip, however, is the dominant copper alloy strip, accounting for about 70 percent of brass mill industry production. A fully integrated brass mill has its own casting facilities and produces a full range of these copper alloy products.

According to the U.S. Bureau of Mines, there are 47 brass mills in the U.S. copper industry, 30 of which are estimated to produce brass strip. The mills are located primarily in New England, with a few located in the Midwest. Entrance into the brass mill industry has been limited by the requirement for high capital investment and the industry's low rate of return and profitability in recent years. The brass mill industry had a capacity for total copper alloy strip production of approximately 423 million pounds in 1979, 411 million pounds in 1980, 405 million pounds in 1981, and 403 million pounds in 1982. The capacity utilization ratio, as reported by trade sources, was 84 percent in 1979, 74 percent in 1980, 91 percent in 1981, and 74 percent in 1982. 1/

Several of the domestic primary copper producers participate either directly or through subsidiaries in copper and copper alloy fabrication. The brass mill divisions, subsidiaries, and affiliates of the major copper producers are believed to account for 35 to 55 percent of the industry's total fabrication capacity. In terms of industry concentration, it is estimated that the four largest copper fabricating firms together account for about 52

1/ Data provided by the Copper & Brass Fabricators Council (CBFC).

percent of industry sales, and the eight largest firms, 74 percent of sales. 1/ These ratios are comparable with those of the steel industry, where the four largest steel mills together account for 45 to 50 percent of industry production, and the top seven, for 70 percent. However, the copper-refining industry is more concentrated; the four largest companies together account for 87 percent of industry shipments.

The production of brass strip is moderately capital intensive. In 1981, the brass mill industry made new capital expenditures totaling $104.1 million, of which $10.4 million is believed to have been attributable to the brass strip producers. Investment per employee in 1981 was $3,337 for the brass mill industry, compared with $4,156 for all manufacturing. In 1981, the value of output per worker hour was $101 for the brass mill industry, compared with $77 for all manufacturing; payroll accounted for 49 percent of the value added in the brass mill industry, compared with 41 percent for all manufacturing.

According to data provided by the Copper & Brass Fabricators Council (CBFC), capital expenditures in the brass mill industry have been relatively small over the past 6 years, declining from $27.5 million in 1977 to $14.0 million in 1980, before rising to approximately $58.4 million in 1982. Weakness in the market in recent years in terms of shipments, profits, and prices has been a deterrent to new capital investment, as the potential for an adequate return on new investment is limited.

Most of the basic processes employed in the brass mill industry today were developed years ago. Technology changes generally involve those designed to lower brass strip costs and those implemented in response to changes in the applications of brass strip in end-use products. The industry is highly automated, utilizing an array of heavy industrial equipment, which is constantly improving. Product technology changes are few, with most changes occuring as a result of direct material substitution or technological change in end-use markets.

According to the CBFC, the brass mill industry employs 2,139 persons, of which 1,336 workers are production related. These production workers earn an average hourly wage of $8.50 2/ and help to provide the industry with value added by manufacture of approximately $113 million per year. 3/

Total sales for the segment of the brass mill industry producing copper alloy strip declined 32 percent during 1979-82, from $523 million to $354 million. Gross profit declined 54 percent during the period, and net operating profit declined 117 percent. Gross profit as a share of sales declined from 7.9 percent in 1979 to 5.4 percent in 1982, and operating profit as a share of sales declined from 4.1 percent in 1979 to -1.0 percent in 1982.

Financial data for the segment of the brass mill industry producing copper-alloy strip during 1979-82 are provided in table 48.

1/ JRB Associates, Economic Impact Analysis of Proposed Effluent Limitations and Standards for the Copper Forming Industry, U.S. Environmental Protection Agency, November 1982, pp. 3-5 through 3-10.

2/ Data provided by the U.S. Department of Labor, Bureau of Labor Statistics.

3/ CBFC.

Table 48.--Income-and-loss experience of 5 U.S. producers 1/ of copper alloy strip, 1979-82

Item	1979	1980	1981	1982
Total sales----------1,000 dollars--	523,064	483,659	473,172	353,650
Gross profit----------do----	41,340	26,263	40,308	19,095
Net operating profit or (loss) 1,000 dollars--	21,259	6,398	16,124	(3,517)
Ratio to total sales of gross profit----------percent--	7.90	5.43	8.52	5.40
Operating profit or (loss)----do----	4.06	1.32	3.41	(0.99)

1/ These 5 U.S. producers represent approximately 80 percent of total U.S. copper alloy strip production.

Source: Industry Income Statement from the Copper & Brass Fabricators Council.

The segment of the brass mill industry producing copper alloy strip experienced irregularly declining profits since 1979, concluding with a net operating loss during 1982. Profitability in the brass mill industry has been traditionally low, compared with the profitability for all manufacturing. During 1979-82, the operating profit on sales for all manufacturing declined from 7.7 percent in 1979 to 5.1 percent in 1982.

U.S. market

The United States is the world's largest producer and consumer of brass mill products, including brass strip. Copper and brass mill products, including brass strip, are used by thousands of large and small enterprises located throughout the United States in the production of final products. The five major markets for copper and brass mill products are for building and construction, electrical and electronic products, industrial machinery and equipment, consumer and general products, and transportation equipment. The major markets for brass strip are for industrial machinery and equipment, which uses strip as fin stock 1/ in heat exchangers and air-conditioning systems, and for electrical and electronic products, which uses strip in switches and as contacts in computers.

In addition to the general level of economic activity, there are four principal factors which influence demand for copper and brass mill products. They are price, direct material substitution, technological changes in end-use markets, and increased efficiency of copper use. The markets for most of the copper and brass mill products are highly price competitive. Direct substitution of copper and brass mill products has been primarily from materials such as aluminum, plastic, and steel. Copper and aluminum are

1/ The material from which the projecting ribs on a radiator or an engine cyclinder are manufactured. These projecting ribs are the focal point for heat transfer in machinery and equipment.

interchangeable in some heat-exchange applications. However, the inability to repair aluminum radiators is inhibiting widespread use. The greatest replacement of copper by aluminum has been in the transmission of electricity; moreover, substitution of aluminum for copper in building wire has been increasing. In addition, plastic has replaced copper in many plumbing applications. Technological substitution has resulted primarily from developments in microwave technology, communication satellites, and fiber-optic transmission technology which displaces copper and brass mill products by reducing or eliminating the need for copper. Improved copper alloys have made it possible to use substantially less material and still achieve the same product efficiency.

The main importers of brass mill products are distributors and trading companies, many of which have long-established relationships with foreign producers. Contracts are generally written for short-term delivery for a specified quantity and price, which is usually quoted in U.S. dollars. When price is quoted in a foreign currency, the domestic distributors and traders usually hedge against exchange-rate changes by forward buying and selling of various foreign currencies in exchange markets. Industry sources indicate that contracts are not generally renegotiated when sharp variances in exchange rates occur.

Domestic primary brass mills market their products through three channels: directly to end users, to distributors, and to reroll and redraw mills. The distributors serve as adjuncts to the brass mills' selling organization, operating primarily from service centers, carrying inventories, performing processing functions, and warehousing for their customers. Most distributors deal in small orders and short-term sales, filling market gaps, since most brass mills deal directly only in large orders and long-term sales. Distributors account for approximately 12 percent of brass mill product sales. Reroll and redraw mills (secondary mills) are not equipped with casting facilities and, therefore, purchase raw stock from fully integrated rolling mills in a form suitable for further processing and finishing.

Competition among domestic producers is high. Although about 45 percent of the industry is vertically integrated, the nature of the industry is such that individual firms are unable to influence market conditions or prices in a significant manner. Most copper and brass mill products are relatively homogeneous in that they have well-defined physical and performance properties which conform to generally accepted standards in the industry. As a result, there is little in the way of advertising and product differentiation, and competition is based on the basis of prices, financing terms, and service, such as proximity to markets and availability of inventoried products.

The degree of competition between domestic and foreign producers is also high. Differences can occur between the domestic and imported articles in terms of physical and/or quality characteristics. These differences, however, cannot be generalized and are dependent upon the industrial consumers' specific material requirements. According to industry sources, some imports are noted for thinner gauges and higher quality in certain specialty applications. However, there are also imports which compete directly with U.S. products in terms of physical and quality characteristics.

Copper and brass mill products are traded worldwide. In recent years, foreign countries which traditionally supplied only copper ores and concentrates or unwrought copper to the United States, such as Brazil, Mexico, Argentina, and Poland, have been moving into the later stages of copper and brass manufacturing and building copper-fabricating and processing plants near the source of their raw material. This has caused foreign competition from overseas copper-fabricating plants to increase as these countries export more advanced, higher value-added products.

Table 49 shows that during 1978-82, the principal sources of U.S. brass strip imports were West Germany, Japan, the Netherlands, and Canada, respectively. The share of total imports supplied by those sources declined from 90 percent in 1978 to 75 percent in 1982 as new countries such as Brazil became more important.

U.S. imports of brass strip fluctuated during 1978-82, falling from a period high of 100.2 million pounds ($75.6 million) in 1978 to 52.0 million pounds ($59.2 million) in 1980. Imports rose in 1981 to 84.0 million pounds ($84.8 million), before falling to 66.1 million pounds ($62.7 million) in 1982. During this same 5-year period, as can be seen in table 50, the ratio of imports to consumption fluctuated between a low of 11.6 percent in 1980 and a high of 17.8 percent in 1978.

Imports maintained their relative market share, in part, by including in their product mix items with special technological features, such as brass strip of very thin gauges, of nonstandard compositions, and other types which are in limited supply in the United States. Copper-pricing methods have also influenced import levels. In 1978, the peak year for brass strip imports, declining demand and excess inventory depressed world copper product prices. New York and London commodity-exchange copper prices, on which foreign brass strip prices were based, fell below the independently set U.S. copper prices, upon which domestic brass strip prices were set. As a result, U.S. consumers increased their purchases of lower priced, imported brass strip. In response, in mid-1978, U.S. brass producers switched to prices based on commodity-exchange quotations. With increased U.S. price competitiveness, imports declined. Currently, U.S. brass producers use a composite copper price that includes U.S., Canadian, and London Metal Exchange (LME) prices.

Price is the most important factor influencing purchasing decisions in the United States for most brass mill products. There is no problem of availability; capacity both in the United States and abroad exceeded demand throughout 1978-82. Some alloys, however, are patented by U.S. producers and have to be purchased domestically. Foreign producers have open access to U.S. markets; tariff and nontariff barriers are minimal. Foreign tariffs, however, are significantly higher, thereby increasing the landed cost of U.S.-fabricated copper products in foreign markets. The tariff on brass strip in the countries covered in this study are as follows: EC nations, 7.3 percent ad valorem; Japan, 11.6 percent; and Canada, 4.6 percent. This compares with a U.S. duty on brass strip of 2.0 percent ad valorem. For long-term contracts, location (transportation costs), past service, and timely delivery are also important decision factors.

Table 49.--Brass strip: U.S. imports for consumption, by principal sources, 1978-82

Source	1978	1979	1980	1981	1982
	Quantity (pounds)				
Fr Germ	23,143,321	15,878,178	15,613,256	27,125,557	19,435,615
Japan	34,935,327	15,195,865	13,389,401	16,801,762	11,514,337
Nethlds	12,521,331	13,502,295	8,430,929	12,929,828	9,862,405
Canada	20,008,967	17,009,256	8,548,629	12,005,884	8,096,312
Brazil	32,483	0	202	2,364,542	5,948,973
France	1,562,330	1,013,173	254,715	6,416,424	2,917,256
U King	1,815,900	4,018,998	2,207,223	2,712,668	2,713,805
Hungary	0	4,381	0	45,236	1,728,994
All other	6,161,240	9,153,001	3,569,341	3,550,657	3,887,679
Total	100,180,899	75,775,147	52,013,696	83,952,558	66,105,376
	Value (1,000 dollars)				
Fr Germ	16,686	13,821	17,351	26,880	18,163
Japan	24,770	13,946	15,094	16,855	10,810
Nethlds	10,207	13,373	10,191	14,399	10,368
Canada	16,788	16,756	10,128	12,799	8,763
Brazil	23	-	1/	2,072	5,105
France	1,201	989	276	5,986	2,397
U King	1,434	3,931	2,306	2,393	2,375
Hungary	-	4	-	40	1,367
All other	4,501	7,742	3,818	3,373	3,368
Total	75,610	70,561	59,164	84,798	62,716
	Unit value (per pound)				
Fr Germ	$0.72	$0.87	$1.11	$0.99	$0.93
Japan	0.71	0.92	1.13	1.00	0.94
Nethlds	0.82	0.99	1.21	1.11	1.05
Canada	0.84	0.99	1.18	1.07	1.08
Brazil	0.71	-	1.66	0.88	0.86
France	0.77	0.98	1.08	0.93	0.82
U King	0.79	0.98	1.04	0.88	0.88
Hungary	-	0.90	-	0.89	0.79
All other	0.73	0.85	1.07	0.95	0.87
Average	0.75	0.93	1.14	1.01	0.95

1/ Less than 500.

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 50.--Brass strip: U.S. producers' shipments, exports of domestic merchandise, imports for consumption, and apparent consumption, 1977-82

(Quantity in thousands of pounds; value in thousands of dollars; unit value per pound)

Year	Producers' shipments 1/	Exports	Imports	Apparent consumption	Ratio (percent) of imports to consumption
	Quantity				
1977	436,111	233	57,958	493,836	11.7
1978	464,243	598	100,181	563,826	17.8
1979	478,316	844	75,775	553,247	13.7
1980	399,381	1,213	52,014	450,182	11.6
1981	446,435	2,001	83,953	528,387	15.9
1982	340,146	818	66,105	405,433	16.3
	Value 2/				
1977	366,333	258	46,222	412,297	11.2
1978	385,322	2,040	75,610	458,892	16.5
1979	540,497	3,460	70,561	607,598	11.6
1980	471,270	3,703	59,164	526,731	11.2
1981	495,543	3,706	84,798	576,635	14.7
1982	353,752	818	62,716	415,650	15.1
	Unit value				
1977	$0.84	$1.10	$0.80	-	-
1978	.83	3.41	.75	-	-
1979	1.13	4.10	.93	-	-
1980	1.18	3.05	1.14	-	-
1981	1.11	1.85	1.01	-	-
1982	1.04	3.99	.95	-	-

1/ Quantity estimated by the staff of the International Trade Commission based on data published in Copper Development Association Market Data. The unit value is the transaction price of copper alloy strip, as reported in Copper Alloy Strip Industry Pricing, published by the Copper & Brass Fabricators Council (table 4A). Value is derived from shipment and unit value data.

2/ Value for imports is the customs value, which does not include U.S. import duties, insurance, freight, and other charges in bringing the merchandise to the United States.

Source: Compiled from official statistics of the U.S. Department of Commerce, except as noted.

Commodity prices in the U.S. market

The major determinants of brass strip prices in the U.S. market are copper costs, fabricating costs, and market conditions, particularly levels of demand and competition. All domestic brass strip producers formulate list or book prices, which are changed periodically as costs and market conditions fluctuate. However, in recent years, intense competition among brass mill product producers has resulted in significant discounting from these list or book prices, with industry sources reporting price discounts of as much as 30 percent based on quantities purchased and trade frequency.

Raw materials constitute the major cost component, the most important of which is copper. Copper prices have historically been based on two major price systems: producer prices set independently by major primary U.S. and Canadian producers and prices established on metal/commodity exchanges such as the LME and the New York Commodity Exchange. Metal costs fluctuate frequently, and since they currently represent about 75 percent of total production costs, they have a great impact on finished-product pricing. Average domestic producer prices for refined copper declined during 1977 and 1978, rose during 1979 and 1980, and declined during 1981 and 1982. London Metal Exchange refined copper prices rose steadily during 1977-80 and then declined during 1981 and 1982.

Production of brass mill products involves converting a relatively high-cost raw material at relatively low and highly competitive fabricating charges. Fabricating costs in the brass mill industry include such items as labor, energy, and environmental compliance costs. Labor costs, as measured by the production workers' average hourly earnings, increased steadily during 1978-82, from $6.79 to $8.60. These increased costs have been partially offset, however, by increased productivity, and labor costs currently represent about 12 percent of total production costs. Production per person-hour rose from 94 to 104 pounds during 1979-82; value added per person-hour rose from $28.33 to $36.16. Energy costs are high compared with manufacturing industries of nonmetals (about 11 percent of total cost), though progress has been made in recent years in energy conservation. State and Federal regulations have had a significant impact on the brass mill industry, especially in terms of Environmental Protection Agency and Occupational Safety and Health Administration regulations. These costs include one-time capital expenditures on pollution control equipment, and operating and maintenance expenses, which add to average production costs. Expenditures by copper alloy strip producers for environmental compliance averaged $200,000 during 1978-82 and accounted for about 3 percent of industry capital expenditures during the period.

Demand for brass mill products depends on activity in markets for finished goods, such as plumbing materials, roofing, wiring, and heat exchangers. Prices tend to be highly variable, due in part to constantly changing raw material costs and in part to the highly competitive nature of the industry. In periods of general economic expansion, the industry's end-use markets expand, and prices for brass mill products tend to increase. During 1977-79, apparent consumption of brass strip increased, as did U.S. shipments and unit values (table 50). During 1980-82, as a result of lowered demand, apparent consumption and U.S. shipments trended downward, to below 1977 levels, and unit values dropped to below 1979 levels.

Domestic price levels for brass mill products also reflect competition from competing aluminum, plastic, or other products. Because of technological constraints, brass mill product purchasers do not generally alter their consumption to reflect short-term or minor price changes. This is because even though some materials can be substituted for brass mill products in some applications, it is often not possible for consuming industries to make a direct substitution of one material for another in a continuous manufacturing process. Rather, material substitutions usually take place over a relatively long period of time and only if (1) the substitute material maintains desirable properties at low cost, (2) the substitute is perceived to be available in sufficient quantities, and (3) the substitute is adaptable to commercial manufacturing processes.

Imports are also important in domestic pricing decisions. The unit value of U.S. brass strip shipments exceeded the unit value of brass strip imports 1/ in all years during 1977-82 (table 50). The price difference ranged from 4 cents per pound, in 1977, to 9 cents per pound, in 1982. Domestic producers must take into account the actions of foreign suppliers in their pricing policies or risk losing a portion of their markets to foreign producers in this price-sensitive market.

Wholesale (producer) list prices for brass strip were $1.12 per pound at the beginning of 1977 and were $1.47 per pound at yearend 1982 (table 51). Brass strip prices peaked at $1.52 per pound in October-December 1981 and reached its lowest level during the period at $1.05 per pound in October-December 1977. Wholesale prices fluctuated during 1977-82 within a 45-percent range. Wholesale prices for brass strip generally declined during 1977 and 1978, rose during 1979 and 1980, and then declined during 1981 and 1982. Prices of imported brass strip followed the same pattern as domestic wholesale prices.

1/ Import unit values calculated using customs value data.

Table 51.--Brass strip: Average U.S. wholesale prices, by quarters, 1977-82 1/

(Per pound)

Year	January-March	April-June	July-September	October-December
1977	$1.12	$1.12	$1.07	$1.05
1978	1.08	1.11	1.14	1.19
1979	1.35	1.34	1.39	1.48
1980	1.51	1.44	1.45	1.47
1981	1.48	1.51	1.52	1.52
1982	1.50	1.45	1.45	1.47

1/ The Bureau of Labor Statistics attempts to base Producer Price Indexes on actual transaction prices (questionnaire respondents are asked to provide net prices or to provide all applicable discounts); however, list or book prices are used if transaction prices are not available, as in this case.

Source: Producers Prices and Price Indexes Data for copper-base alloy strip, reported by the U.S. Department of Labor, Bureau of Labor Statistics. Data for 1977, taken from Wholesale Prices and Price Indexes for Commodity Groupings and Individual Items for cartridge brass strip 70-30 alloy which was converted as stated above in January 1978.

Foreign industries

World production of copper semimanufactures (which includes brass strip) is shown in table 52.

Table. 52--Copper semimanufactures: World production, by principal countries, 1977-82

(In thousands of tons)

Country	1977	1978	1979	1980	1981	1982
United States	2,808.4	2,953.0	3,069.9	2,654.4	2,742.0	2,228.5
Japan	1,713.9	1,891.4	2,018.2	1,959.1	1,940.5	1,908.1
West Germany	1,031.1	1,109.8	1,199.2	1,232.7	1,169.1	1,147.1
France	637.9	645.1	672.2	725.6	716.2	716.8
Italy	582.0	580.9	585.3	659.2	619.5	584.2
United Kingdom	741.7	745.0	708.4	597.9	513.7	541.1
Benelux 1/	486.8	465.0	485.2	487.1	423.5	408.5
Canada	285.8	319.0	324.8	256.1	311.5	216.1
All others	1,257.7	1,320.4	1,389.3	1,452.2	1,229.0	1,159.5
Total	9,545.4	10,029.6	10,452.7	10,024.3	9,664.9	8,909.9

1/ Includes Belguim, the Netherlands, and Luxembourg.

Source: World Bureau of Metal Statistics, World Metal Statistics.

During most of 1977-82, the production of copper semimanufactures in most countries was fairly stable, except that in the United Kingdom, which showed a 27-percent decline in production, and Brazil, Mexico, the Republic of Korea (Korea), Taiwan, and Yugoslavia, which each showed increases of at least 50 percent in production over the period. Although none of these countries are major producers of copper semimanufactures at present, this trend indicates that they may develop a larger and more meaningful share of world production and trade.

There are three countries which predominate in the world production of copper semimanufactures: the United States, Japan, and West Germany, respectively. These three countries together accounted for 59 percent of total world production of these products in 1982. The other two countries covered in this study are ranked as follows: Canada, eighth, and the Netherlands, eighteenth.

West Germany and Japan were selected for analysis in this study, because they have been the major sources of U.S. brass strip imports over the past 6 years, together accounting for 51 percent of the imports during 1978-82. The Netherlands and Canada accounted for an additional 33 percent. Producers in the four countries have a competitive advantage, compared with U.S. brass strip producers with respect to the cost of copper. West Germany, Japan, and the Netherlands import large quantities of copper from low-cost producers such as Papaua New Guinea, Mexico, the Philippines, Zaire, and Chile. Canada, because of its rich copper resources and low mining and refining costs, is also a lower cost copper producer than the United States. The United States is considered to be the world's highest-cost copper producer, and it is primarily domestic copper which is used by U.S. brass mills. Industry sources also indicate that plants in West Germany and Japan are newer than those in the United States, giving them more flexibility and higher productivity than their U.S. counterparts. However, freight, insurance, import duties, and other importing costs partially offset foreign cost advantages.

West Germany.--West Germany is Europe's largest producer and consumer of semimanufactured copper and serves as the regional trade center of the metals industry for the EC. West Germany depends heavily on raw material imports, because domestic production of copper ores, concentrates, and scrap is inadequate. There is only limited vertical integration in the industry. Generally, the bulk of the semimanufactures and castings produced are consumed domestically or within the European Community, with other trade in semimanufactures limited to a small portion of total production. The main product lines of the copper alloy semimanufactures industry in West Germany consist of rod, bar, and sections, followed by plate, sheet, and strip.

West Germany exports 44 percent of the copper alloy plate, sheet, and strip that it produces. In the case of brass strip, other EC countries serve as its primary export market, receiving a total of 56 percent of West Germany's brass strip exports. The United States is West Germany's second largest export market, accounting for 28 percent of its brass strip exports.

The latest statistics published for West Germany's manufacturing industries 1/ cover the production and preliminary processing of nonferrous metals in 1979. According to these statistics, this sector had 152 firms employing 74,593 people. It is believed that only about 12 companies, operating 18 plants, were actively engaged in the production of brass strip. 2/

These statistics further indicate that in 1979, the production value of the nonferrous metals industry was $9.2 billion; sales and revenue for the year amounted to $8.8 billion. The cost of materials and services amounted to $6.3 billion (68 percent of production value), and the gross value-added factor was $2.4 billion (26 percent of production value). The West German industry had labor costs of $1.7 billion (18 percent of production value) in 1979, of which gross wages and salaries accounted for $1.4 billion. Of the sales of nonferrous metals, $6.7 billion (76 percent of sales) was attributable to intermediate consumption--the production of pure and alloyed nonferrous semimanufactures and castings. Production of brass sheet, strip, and plate rose 13 percent from 69,600 tons in 1978 to 78,300 tons in 1981. 3/

The average unit value of brass strip imported from West Germany, after increasing significantly during 1978-80, declined steadily in 1981 and 1982 (table 53). However, the 1982 price level was still higher than that in 1978 and 1979.

Table 53.--Brass strip: U.S. imports from West Germany, by quarters, 1978-82

(Per pound)

Year	January-March	April-June	July-September	October-December
1978	$0.74	$0.70	$0.71	$0.72
1979	.82	.85	.89	.92
1980	1.08	1.20	1.07	1.08
1981	1.08	.99	.96	.94
1982	.93	.94	.94	.93

Source: Compiled from offical statistics of the U.S. Department of Commerce.

1/ Statistical Office of the European Communities (Eurostat), "Structure and Activity of Industry," Coordinated Annual Inquiry into Industry Activity in the Member States, Luxembourg.

2/ Metal Bulletin Books Ltd., Non-Ferrous Metal Works of the World, London, third edition, 1982.

3/ Organization for Economic Co-Operation and Development, The Non-Ferrous Metals Industry, Paris.

The following tabulation shows quantity and value data on brass strip from West Germany on an annual basis, 1977-82: 1/

Year	Quantity (1,000 pounds)	Value (1,000 dollars)
1977	92,745	85,895
1978	83,381	69,589
1979	82,551	85,469
1980	84,786	98,851
1981	115,158	110,826
1982	109,566	98,049

Japan.--With the exception of Russia and China, Japan is Asia's largest producer and consumer of semimanufactured copper and serves as the regional trade center of the metals industry for Asia. Japan depends heavily on raw material imports, because domestic production of copper ores, concentrates, and scrap is inadequate. As an industry which developed in the post-World War II national economic expansion, production expanded particularly quickly in those copper products controlled by a few manufacturers. Growth in output was the result of an increase in domestic demand combined with vigorous growth in exports.

Japan exports 18 percent of the copper alloy plate, sheet, and strip that it produces. The primary export markets for these products are China and Taiwan, accounting for 24 and 23 percent, respectively, of Japan's brass mill product exports. The United States is Japan's third largest export market, accounting for 22 percent of brass mill product exports.

The latest statistics published for Japan's manufacturing industry 2/ cover the manufacturing of nonferrous metal products in 1980. According to these statistics, this sector had 4,259 establishments, employing 190,000 persons. It is believed that only approximately three companies, operating five plants, were actively engaged in the production of brass strip. 3/

These statistics further indicate that in 1980, the value of production of nonferrous metal products was $3.6 billion; sales for the year totaled $4.3 billion. The value of raw materials used totaled $2.7 billion (75 percent of the value of production), and the value added was $857 million (24 percent of the value of production). The Japanese industry had labor costs consisting of $18 million as compensation for management employees, and $315 million as compensation for workers in 1980. Earnings of the nonferrous metal products industry of Japan in 1980 totaled $265 million (6 percent of sales). Production of copper alloy strip rose 10 percent during 1978-81, from 167,444 tons in 1978 to 183,750 tons in 1981. 4/

1/ Federal Statistical Office, Foreign Trade by Commodities and Countries (special trade), Wiesbaden.

2/ Research and Statistics Department, Minister's Secretariat, Ministry of International Trade and Industry, Japan Statistical Yearbook.

3/ Metal Bulletin Books Ltd., op. cit.

4/ World Bureau of Metal Statistics, World Metal Statistics, London.

The average unit value of brass strip imported from Japan increased each quarter from 1978 through April-June 1980, and then declined steadily in 1981 and 1982 (table 54).

Table 54.--Brass strip: U.S. imports from Japan, by quarters, 1978-82

(Per pound)

Year	January-March	April-June	July-September	October-December
1978	$0.69	$0.70	$0.72	$0.74
1979	.78	.90	1.00	1.01
1980	1.07	1.20	1.14	1.07
1981	1.05	1.02	1.01	.94
1982	1.00	.95	.89	.86

Source: Compiled from offical statistics of the U.S. Department of Commerce.

The following tabulation shows data taken from the Japan Tariff Association, Japan Exports and Imports, Commodity by Country, on Japan's exports of brass plate, sheet, and strip, by quantity and by value, 1977-82:

Year	Quantity (1,000 pounds)	Value (1,000 dollars)
1977	90,345	71,530
1978	86,031	69,712
1979	76,708	83,159
1980	85,134	104,135
1981	84,155	91,361
1982	76,710	76,567

Netherlands.--The Netherlands serves as an auxiliary metal-processing center for the EC. The Netherlands has a very small copper and copper alloy semifabricating industry, with international trade in semimanufactures limited to a small portion of total production. The country depends heavily on refined copper imports, because it has no domestic production of copper ores and concentrates or unwrought copper. The main product sectors of the copper alloy semimanufactures industry in the Netherlands are made up of rod, bar, and sections, followed by plate, sheet, and strip.

The Netherlands exports 66 percent of the copper and copper alloy semimanufactures that it produces. The United States is its primary export market, receiving 49 percent of Netherlands' exports. The other EC countries account for 30 percent of the Netherlands brass mill product exports, and are its second largest export market.

It is believed that only one company is actively engaged in the production of brass strip. 1/ Production of semifinished copper products declined by 28 percent during 1978-81, from 59,400 tons to 43,000 tons. 2/

Table 55 shows that the average unit value for brass strip from the Netherlands increased steadily during 1978 through mid-1980, when it peaked at $1.27 per pound, and then declined each quarter until October-December 1982, when it rebounded to $1.15 per pound.

Table 55.--Brass strip: U.S. imports from the Netherlands, by quarters, 1978-82

(Per pound)

Year	January-March	April-June	July-September	October-December
1978	$0.81	$0.80	$0.82	$0.84
1979	.90	.97	1.04	1.08
1980	1.13	1.27	1.22	1.21
1981	1.17	1.12	1.10	1.07
1982	1.08	1.09	.92	1.15

Source: Compiled from offical statistics of the U.S. Department of Commerce.

The following tabulation shows data on Netherlands' exports of brass plate, sheet, and strip, by quantity and by value, 1977-82: 3/

Year	Quantity (1,000 pounds)	Value (1,000 dollars)
1977	19,839	17,538
1978	19,107	16,685
1979	22,295	23,990
1980	19,363	23,934
1981	20,983	22,569
1982	18,391	18,296

Canada.--Canada is not a relatively large producer or consumer of semimanufactured copper. Canada has a captive raw materials base which is lower cost than that of the United States, primarily because of the richness of its copper resource base and generally lower copper-mining and refining costs. The copper and brass mills of Canada make plate, sheet, strip, rod, bar, roll, pipe and tube. Most plants have melting and alloying furnaces and cast most of their own copper and alloy cakes and billets. Four principal

1/ Metal Bulletin Books Ltd., op. cit.
2/ Organization for Economic Co-Operation and Development, op. cit.
3/ Netherlands Central Bureau of Statistics, Monthly Statistical Bulletin of Foreign Trade, by Commodities.

companies operate copper and brass mills in Canada (only three of these produce brass strip 1/), of which one is integrated (i.e., it mines, smelts, and refines copper).

Canada exports 19 percent of the copper alloy semimanufactures (excluding tubes) that it produces. The United States is, by far, Canada's primary export market, accounting for 82 percent of the country's exports. Canada is a major trading partner of the United States in these commodities primarily because of its proximity to the United States and the interlocking ties of industry ownership between the two countries.

The latest statistics published for Canada's manufacturing industries 2/ cover copper and copper alloy rolling, casting, and extruding in 1980. According to these statistics, this industry segment had 42 establishments, employing 2,707 people.

These statistics further indicate that in 1980, the value of shipments of goods of own manufacture was $490 million. The cost of materials and supplies amounted to $387 million (79 percent of the value of shipments), and the value added was $90 million (18 percent of the value of shipments). The Canadian industry had labor costs of $41 million (8 percent of the value of shipments) in 1980. Production of copper alloy sheet, rods, wire, and other semimanufactures declined 11 percent during 1978-81, from 76,773 tons in 1978 to 68,100 tons in 1981.

The average unit value of brass strip from Canada increased steadily during 1978 and 1979, from 81 cents per pound to $1.05 per pound. During January-March 1980, it rose to $1.24 per pound, and then declined erratically until October-December 1982, when it reached $1.30 per pound, the highest amount for the period (table 56).

Table 56.--Brass strip: U.S. imports from Canada, by quarters, 1978-82

(Per pound)

Year	January-March	April-June	July-September	October-December
1978	$0.81	$0.84	$0.85	$0.86
1979	.87	1.02	1.02	1.05
1980	1.24	1.17	1.16	1.14
1981	1.07	1.05	1.07	1.09
1982	1.17	1.01	.95	1.30

Source: Compiled from offical statistics of the U.S. Department of Commerce.

1/ Metal Bulletin Books Ltd., op. cit.

2/ "Copper and Copper Alloy Rolling, Casting and Extruding," Annual Census of Manufactures, Statistics Canada.

The following tabulation shows data on Canada's exports of brass strip, 1/ by quantity and by value, 1977-82:

Year	Quantity (1,000 pounds)	Value (1,000 dollars)
1977	3,159	4,042
1978	3,112	3,507
1979	3,601	4,798
1980	3,772	6,401
1981	3,092	5,811
1982	1,773	3,314

Analysis of exchange rates and other factors influencing U.S. trade 2/

An econometric analysis of brass strip imports was done to determine the importance of exchange-rate changes relative to various other factors that were hypothesized to influence the price and quantity of U.S. imports from Japan and West Germany. The import price in the exporters' currency was related to (1) the unit value (in U.S. dollars) of competing sources of brass strip, (2) the price of copper on the London Metal Exchange, (3) production of brass strip in the United States and the selected foreign country, and (4) the bilateral exchange rate in units of foreign currency per U.S. dollar.

The hypothesis is that U.S. import prices will increase as competitors' prices of brass strip increase, as the costs of producing brass strip in the foreign country increase (i.e., copper prices), and as the dollar appreciates and that increases in the levels of production of brass strip in the United States and the foreign country will cause import prices to decrease.

The quantity of imports was related to (1) apparent U.S. consumption of brass strip, (2) the U.S. price of brass strip from domestic and foreign sources other than the selected country, (3) the estimated import price from the price model, (4) nonprice factors in the country of origin, and (5) the exchange rate. The hypothesis is that the quantity of U.S. imports of brass strip will increase as U.S. demand for brass strip increases, as prices of brass strip from competing sources increase, and as the dollar appreciates and that imports will decrease as the estimated import prices increase. No prior assumption was made about the effects of nonprice factors on import volume.

1/ Exports of copper and alloy fabricated material, not elsewhere specified (includes brass strip and other products). Trade of Canada, "Exports, Annual Merchandise Trade," Statistics Canada.

2/ Data used in the development of the econometric model for the six commodities are contained in app. A. App. B contains a discussion of the methodology used and tables B-1 through B-6, showing the complete regression results.

Japan.--Prices of brass strip from Japan were significantly affected by several factors, including changes in the bilateral exchange rate. 1/ As shown in table 57, the results of the econometric analysis indicate that Japanese exporters respond to an appreciation of the U.S. dollar by raising the yen price of brass strip and by lowering the yen price when the dollar depreciates. The estimates suggest that if the U.S. dollar appreciates 1 percent against the yen, yen prices will rise approximately 0.7 percent. 2/ Thus, U.S. dollar prices of brass strip from Japan will decline approximately 0.3 percent following a 1-percent appreciation of the dollar.

Japanese exporters appear to increase their prices in response to changes in the price of raw materials, here represented by world copper prices, and in the price of competing sources of brass strip. The estimated relationship between copper prices and the price of U.S. brass strip imports from Japan suggests that Japanese exporters pass through approximately 66 percent of the change in the price of copper. Also, the results show that the Japanese exporters do not change yen prices by the full percentage amount of the change in their competitors' prices. Some product differentiation may exist in the brass strip market that permits the Japanese more autonomy in their pricing decisions.

1/ As indicated in table 57, the variables that have a significant or demonstrable effect on import prices are those with a t-ratio (the figure in parentheses) of more than 2.160. When variables have a t-ratio this large or larger, the analyst is 95 percent certain that the estimate is different from zero, or a result that shows no relationship between the variables. Since the t-ratio for exchange-rate changes is 5.95, this variable is considered significant.

2/ The coefficient on the exchange-rate term was significantly different from 1 at the 95-percent confidence level.

Table 57.--Brass strip: The effects of movements in specified indicators on unit values of U.S. imports from Japan and West Germany, based on quarterly data for 1977-82 1/

Country	Percentage change in import unit value resulting from a 1-percent change in--				
	Exchange rate 2/	U.S. production	Competitors' prices in U.S. market 3/	World copper prices	Production in country of origin
Japan	0.7303	-0.0853	0.6226	0.6594	-0.5389
	(5.95)	(-1.69)	(5.03)	(11.49)	(-2.28)
West Germany	1.4341	-0.0815	-0.3501	1.0932	-0.1610
	(5.40)	(-0.96)	(-1.23)	(5.37)	(-0.93)

1/ The unit values were based on the currency of the country of origin. Figures in parentheses are t-ratios. The coefficient is significant at the 1-percent level if the t-ratio exceeds 3.012, and at the 5-percent level if it exceeds 2.160.

2/ Units of foreign currency per U.S. dollar.

3/ The U.S. price used is a weighted average of the U.S. prices of domestic and imported brass strip.

Source: Based on data in table B-5.

Table 58.--Brass strip: The effects of movements in specified indicators on the quantity of U.S. imports from Japan and West Germany, based on quarterly data for 1977-82 1/

Country	Percentage change in quantity of imports resulting from a 1-percent change in--				
	Exchange rate 2/	Competitors' prices in U.S. market	Estimated U.S. import price 3/	Apparent U.S. consumption	Demand in country of origin
Japan	2.0992	-0.4961	-0.4229	1.4475	4/ -7.9869
	(1.59)	(-0.92)	(-0.70)	(4.01)	(-3.27)
West Germany	-2.5903	-4.2479	-3.3363	0.8665	5/ 13.1588
	(-3.28)	(-2.60)	(-4.59)	(3.05)	(1.80)

1/ Figures in parentheses are t-ratios. The coefficient is significant at the 1-percent level if the t-ratio exceeds 3.055, and at the 5-percent level if it exceeds 2.179.

2/ Units of foreign currency per U.S. dollar.

3/ Based on the currency of the country of origin.

4/ Factor used was Japanese aggregate domestic demand.

5/ Factor used was West German gross national product.

Source: Based on data in table B-5.

Also significantly influencing import prices was Japanese production of brass strip. 1/ The results of the econometric analysis indicate that increases in Japanese production will result in declines in the yen prices of Japanese brass strip exports.

Exchange-rate changes were not a significant factor influencing the quantity of imports from Japan, 2/ according to the results of the econometric analysis shown in table 58. The results indicate that increases in apparent U.S. consumption of brass strip, used here as a proxy for demand, led to increased imports. Nonprice factors in Japan, represented by aggregate domestic demand, also significantly affected U.S. imports of brass strip. Increases in aggregate demand in Japan resulted in reduced shipments to the United States. As economic activity improved in Japan, nonprice factors inhibited U.S. imports, perhaps because of tighter capacity utilization in Japan.

West Germany.--The results of the econometric analysis show that the exchange rate significantly affected prices of brass strip imports from West Germany (table 57). 3/ They indicate that if the U.S. dollar appreciates 1 percent relative to the deutsche mark, West German exporters will raise deutsche mark prices approximately 1.4 percent. 4/ The West Germans seem to maintain a relatively constant dollar price of their brass strip following exchange-rate changes.

The only other factor affecting import prices was world copper prices, supporting the hypothesis that copper prices influence brass strip prices. The estimated relationship between copper prices and the price of U.S. brass strip imports from West Germany shows that a 1-percent increase or decrease in world copper prices would result in a corresponding increase or decrease in prices of brass strip from that country of 1.09 percent.

Although the results of the econometric analysis indicate that the exchange rate was significantly correlated to the quantity of U.S. imports of brass strip from West Germany, 5/ the relationship was not expected. It suggests that the import quantity will decrease 2.6 percent following a 1-percent increase in the value of the dollar relative to that of the deutsche mark (table 58). This is contrary to the hypothesis that an appreciation of the dollar will result in an increase in imports. The result also conflicts with the apparent stability of the dollar price found in the price model. Since West Germany imports much of its raw materials, the model for West Germany may include a relationship between exchange-rate changes and West German costs that is not completely captured by the estimated import price, which may explain the unexpected results with respect to exchange rates and imports from West Germany.

1/ The t-ratio for Japanese production is -2.28.
2/ The t-ratio for exchange rates is 1.59.
3/ The t-ratio for exchange rates is 5.40.
4/ However, the coefficient on the exchange-rate term was not significantly different from 1 at the 95-percent confidence level.
5/ The t-ratio for exchange rates is -3.28.

In addition, competitors' price changes also influenced imports in an unexpected manner. The results suggested that an increase in competitors' prices will lead to a decrease in imports from West Germany. A possible explanation is that the results are caused by an excluded variable, which may have a negative relationship with import volume, exchange rates, and competitors' prices. The exclusion of such a variable might lead to a spurious negative coefficient on the exchange-rate variable as well as on the competitors' price variable.

Additional factors found to influence the quantity of imports of brass strip from West Germany were U.S. import prices and apparent U.S. consumption of brass strip, used here as a proxy for domestic demand. The results suggest that imports of brass strip from West Germany are highly sensitive to price, with a 1-percent increase in the deutsche mark price leading to a decline in shipments from that country of 3.3 percent.

Pianos

Product description

Pianos 1/ are keyboard string instruments classified as either uprights (or verticals), which are strung vertically within a rectangular case, or grands, which are strung horizontally within a somewhat wing-shaped case. Uprights are grouped according to the height of the case. Those traditionally used in the home include spinets, measuring 36 to 37 inches; consoles, 38 to 42 inches; and studio uprights, 43 inches and higher. Uprights used in schools, churches, small nightclubs, and other institutions usually range from 46 to 52 inches in height. Grand pianos usually range in length from about 5 to 9 feet, but can be up to 11 feet. Grand pianos are used chiefly in the entertainment industry, although the so-called parlor or baby grands are frequently found in homes. Grand pianos are generally regarded as superior to uprights in terms of tuning stability, touch, beauty, and performance capability.

A piano is made of four essential elements: strings, action, soundboard, and framework. A piano has about 230 steel strings, graduated in length and thickness to one of the 88 notes of the piano's scale. The shortest string in the treble or high section of the scale is about 2 inches long, and the longest in the bass or low section may be 80 inches or more in larger pianos.

The piano action is a complex mechanism. A set of 88 actions consists of up to 8,000 separate parts, mostly of wood, that transmit the energy from the keyboard to the soundboard. The action assembly includes hammers (a wooden head covered with a special felt); a keyboard; the action itself (each action is a system of levers to propel the hammer toward the strings when the player presses the key); and dampers, which press down on the strings to silence them when the player releases the key. Piano actions are not interchangeable.

The soundboard, consisting of a sheet of wood (usually of spruce and at least three-eighths of an inch thick), serves as a resonator. The strings pass over strips of wood (bridges) attached to the soundboard and thus transmit their vibrations to the soundboard.

The framework, consisting of the case and the cast-iron plate, holds the entire piano mechanism together. The case is made of walnut, mahogany, or fruitwood veneer, with a core of poplar, gum, or similar wood. The grand has a bent rim of maple with interior bracings of spruce. The back of an upright is usually made of maple and spruce. The cast-iron plate holds the strings taut by using tuning pins.

1/ Imports of these products are provided for in the Tariff Schedules of the United States Annotated (TSUSA) as follows:

Commodity	TSUSA item No.
Pianos, except grand pianos----------	725.0100
Grand pianos----------	725.0320

Due to variations in the acoustical qualities of pieces of wood, the manufacture of pianos does not readily lend itself to mass-production methods. Pianos are handcrafted for the most part, although use of automated equipment by domestic producers has increased in recent years, including use of automatic bridge-drilling machines and similar equipment.

In terms of quality and appearance, pianos imported by the United States are generally competitive with the domestic instrument. The imports consist of both grand and upright pianos (except spinets). The landed average unit value of imported upright pianos was $972 in 1982, compared with $1,109 for domestically produced uprights. The unit value for imported grand pianos in 1982 averaged $2,516, compared with $5,688 for domestically produced grands. U.S. imports of grand pianos and professional uprights indicate a growing interest on the part of the consumer to obtain pianos with superior tone to that of console or spinet pianos. Principal purchasers of these more expensive pianos tend to be professional musicians or those who have had some music training.

U.S. industry

The number of firms producing pianos in the United States in recent years has remained essentially unchanged at approximately 15. These firms together operated 19 plants devoted to the production of pianos or their components in 1982. Four of the firms also produced organs.

The four largest firms together accounted for 72 percent of domestic production in eight plants in 1982. The other 11 firms operated 1 plant each. Of the 19 plants, 9 were in the mid-South (Tennessee, Mississippi, North Carolina, and Arkansas), 5 were in East North Central States (Indiana, Ohio, and Michigan), and the remaining 5 were located in New York, Connecticut, California, and Utah. In addition, the four largest U.S. firms have production facilities in Canada, Mexico, the Republic of Korea (Korea), the United Kingdom, and Austria. Another firm has a subsidiary in West Germany.

Total employment in the piano industry decreased 33 percent from 6,089 in 1978 to about 4,059 in 1982. About 85 percent of the labor force consisted of production workers, primarily skilled craftmen, such as woodworkers, assemblers, tuners, and finishers.

The production of pianos is characterized by a high degree of labor intensity, as demonstrated by the ratio of production worker wages to value added, which averaged 36 percent, compared with 27 percent for all manufacturing in 1980. Assembly-line-type operations are used to a great extent, but the production process has not undergone significant changes over the years, though there has been an increase in the use of automated equipment, with a few producers using computer-controlled machinery. Efforts toward automation have been concentrated on production of upright pianos, although the degree of automation varies considerably among the producers.

Although the largest domestic manufacturers operate modern, single-story plants, several producers are in multistory buildings, which inhibits efficient work flow. Four of the domestic firms which are somewhat integrated operate plants that are long distances apart, and the costs of transporting components between the plants increases the cost of the product.

Since no producers of keyboard string instruments in the United States are completely integrated, purchases of various components and parts are made from other manufacturers, both foreign and domestic. In addition, specialized plants or foundries cast the iron plates, draw wire for steel strings, and assemble keyboards and actions.

As shown in the following tabulation, the profitability of major U.S. piano manufacturers has dropped abruptly in recent years: 1/

Item	1978	1979	1980	1981	1982
Net sales--1,000 dollars--	257,441	285,681	278,578	286,795	264,643
Net income or (loss) 1,000 dollars--	17,762	14,004	21	23	(3,428)
Ratio of net income or (loss) to net sales----------percent--	6.9	4.9	1/	1/	(1.3)

1/ Less than 0.05 percent.

U.S. market

The piano market is the largest sector of the musical instruments market in the United States, accounting for 20 percent, or $458 million, of the 1.9 billion dollars' worth of retail musical instrument sales in 1981. Of the nearly 55 million people playing musical instruments in the United States today, 33 percent play pianos. Of these, three-quarters are female and the median age is 28 years, according to the American Music Conference.

There are two broad markets for pianos: household and institutional. For use in the home, purchasers tend to select either a spinet or a console piano (industry sources estimate there is one grand piano sold for every 20 uprights sold). For use in schools, churches, and hotels, purchasers usually choose studio uprights, but do purchase some grands, and for use in concert halls, the large grands are the choice. However, these two markets are not completely mutually exclusive; some grands are found in households and some consoles are purchased by institutions.

Apparent U.S. consumption of pianos increased from 229,400 units in 1977 to 244,400 units in 1978, and declined thereafter to 186,000 units in 1982 (table 59). However, the value of U.S. consumption increased 34 percent from

1/ A Study on the Conditions of Competition Between Imported and Domestically Produced Pianos: Report to the Subcommittee on Trade, Committee on Ways and Means, U.S. House of Representatives on Investigation No. 332-159 Under Section 332(b) of the Tariff Act of 1930, USITC Publication 1411, p. 31.

Table 59.--Pianos: U.S. producers' shipments, 1/ imports, exports, and apparent consumption, 1977-82

(Quantity in units; value in thousands of dollars)

Year	Producers' shipments	Imports	Exports	Apparent consumption	Ratio (percent) of imports to consumption
	Quantity				
1977	216,152	24,967	11,472	229,446	10.9
1978	235,627	28,025	19,252	244,400	11.5
1979	230,596	27,189	20,561	237,224	11.5
1980	195,353	25,359	20,151	200,561	12.6
1981	186,362	30,096	21,124	195,334	15.4
1982	159,762	37,925	11,681	186,006	20.4
	Value				
1977	169,533	23,237	9,931	182,839	12.7
1978	203,283	31,389	14,131	220,541	14.2
1979	224,031	34,909	17,794	241,146	14.5
1980	210,732	31,485	20,047	222,170	14.2
1981	222,982	43,539	22,219	244,302	17.8
1982	200,495	58,641	13,270	245,866	23.9
	Unit value				
1977	$784	$931	$866	$796	-
1978	863	1,120	734	902	-
1979	972	1,284	865	1,017	-
1980	1,079	1,242	995	1,108	-
1981	1,196	1,447	1,052	1,251	-
1982	1,255	1,546	1,136	1,322	-

1/ Data submitted by U.S. producers in response to questionnaires of the U.S. International Trade Commission in A Study on the Conditions of Competition Between Imported and Domestically Produced Pianos (investigation No. 332-159) show that U.S. producers' shipments totaled 225,123 units (valued at 204,257 thousand dollars) in 1978, 218,093 units (218,113 thousand dollars) in 1979, 176,302 units (201,677 thousand dollars) in 1980, 173,292 units (212,897 thousand dollars) in 1981, and 149,384 units (193,385 thousand dollars) in 1982. These shipments closely parallel the shipments shown above, which were available on a quarterly basis and which were used in the econometric model.

Source: Producers' shipments, estimated from data supplied by the National Piano Manufacturers Association of America, Inc.; imports and exports, compiled from official statistics of the U.S. Department of Commerce.

$182.8 million in 1977 to $245.9 million in 1982, as a result of increases in the average unit value of both U.S. producers' shipments (60 percent) and of imports (66 percent). The ratio of imports to consumption, in terms of quantity, rose from 10.9 to 20.4 percent during the period.

U.S. imports of pianos, after declining from 28,025 units in 1978 to 25,359 units in 1980, rose significantly to 37,925 units in 1982 (table 60). Japan's share of the import market slipped from 78 to 74 percent in quantity during 1978-82 while Korea's rose from 11 percent to 21 percent.

Imports from Japan were stable during 1978-80, off just 1 percent; imports from Korea tumbled by 55 percent. During 1980-82, however, imports from Korea increased almost fivefold, whereas imports from Japan increased by 29 percent. During 1978-82, the average unit value of imports from Korea rose by 51 percent, compared with a 34-percent increase for those from Japan. Korea's exports to the United States benefited from Generalized System of Preferences (GSP) treatment it received on grand pianos. Despite the large increase in unit values of imported pianos during 1977-82, U.S. imports increased due to increasing popularity of imported professional size uprights and of grand pianos.

U.S. exports of pianos increased gradually during 1978-81, before falling sharply in 1982 (table 59). The sharp drop in exports in 1982 is attributed primarily to the effects of the recession in Canada and Europe, the major markets.

A large number of factors have adversely influenced U.S. consumption of pianos in recent years. The most frequently given reason was high interest rates which increased prices through the entire distribution system and which forced reduction of inventories to avoid high carrying costs. Also, increased use of television and stereophonic equipment and growing interest in other musical instruments and in many other kinds of recreation have diverted money and time away from pianos. Moreover, since many young people are introduced to music through school programs, sales of musical instruments, including pianos, are influenced by the rate of expenditures in public school systems for music programs. Budget cuts by States such as Massachusetts and California, along with education fund cuts by the Federal Government, have curtailed music programs in major markets. Institutional sales are estimated to have declined by 50 percent during 1981 and 1982. Finally, because a large share of all piano purchases are made by young families for their children to learn piano playing, the composition of the population in terms of age and the rate of population increase or decrease also influence the market for pianos. The population of children aged 5 to 14 (the age range most likely for beginning piano lessons) declined by 10 percent from 1975 to 1981. 1/

1/ U.S. Bureau of the Census, Estimates of the Population of the United States, by Age, and Race: 1970-1981.

Table 60.--Pianos: U.S. imports for consumption, by principal sources, 1978-82

Source	1978	1979	1980	1981	1982
	Quantity (units)				
Japan	21,960	21,957	21,714	24,024	28,219
Republic of Korea	3,195	2,484	1,440	4,351	7,939
West Germany	327	354	267	198	212
Austria	147	139	62	98	139
United Kingdom	2,239	1,967	1,544	1,194	1,143
All other	157	288	332	231	303
Total	28,025	27,189	25,359	30,096	37,925
	Value (1,000 dollars)				
Japan	25,193	27,597	26,386	34,302	43,429
Republic of Korea	3,277	3,144	2,057	6,020	12,294
West Germany	1,497	1,665	1,196	1,481	1,397
Austria	688	1,435	644	1,003	745
United Kingdom	501	495	569	294	385
All other	233	572	632	440	390
Total	31,389	34,909	31,485	43,539	58,641
	Unit value				
Japan	$1,147	$1,257	$1,215	$1,428	$1,539
Republic of Korea	1,026	1,266	1,428	1,384	1,549
West Germany	4,578	4,703	4,479	7,480	6,590
Austria	4,680	10,324	10,387	10,235	5,360
United Kingdom	224	252	369	246	337
All other	1,484	1,986	1,904	1,905	1,287
Average	1,120	1,284	1,242	1,447	1,546

Source: Compiled from official statistics of the U.S. Department of Commerce.

Competition in the U.S. market is based on (1) the characteristics of the piano itself, including tone, price, perceived quality and durability, brand name, and appearance, (2) the services, availability, and promotional activities of the distribution system, and (3) the marketing strategies taken by U.S. and foreign producers. The least expensive pianos, spinets, are supplied almost entirely by domestic producers. However, for most other types of pianos, the imports from Japan are fully competitive and consumer selections are based on the factors listed above. Domestic producers account for over 85 percent of upright sales, while imports supplied about 65 percent of U.S. consumption of grands. Each brand of imported and domestic pianos has its adherents. Some imports offer price advantages over domestic pianos in some models, particularly grands, and the polyester finish 1/ is also viewed

1/ The polyester finish imparts a higher gloss and mar resistance to the piano than the traditional lacquer finish used by domestic producers. The lacquer finish, however, is lower in cost than polyester and more closely resembles other furniture.

as an advantage for the imported pianos. Some piano purchasers feel that the domestic pianos have a mellower tone, need voicing less often and stand up to U.S. climate variations better than imports. Imports are concentrated in areas where it was felt that they could establish a market niche. That is, in large, professional quality uprights and lower priced grands and in products offering styling and the polyester finish that is not available from U.S. producers. However, when all of the factors are taken into account, imported and domestically produced pianos are highly competitive.

There are usually no middlemen involved in the distribution and sale of pianos. Dealers receive their instruments directly from the domestic producer or the importer. Most dealers carry at least two lines of pianos, one of which may be an import. A majority of the musical instrument retailers are independent entrepreneurs (estimated at about 80 percent); many of them are small, family stores. Most manufacturers and the major importers have licensed or franchised dealers which have exclusive sales rights in defined geographical areas. A small number of pianos are sold through accessory distributors, tuner-technicians, and furniture stores, but most are generally sold by musical instrument stores. Services offered by producers to retailers may include consignment sales; retail financing; training programs; promotional support; pianos for rental; special assistance for new stores; and support for music camps, music schools, and artists. Although most producers do not provide all those services, many offer special financing terms to dealers, including extended payment periods and free or shared freight costs, which are customarily borne by the retail dealers. Customary terms are 2 to 3 percent down payment within 10 days of invoice and the balance due in 30 to 45 days. Despite these services, adverse business conditions during 1980-82 resulted in an estimated 1,200 dealers going out of business.

The two major producers in Japan used similar approaches to enter the U.S. market. Each offered a limited selection of moderately priced, fair-quality uprights and grands to the U.S. market. Over the next two decades, each has upgraded the quality of its pianos and has broadened its range of models and finishes. They introduced their high-polish polyester finishes to the U.S. market in 1972, with these finishes eventually accounting for the vast majority of their sales.

One of these Japanese manufacturers has stressed the role of education in developing markets. Through offering seminars for piano tuners and teachers, this manufacturer's piano has become well respected and highly recommended by technicians to potential customers. The firm's pianos are now the most popular brand for institutional buyers. Students who learn to play on its pianos tend to buy its products. The other Japanese producer has also been successful using this approach, but to a much lesser degree. It places more emphasis on the professional market.

The two Japanese producers each maintain a limited number of dealers, generally not allowing more than one per market area. Once a dealership is established by either and beginning inventory is shipped, future shipments will be made only to replace sales. Consequently, when the high interest rates hurt sales during 1980-82, few of their dealers went out of business. Conversely, several U.S. manufacturers persuaded their dealers to increase the number of pianos in their showrooms. Many of these dealers went out of business, because they could not sell their increased inventories at a profit,

and this resulted in a loss of sales outlets for U.S. producers. As dealers sought to limit the lines they carried in order to reduce inventory, the larger Japanese manufacturer became especially attractive because of its broad range of price points, styles, and finishes. The other Japanese producer appealed to dealers because it reportedly had the fastest turnover rate in the industry.

As the Japanese producers upgraded the quality and price of their pianos, three producers in Korea attempted to fill the void created by the exit of Japanese manufacturers from the low-end of the U.S. market. They began exporting to the U.S. market during 1978-81. The high-polish, polyester finish they offered at low price points was an immediate success. By 1980, most of the pianos sold by the Japanese producers had polyester finishes, but they were generally too expensive for parents of beginning piano players. Imports from Korea presented middle-income consumers with a piano they could not previously afford. By then, only one domestic producer was offering a polyester finish. Rather than invest in polyester finishing operations, three of the largest producers began importing from Korea. Another began importing polyester-finish pianos from its subsidiary in West Germany. In addition to requiring a significant capital investment, the application of polyester finishes is labor intensive, giving the Koreans a cost advantage.

Korean producers also quickly began emphasizing low-end, grand pianos. In 1982, 47 percent of the pianos imported from Korea were grands, compared with 35 percent of those imported from Japan and 4 percent of those shipped by U.S. producers. The manufacture of grand pianos is more labor intensive than that of uprights, giving the Koreans a greater cost advantage in producing grand pianos than in making uprights. In addition, many U.S. producers are geared toward the production of uprights and cannot easily convert to the production of grands. Many of the polyester-finish pianos imported by domestic manufacturers are grands.

Certain U.S. producers have advantages over imported pianos because of name recognition due to traditionally high quality or an association with an organ line. These producers may also have an advantage because of the number of dealers with whom they have longstanding relationships. Furthermore, one producer makes a small grand not offered by any other producer or importer that it terms the "home-owner grand." Also, the two domestic producers of player pianos are not challenged by imports.

Commodity prices in the U.S. market

Producer costs directly affect retail price levels of pianos. Manufacturing costs vary considerably and depend principally on labor, raw material, purchased components, and overhead. The most significant portion of a piano's production cost is material, which ranges from about 50 to 60 percent of total costs. U.S. piano producers benefit from domestic availability of lumber and other raw materials; foreign producers, which usually must import these materials, have the advantage of lower labor costs. Producer costs may also include fees for promotion and advertising and for warranties.

The high interest rates for financing for retailers, a condition in the recent recession, has been a factor causing prices of pianos to rise and contributed to a drop in domestic shipments. Most retailers of domestic and imported pianos rely on banks, finance companies, and other such institutions to finance their inventory, and for consumer purchases of pianos. The prime interest rate rose from 8 percent in April 1978 to 19.8 percent in 1980. After a brief respite, the rate remained around 20 percent until October 1981 and stayed above 15 percent until August 1982. Most bank borrowing averaged 3 percent above the prime, and consumers were hesitant to buy pianos at these rates. In addition to interest rates, retailers customarily pay freight costs for their shipments. These costs vary by the distance pianos are shipped and, in some cases, by the size of the order. Promotion and advertising costs and sales commissions are other charges which may ultimately be passed on to the consumer.

The role of imports is considered significant in piano sales, because they allow dealers to complement their line of pianos with a larger selection of items. The imported pianos, particularly the grands, tend to be cheaper than those produced domestically, although the economies of scale of domestic producers have enabled them to produce upright pianos more efficiently than grand pianos, and to be, therefore, more competitive with imports in the upright category. In addition, imported pianos come in styles and finishes not offered by some U.S. producers, as well as the fact that several U.S. producers do not make both uprights and grands.

Importer costs reflect the price of the piano at the port of entry in addition to the margin of markup added by the buyer. In most instances, the buyer is the sales organization of the manufacturing or parent firm. Inland freight costs from the port to the importer's distribution center are passed along to the customer.

Table 61 shows Producer Price Index data for musical instruments, of which pianos are a part, by quarters, during 1977-82. Overall, the index (1978=100) increased from 93.1 in January-March 1977 to 137.7 in October-December 1982, or by 48 percent. The data reflect the general pricing pattern of the industry. The average unit value of apparent consumption of pianos increased 65 percent from 1977 to 1982. The number of pianos consumed dropped by 20 percent during the period, whereas the value increased by 32 percent as prices of pianos increased and as consumers chose to buy more expensive studio and professional uprights and grand pianos. Piano sales generally follow the school year, with heavier buying between mid-August to November.

Table 61.--U.S. Producer Price Index for all musical instruments, 1/ by quarters, 1977-82

(January 1978=100)

Year	January-March	April-June	July-September	October-December
1977	93.1	94.6	96.0	97.1
1978	100.0	101.4	102.5	104.2
1979	107.4	109.6	111.5	113.3
1980	117.2	119.4	121.5	124.5
1981	126.9	128.3	129.8	130.9
1982	134.3	134.5	136.5	137.7

1/ Pianos represent approximately 25 percent of the value of shipments for all musical instruments.

Source: Compiled from official statistics of the U.S. Department of Labor.

Foreign industry

Total world production of pianos annually ranges from 800,000 to 1 million units. About three-fourths of the total is produced by the U.S.S.R. and Japan, each manufacturing approximately 300,000 pianos annually. The United States is the third largest producer, making slightly less than 200,000 pianos a year, or about one-fifth of total world output. Western Europe annually produce about 100,000 pianos, and Korea, 70,000 to 80,000 units.

The piano-manufacturing industry in Japan consists of approximately 25 to 30 companies located principally on the island of Honshu in central Japan. The two largest piano manufacturers in the world are based in Japan, and the five largest manufacturers in Japan are estimated to account for over 90 percent of Japan's annual production. In 1982, production of pianos in Japan is estimated to have been approximately 325,000 units, of which about 25 percent were exported. The United States accounted for about 30 percent of those exports. Tables 62 and 63 show data for exports of pianos from Japan to all countries and to the United States.

Table 62.--Pianos: Exports from Japan to all countries, 1977-81

Year	Quantity	Value	Unit value
	Units	1,000 yen	Yen
1977	58,250	13,962,215	239,695
1978	57,381	13,627,975	237,500
1979	59,209	14,594,589	246,493
1980	72,428	18,975,542	261,992
1981	89,912	26,040,808	289,626

Source: Japan Tariff Association, Japan Exports and Imports: Commodity by Country.

Table 63.--Pianos: Exports from Japan to the United States, 1/ 1977-81

Year	Quantity	Value	Unit value
	Units	1,000 dollars	
1977	20,758	26,282	$1,266
1978	22,279	25,092	1,126
1979	21,359	28,365	1,328
1980	21,351	29,425	1,378
1981	26,865	33,171	1,235

1/ Dollar values for the years calculated using the following yen/dollar exchange rates: 1977=268.51; 1978=210.44; 1979=219.14; 1980=226.74; 1981-220.54.

Source: Japan Tariff Association, Japan Exports and Imports: Commodity by Country.

The level of automation used in the production process of pianos in Japan is generally regarded by U.S. producers and importers as being higher than that used by U.S. producers using technology, such as computer-controlled machines and high-frequency gluing. However, production of the piano is still considered labor intensive, and skilled laborers are employed as woodworkers and finishers. Since the piano has not changed significantly from its original designs, modern producers use automation and technological advances to upgrade production techniques and material used in the production process. In these respects, the Japanese piano producers are considered more advanced than U.S. producers. The major Japanese producers are vertically integrated, in that with the exception of certain raw materials such as lumber and iron ore, and certain components, such as tuning pins and felt, most parts of the pianos, including both wood and metal parts, are fabricated or developed within that firm. Tuning pins are usually purchased from a supplier in Japan, whereas felt may be imported from Europe. Lumber is imported principally from the United States and Canada.

Analysis of exchange rates and other factors influencing U.S. trade 1/

An econometric analysis of piano imports was done to determine the importance of exchange-rate changes relative to various other factors that were hypothesized to influence the price and quantity of U.S. imports from Japan and West Germany. The import price was related to (1) the unit value (in U.S. dollars) of pianos from competing sources, (2) production of pianos in the United States and the selected foreign country, and (3) the bilateral exchange rate in units of foreign currency per U.S. dollar.

1/ Data used in the development of the econometric model for the six commodities are contained in app. A. App. B contains a description of the methodology used and tables B-1 through B-6, showing the complete regression results.

The hypothesis is that U.S. import prices in the exporter's currency will increase as prices of pianos from competing sources increase and as the dollar appreciates, and that increases in the levels of piano production in the United States and the selected foreign country will lead to a decrease in prices.

The quantity of imported pianos was related to (1) apparent U.S. consumption of pianos, (2) the U.S. price of pianos from domestic and foreign sources other than the selected foreign country, (3) the estimated import price from the price model, (4) nonprice factors in the country of origin, and (5) the exchange rate. The hypothesis is that the quantity of U.S. piano imports from Japan and West Germany will increase as U.S. demand for pianos increases, as prices of pianos from competing sources increase, and as the dollar appreciates, and that imports will decrease as the import price of pianos increases. No prior assumption was made about the effects of nonprice factors on import volume.

Japan.--Prices of pianos from Japan are sensitive to changes in the bilateral exchange rate. As shown in table 64, the results of the econometric analysis show that if the U.S. dollar appreciates 1 percent, Japanese exporters will increase yen prices 0.6 percent. 1/ Thus, U.S. dollar prices of pianos from Japan will decrease following an appreciation of the dollar.

The results also suggest that Japanese exporters of pianos adjust their export prices in response to changes in the prices from competing sources of pianos. However, Japanese exporters do not change prices by the full percentage amount of the corresponding change in their competitors' prices. 1/ Competitors' pianos may not be perfect substitutes for Japanese pianos, giving the Japanese greater antonomy in their pricing decisions.

As shown in table 65, only nonprice factors, represented by Japanese aggregate demand, significantly affected the quantity of pianos imported from Japan. This may have resulted from the fact that factors not captured by the econometric model play a key role in the marketplace. Consumer perceptions of quality, performance, and styling in a given price range are believed to be the most important factors influencing sales of Japanese pianos, and brand names enjoy significant consumer loyalty.

West Germany.--The prices of pianos from West Germany were not significantly affected by exchange-rate changes. The results do indicate that increases in U.S. production will reduce West German export prices. The pianos imported from West Germany are relatively few in number and are priced at the high end of the market. U.S. producers also produce for this market, and some competition may take place.

The econometric analysis revealed that West German export prices are not significantly influenced by changes in competitors' prices. 2/ Purchasers may be willing to pay higher prices for the quality of the West German piano and, thus, West German exporters may not face direct price competition from other piano producers.

1/ The coefficient was significantly different from 1 at the 95-percent confidence level.

2/ The t-ratio for competitors' prices is 1.36.

Table 64.--Pianos: The effects of movements in specified indicators on unit values of U.S. imports from Japan and West Germany, based on quarterly data for 1977-82 1/

Country	Percentage change in import unit value resulting from a 1-percent change in--			
	Exchange rate 2/	U.S. production	Competitors' price in U.S. market 3/	Production in country of origin
Japan	0.6101	-0.0383	0.5703	-0.2628
	(3.69)	(-0.33)	(4.75)	(-1.27)
West Germany	0.4074	-0.7151	-0.2743	0.0539
	(1.46)	(-2.12)	(1.36)	(0.13)

1/ The unit values were based on the currency of the country of origin. Figures in parentheses are t-ratios. The coefficient is significant at the 1-percent level if the t-ratio exceeds 2.977 for Japan and 2.898 for West Germany, and at the 5-percent level if it exceeds 2.145 for Japan and 2.110 for West Germany.

2/ Units of foreign currency per U.S. dollar.

3/ The price used was a weighted average of the U.S. prices of domestic and other foreign sources of pianos.

Source: Based on data in table B-2.

Table 65.--Pianos: The effects of movements in specified indicators on the quantity of U.S. imports from Japan and West Germany, based on quarterly data for 1977-82 1/

Country	Percentage change in quantity of U.S. imports resulting from a 1-percent change in--				
	Exchange rate 2/	Competitors' price in U.S. market	Estimated U.S. import price 3/	Apparent U.S. consumption	Nonprice factors in country of origin
Japan	-0.6504	1.4544	-0.4693	-0.4767	4/ 0.0560
	(-0.63)	(1.60)	(-0.46)	(1.61)	(2.18)
West Germany	5.5808	-0.4421	-4.6463	-2.3259	5/ -0.2137
	(3.42)	(-0.51)	(-2.62)	(-1.57)	(-3.04)

1/ Figures in parentheses are t-ratios. The coefficient is significant at the 1-percent level if the t-ratio exceeds 3.055, and at the 5-percent level if it exceeds 2.179.

2/ Units of foreign currency per U.S. dollar.

3/ Based on the currency of the country of origin.

4/ Based on Japanese aggregate domestic demand.

5/ Based on West German gross national product.

Source: Based on data in table B-2.

The quantity of piano imports from West Germany, on the other hand, are significantly affected by changes in the deutsche mark/dollar exchange rate. The results of the econometric analysis suggest that a 1-percent increase in the value of the dollar will cause imports from West Germany to increase approximately 5.6 percent. Because exchange-rate changes do not lead to changes in West German deutsche mark prices, a bigger change in U.S. dollar prices for West German pianos occurs. Consequently, West German exports of pianos are more sensitive to the exchange rate. Because West German pianos are generally more expensive, an increasing value of the dollar may permit purchasers to afford a higher valued, higher quality product.

The results also suggest that import demand for West German pianos is sensitive to price changes. A 1-percent increase in the deutsche mark price will reduce the quantity of pianos from West Germany by 4.6 percent. Imports are also significantly affected by nonprice factors in West Germany (represented by West German GNP), which reduce imports from that country as West German economic activity increases.

Appendix A

Statistics Used in the Development of the Econometric Analysis

Table A-1.--Exchange rates of the U.S. dollar vis-a-vis the currencies of Italy, the United Kingdom, Canada, Hong Kong, West Germany, and Japan, by quarters, 1977-82

Period	Italy	United Kingdom	Canada	Hong Kong	West Germany	Japan
	Lire	Pounds	-------Dollars------		Deutsche marks	Yen
1977:						
January-March	882.6	0.58	1.03	4,638	2.40	285.6
April-June	886.2	.58	1.05	4,658	2.36	275.2
July-September	882.7	.57	1.07	4,648	2.31	266.2
October-December	878.1	.55	1.10	4,653	2.22	247.1
1978:						
January-March	861.9	.52	1.11	4,590	2.08	237.6
April-June	862.4	.55	1.13	4,633	2.08	220.8
July-September	838.0	.52	1.14	4,690	2.01	192.8
October-December	832.5	.51	1.18	4,753	1.87	190.5
1979:						
January-March	839.1	.50	1.19	4,815	1.85	201.5
April-June	847.0	.48	1.16	5,100	1.89	217.6
July-September	816.7	.45	1.17	5,112	1.82	218.9
October-December	820.7	.46	1.17	4,988	1.77	238.6
1980:						
January-March	824.8	.44	1.16	4,928	1.77	243.5
April-June	851.5	.44	1.17	4,942	1.81	232.7
July-September	843.5	.42	1.16	4,943	1.78	220.1
October-December	906.1	.42	1.18	5,091	1.91	210.7
1981:						
January-March	1,001.4	.43	1.19	5,263	2.09	205.6
April-June	1,139.1	.48	1.20	5,441	2.28	220.0
July-September	1,215.4	.54	1.21	5,884	2.43	231.9
October-December	1,196.2	.53	1.19	5,769	2.24	224.7
1982:						
January-March	1,261.8	.54	1.21	5,837	2.35	233.5
April-June	1,319.3	.56	1.24	5,816	2.38	244.2
July-September	1,393.7	.58	1.25	6,029	2.48	258.9
October-December	1,435.2	.61	1.23	6,606	2.50	259.7

Source: Compiled from data provided by the International Monetary Fund in International Financial Statistics, Federal Reserve Bank of New York, and Pick's Currency Yearbook.

Table A-2.--Polyester staple fiber: U.S. exports of domestic merchandise to Hong Kong and Canada, by quarters, 1977-82

Period	Canada		Hong Kong	
	Quantity	Value	Quantity	Value
	1,000 pounds	1,000 dollars	1,000 pounds	1,000 dollars
1977:				
January-March	12,160	6,250	1,432	629
April-June	5,354	3,081	322	145
July-September	5,439	2,961	4,670	1,857
October-December	4,113	2,370	1,435	683
1978:				
January-March	7,525	4,507	1,249	523
April-June	7,884	4,488	1,367	668
July-September	12,252	6,444	4,668	1,931
October-December	10,752	6,102	8,246	3,537
1979:				
January-March	14,306	8,406	6,379	2,703
April-June	11,445	7,695	5,213	2,693
July-September	12,127	7,385	7,467	4,359
October-December	12,421	7,766	6,678	4,185
1980:				
January-March	10,605	7,107	5,367	3,074
April-June	9,225	6,257	5,536	3,439
July-September	9,535	6,408	1,154	767
October-December	10,530	7,182	6,163	4,025
1981:				
January-March	9,284	7,427	5,569	3,831
April-June	10,044	7,785	5,217	3,564
July-September	8,986	6,865	612	463
October-December	6,455	5,134	823	622
1982:				
January-March	6,906	5,773	179	160
April-June	8,694	7,163	711	539
July-September	6,181	5,194	309	329
October-December	7,518	5,975	414	319

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table A-3.--Raw cotton: C.i.f. prices North Europe Quotations Memphis Territory, 1/ by quarters, 1977-83

(Per pound)

Year	January-March	April-June	July-September	October-December
1977	$0.8398	$0.8016	$0.6405	$0.6064
1978	2/ .6635	2/ .6938	.7365	.7880
1979	.7518	2/ .7548	.7776	.8045
1980	.9437	.9188	1.009	2/ 1.0467
1981	2/ 1.0304	2/ .9753	.8324	.7289
1982	.7336	.7807	.7799	.7281
1983	.7703	-	-	-

1/ SMI 1/16" through July 1981, MI 3/32" thereafter.
2/ Nominal.

Source: Compiled from International Cotton Advisory Committee, Cotton-World Statistics.

Table A-4.--Polyester staple fiber: Canadian imports for consumption, total and from the United States, by quarters, 1977-82

Period	Total		United States		All other	
	Quantity	Value	Quantity	Value	Quantity	Value
	Metric tons	1,000 Canadian dollars	Metric tons	1,000 Canadian dollars	Metric tons	1,000 Canadian dollars
1977:						
January-March	3,955	5,151	3,819	4,979	136	172
April-June	3,308	4,236	2,990	3,960	318	276
July-September	2,906	3,735	2,828	3,616	78	119
October-December	2,457	3,272	2,427	3,211	30	61
1978:						
January-March	2,310	3,136	2,267	3,055	43	81
April-June	3,584	4,791	3,445	4,582	139	209
July-September	4,299	5,500	4,216	5,370	83	130
October-December	4,359	6,081	4,317	6,009	42	72
1979:						
January-March	4,227	5,992	4,147	5,846	80	146
April-June	4,889	7,011	4,757	6,776	132	235
July-September	5,606	8,364	5,503	8,163	103	201
October-December	4,292	6,939	4,288	6,929	4	10
1980:						
January-March	4,429	7,498	4,376	7,393	53	105
April-June	2,715	5,119	2,675	4,994	40	125
July-September	3,028	5,524	2,987	5,403	41	121
October-December	4,113	7,458	4,087	7,364	26	94
1981:						
January-March	3,758	7,750	3,741	7,699	17	51
April-June	3,420	7,006	3,386	6,912	34	94
July-September	3,273	6,793	3,111	6,540	162	253
October-December	3,288	7,045	3,281	7,088	7	43
1982:						
January-March	2,516	5,920	2,503	5,888	13	32
April-June	2,729	6,382	2,718	6,341	11	41
July-September	2,489	6,474	2,427	6,275	62	199
October-December	3,553	7,792	3,536	7,741	17	51

Source: Compiled from data published by the Minister of Supply and Service Canada, Statistics Canada Imports by Commodities.

Table A-5.--Polyester staple fiber: Canadian production, apparent consumption, wholesale prices, and rates of duty, by quarters, 1977-82

Period	Production		Consumption		Wholesale price	Rate of duty
	Quantity	Value	Quantity	Value		
	Metric tons	1,000 Canadian dollars	Metric tons	1,000 Canadian dollars	Per kilogram	Percent ad val.
1977:						
January-March						10
April-June						10
July-September						10
October-December						10
1978:						
January-March						10
April-June						10
July-September						10
October-December						10
1979:						
January-March						10
April-June						10
July-September						10
October-December						10
1980:						
January-March						10
April-June						10
July-September						10
October-December						10
1981:						
January-March						10
April-June						10
July-September						10
October-December						10
1982:						
January-March						9.8
April-June						9.8
July-September						9.8
October-December						9.8

Source: Compiled from statistics provided by the Textile Economics Bureau Inc., and the Minister of Supply and Service Canada, Statistics Canada.

Table A-6.--Polyester staple fiber: Hong Kong apparent consumption, wholesale prices, and rates of duty, by quarters, 1977-82 1/

Period	Consumption 2/		Wholesale price	Rate of duty
	Quantity	Value		
		1,000		
	Metric tons	Hong Kong dollars	Per kilogram	
1977:				
January-March	3,350	15,785	HK$4.80	Free.
April-June	3,998	18,915	4.73	Free.
July-September	3,866	17,695	4.60	Free.
October-December	5,462	23,961	4.41	Free.
1978:				
January-March	6,627	28,171	4.25	Free.
April-June	7,921	33,747	4.26	Free.
July-September	9,562	43,175	4.51	Free.
October-December	9,586	44,983	4.70	Free.
1979:				
January-March	8,247	42,385	5.14	Free.
April-June	9,189	54,104	5.99	Free.
July-September	6,883	45,531	6.64	Free.
October-December	8,962	59,598	6.78	Free.
1980:				
January-March	5,797	43,700	6.73	Free.
April-June	7,538	46,919	7.55	Free.
July-September	3,719	36,667	7.79	Free.
October-December	5,929	47,558	7.84	Free.
1981:				
January-March	8,258	60,898	7.57	Free.
April-June	8,461	76,492	8.99	Free.
July-September	4,938	48,967	9.92	Free.
October-December	5,527	52,279	9.48	Free.
1982:				
January-March	2,511	23,085	9.39	Free.
April-June	6,302	56,605	8.91	Free.
July-September	4,589	39,456	8.47	Free.
October-December	2,024	17,588	8.69	Free.

1/ Hong Kong produces no polyester staple.

2/ Consumption represents polyester staple Hong Kong imports minus reexports of polyester staple.

Source: Compiled from Hong Kong Department of Census and Statistics, Hong Kong Trade Statistics.

Table A-7.--Polyester staple fiber: Hong Kong imports for consumption, total and from the United States, by quarters, 1977-82

Period	Total		United States		All other	
	Quantity	Value	Quantity	Value	Quantity	Value
	1,000 metric tons	1,000 Hong Kong dollars	1,000 metric tons	1,000 Hong Kong dollars	1,000 metric tons	1,000 Hong Kong dollars
1977:						
January-March	3,531	16,960	181	918	3,350	16,042
April-June	4,028	19,055	380	1,897	3,648	17,158
July-September	4,124	18,963	228	1,162	3,896	17,801
October-December	5,776	25,451	97	473	5,679	24,978
1978:						
January-March	6,645	28,248	682	3,235	5,963	25,013
April-June	7,937	33,824	1,317	5,898	6,620	27,926
July-September	9,611	43,363	2,788	12,800	6,823	30,563
October-December	9,653	45,356	3,350	15,790	6,303	29,566
1979:						
January-March	8,863	45,567	2,993	14,481	5,870	31,086
April-June	10,260	61,464	2,278	12,438	7,982	49,026
July-September	8,559	56,840	2,081	12,093	6,478	44,747
October-December	11,256	76,315	4,648	30,118	6,608	46,197
1980:						
January-March	10,075	67,828	1,822	12,541	8,253	55,287
April-June	10,213	64,590	2,629	22,888	7,584	41,702
July-September	11,326	96,163	481	1,315	10,845	94,848
October-December	8,201	64,279	1,327	10,463	6,874	53,816
1981:						
January-March	11,638	88,117	3,841	25,170	7,797	62,947
April-June	10,219	91,880	3,494	31,075	6,725	60,805
July-September	5,844	57,944	620	6,143	5,224	51,801
October-December	6,748	63,975	454	4,983	6,294	58,992
1982:						
January-March	4,313	40,492	57	530	4,256	39,962
April-June	6,978	62,181	551	4,478	6,427	57,703
July-September	5,129	43,460	300	2,878	4,829	40,582
October-December	2,724	23,658	350	3,000	2,374	20,658

Source: Compiled from Hong Kong Department of Census and Statistics, Hong Kong Trade Statistics.

Table A-8.--Denim: U.S. exports of domestic merchandise to Italy and the United Kingdom, by quarters, 1977-82

Period	Italy		United Kingdom	
	Quantity	Value	Quantity	Value
	1,000 sq. yd.	1,000 dollars	1,000 sq. yd.	1,000 dollars
1977:				
January-March	13,510	21,431	4,164	6,139
April-June	7,895	13,121	2,407	3,893
July-September	6,453	10,098	2,040	2,917
October-December	5,480	7,808	2,678	4,030
1978:				
January-March	7,172	10,526	1,965	2,780
April-June	8,574	12,579	1,435	2,078
July-September	6,861	10,897	1,693	2,591
October-December	15,326	23,859	1,749	2,978
1979:				
January-March	13,563	17,334	2,238	3,810
April-June	9,202	14,104	2,373	4,382
July-September	7,871	13,083	2,642	4,595
October-December	12,372	21,271	1,689	3,996
1980:				
January-March	10,986	17,697	2,120	3,186
April-June	12,810	22,808	1,504	2,869
July-September	7,937	15,678	536	1,014
October-December	7,399	15,017	616	1,220
1981:				
January-March	5,472	11,164	252	432
April-June	3,859	8,039	193	454
July-September	1,616	3,326	377	1,041
October-December	3,963	7,547	373	982
1982:				
January-March	3,400	5,663	59	107
April-June	4,648	7,178	144	259
July-September	7,302	10,184	245	464
October-December	5,189	8,116	540	1,117

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table A-9.--Denim: Italian production, apparent consumption, wholesale prices, and rates of duty, by quarters, 1977-82

Period	Production		Consumption		Wholesale price	Rate of duty
	Quantity	Value	Quantity	Value		
	Million square meters	Million lire	Million square meters	Million lire	Per square meter	Percent ad val.
1977:						
January-March	3.3	5,660	13.0	23,140	Lit1,715	14
April-June	3.2	5,517	8.3	14,956	1,724	14
July-September	2.8	4,539	4.6	7,835	1,621	14
October-December	3.1	5,248	5.4	9,307	1,693	14
1978:						
January-March	3.4	5,698	8.3	13,911	1,676	14
April-June	3.5	6,304	9.7	15,668	1,801	14
July-September	3.1	6,098	7.4	11,959	1,967	14
October-December	3.9	7,457	15.1	24,263	1,912	14
1979:						
January-March	4.4	8,263	18.9	31,983	1,878	14
April-June	4.4	8,646	18.5	30,684	1,965	14
July-September	3.9	7,433	11.6	19,416	1,906	14
October-December	4.7	9,179	21.9	38,022	1,953	14
1980:						
January-March	5.2	10,395	20.7	37,031	1,999	14
April-June	5.4	11,437	18.0	34,287	2,118	14
July-September	4.7	9,475	15.6	29,907	2,016	14
October-December	5.4	12,884	16.1	34,843	2,386	14
1981:						
January-March	5.1	11,047	10.1	17,600	2,166	14
April-June	4.9	14,636	14.2	38,862	2,987	14
July-September	4.0	11,220	11.7	29,328	2,805	14
October-December	5.6	17,657	12.4	33,508	3,153	14
1982:						
January-March	5.5	15,604	13.8	36,300	2,837	13.3
April-June	5.7	16,182	14.6	38,803	2,839	13.3
July-September	5.5	15,813	13.0	34,719	2,875	13.3
October-December	6.0	16,548	13.5	35,866	2,758	13.3

Source: Compiled from Institute Centrale di Statistica, Statistica del Commercio Con L' Estero.

Table A-10.--Denim: United Kingdom imports for consumption, total and from the United States, by quarters, 1977-82

(In millions of square meters)

Period	Total	United States 1/	All other
1977:			
January-March	2.75	3.50	0.75
April-June	2.53	2.02	.51
July-September	2.20	1.71	.49
October-December	3.52	2.25	1.27
1978:			
January-March	2.74	1.65	1.09
April-June	1.78	1.20	.58
July-September	1.54	1.42	.12
October-December	2.31	1.47	.84
1979:			
January-March	2.58	1.88	.70
April-June	2.72	1.99	.73
July-September	2.88	2.22	.66
October-December	3.47	1.42	2.05
1980:			
January-March	4.26	1.78	2.48
April-June	4.57	1.26	3.31
July-September	3.94	.45	3.49
October-December	3.83	.52	3.31
1981:			
January-March	2.84	.21	2.63
April-June	3.90	.16	3.74
July-September	3.35	.32	3.03
October-December	3.01	.31	2.70
1982:			
January-March	5.33	.05	5.28
April-June	4.20	.12	4.08
July-September	3.58	.21	3.37
October-December	4.12	.45	3.67

1/ Estimated by the staff of the U.S. International Trade Commission on the basis of reported exports of the United States.

Source: Compiled from the Textiles Statistics Bureau, Quarterly Statistical Review, and from official statistics of the U.S. Department of Commerce.

Table A-11.--Denim: United Kingdom production, apparent consumption, wholesale prices, and rates of duty, by quarters, 1977-82

Period	Production		Consumption		Wholesale price	Rate of duty
	Quantity	Value	Quantity	Value		
	Million square meters	1,000 pounds	Million square meters	1,000 pounds	Per square meter	Percent ad val.
1977:						
January-March	7.8	8,288	9.9	10,145	£1.04	14
April-June	7.2	7,591	9.1	9,349	1.05	14
July-September	7.7	8,095	9.6	9,908	1.05	14
October-December	4.8	5,130	6.7	6,936	1.08	14
1978:						
January-March	3.9	4,151	6.1	6,337	1.07	14
April-June	4.0	3,698	5.4	4,823	.92	14
July-September	3.5	3,598	4.0	4,025	1.04	14
October-December	4.3	4,408	5.2	5,161	1.03	14
1979:						
January-March	4.2	4,378	6.1	6,173	1.05	14
April-June	3.7	4,151	5.3	5,532	1.11	14
July-September	3.0	3,248	5.5	5,478	1.09	14
October-December	3.6	3,841	6.4	6,667	1.07	14
1980:						
January-March	3.7	4,051	7.9	6,560	1.11	14
April-June	3.7	4,413	7.1	8,375	1.18	14
July-September	2.9	3,351	6.3	6,916	1.14	14
October-December	2.8	3,080	5.7	6,012	1.12	14
1981:						
January-March	1.5	1,549	4.1	4,319	1.04	14
April-June	1.9	2,120	4.9	6,113	1.14	14
July-September	1.3	1,638	4.5	6,026	1.27	14
October-December	2.1	2,522	3.7	4,823	1.19	14
1982:						
January-March	2.3	2,852	5.9	8,674	1.24	13.3
April-June	2.1	2,863	5.1	7,131	1.37	13.3
July-September	1.8	2,273	4.9	6,475	1.27	13.3
October-December	2.1	2,671	5.1	6,912	1.26	13.3

Source: Compiled from the Department of Trade, Overseas Trade Statistics of the United Kingdom, and the Textiles Statistics Bureau, Quarterly Statistical Review.

Table A-12.--Denim: Italian imports for consumption, total and from the United States, by quarters, 1977-82

Period	Total		United States		All other	
	Quantity	Value	Quantity	Value	Quantity	Value
	1,000 square meters	Million lire	1,000 square meters	Million lire	1,000 square meters	Million lire
1977:						
January-March	12,816	22,446	9,300	14,666	3,516	7,780
April-June	8,680	15,389	7,194	11,438	1,486	3,951
July-September	5,361	9,018	4,414	6,524	947	2,494
October-December	6,123	10,439	3,880	4,800	2,243	5,639
1978:						
January-March	7,733	12,906	5,240	5,963	2,493	6,943
April-June	7,762	12,719	5,223	6,800	2,539	5,919
July-September	4,912	7,419	4,128	5,020	784	2,399
October-December	11,787	19,588	5,701	7,115	6,086	12,473
1979:						
January-March	15,666	26,682	8,636	12,168	7,020	14,514
April-June	14,744	23,877	8,428	11,479	6,316	12,398
July-September	8,451	13,932	5,519	8,246	2,932	5,686
October-December	18,857	33,343	10,130	14,874	8,727	18,469
1980:						
January-March	17,912	32,674	11,150	17,307	6,762	15,367
April-June	14,704	28,259	8,871	15,014	5,833	13,245
July-September	12,610	24,225	8,412	14,188	4,198	10,037
October-December	12,686	27,581	5,863	11,775	6,823	15,806
1981:						
January-March	7,092	12,066	2,539	3,751	4,553	8,315
April-June	9,748	25,679	3,974	11,698	5,774	13,981
July-September	8,411	20,555	3,250	8,724	5,161	11,831
October-December	8,549	22,304	3,042	7,730	5,507	14,574
1982:						
January-March	10,287	27,023	3,267	7,713	7,020	19,310
April-June	10,733	28,274	4,018	9,603	6,715	18,671
July-September	9,176	24,326	4,146	9,760	5,030	14,566
October-December	13,837	41,168	4,457	11,919	9,380	29,249

Source: Compiled from Institute Centrale di Statistica, Statistica del Commercio Con L'Estero.

Table A-13.--Primary magnesium: Japanese production, apparent consumption, wholesale prices, and rates of duty, by quarters, 1977-82

Period	Production		Consumption		Wholesale price	Rate of duty
	Quantity	Value	Quantity	Value		
	Tons	1,000 yen	Tons	1,000 yen	Per pound	Percent ad val.
1977:						
January-March	2,809	1,488,770	3,682	1,913,658	265	15
April-June	2,728	1,456,752	3,290	1,744,834	267	15
July-September	2,315	1,189,910	2,962	1,501,275	257	15
October-December	2,505	1,202,400	2,803	1,340,265	240	15
1978:						
January-March	2,762	1,452,812	3,529	1,793,185	263	15
April-June	3,207	1,674,054	5,461	2,645,671	261	15
July-September	3,171	1,192,296	6,334	2,926,974	188	15
October-December	3,139	1,205,376	6,336	2,368,254	192	15
1979:						
January-March	3,276	1,618,344	6,476	3,022,838	247	15
April-June	3,229	1,976,148	8,687	4,615,071	306	15
July-September	3,051	1,867,212	6,739	3,539,293	291	15
October-December	2,949	1,675,032	3,957	2,178,219	284	15
1980:						
January-March	2,805	1,755,930	4,207	2,526,676	313	12.9
April-June	2,774	1,897,416	11,732	6,799,744	342	12.9
July-September	2,695	1,859,550	4,395	2,800,828	345	12.9
October-December	1,903	989,560	3,388	1,773,734	260	12.9
1981:						
January-March	1,509	908,418	9,615	5,183,517	301	12.9
April-June	1,607	883,850	1,639	903,421	275	12.9
July-September	1,597	910,290	2,590	1,477,096	285	12.9
October-December	1,520	1,033,600	4,391	2,613,222	340	12.9
1982:						
January-March	1,389	897,294	7,572	3,801,479	323	11.8
April-June	1,379	934,962	3,012	1,782,421	339	11.8
July-September	1,387	790,590	4,772	2,506,670	285	11.8
October-December	1,200	684,000	5,021	2,273,726	226	11.8

Source: Compiled from data provided by Ministry of Industry and Trade Information, Yearbook of Mining, Non-Ferrous Metals, and Product Statistics, Japan.

Table A-14.--Primary magnesium: EC imports for consumption, total and from Norway, by quarters, 1977-82

(In tons)

Period	Total	Norway
1977:		
January-March	4,034	2,093
April-June	5,503	2,664
July-September	5,806	2,853
October-December	4,609	1,903
1978:		
January-March	5,222	3,130
April-June	6,409	2,169
July-September	6,409	3,761
October-December	5,696	1,624
1979:		
January-March	6,923	3,059
April-June	8,365	3,561
July-September	7,212	2,951
October-December	6,346	2,377
1980:		
January-March	7,958	3,224
April-June	7,402	2,490
July-September	6,289	3,091
October-December	6,177	2,313
1981:		
January-March	6,495	2,330
April-June	6,591	2,586
July-September	5,301	2,179
October-December	5,493	1,763
1982:		
January-March	7,069	2,397
April-June	6,950	1,831
July-September	5,838	2,131
October-December	-	-

Source: Compiled from data provided by Eurostat, Analytical Tables of Foreign Trade.

Table A-15.--Primary magnesium: U.S. and Japanese production, by quarters, 1977-82

(In tons)

Period	United States 1/	Japan
1977:		
January-March	29,600	20,847
April-June	31,111	29,749
July-September	31,111	24,816
October-December	34,136	19,407
1978:		
January-March	57,515	24,760
April-June	38,113	39,165
July-September	36,170	33,125
October-December	37,665	29,932
1979:		
January-March	40,779	32,938
April-June	41,428	42,220
July-September	39,316	34,142
October-December	40,941	28,760
1980:		
January-March	42,878	39,342
April-June	43,047	38,337
July-September	40,505	19,359
October-December	43,047	19,221
1981:		
January-March	40,437	30,954
April-June	39,865	33,210
July-September	32,864	27,494
October-December	29,721	24,528
1982:		
January-March	32,125	32,900
April-June	32,000	2/
July-September	30,625	2/
October-December	30,250	2/

1/ Estimated.
2/ Not available.

Source: Compiled from official statistics of the U.S. Bureau of Mines, and Ministry of Industry and Trade Information, Yearbook of Mining, Non-Ferrous Metals, and Product Statistics, Japan.

Table A-16.--Primary magnesium: U.S. exports of domestic merchandise, total and to Japan, by quarters, 1977-82

Period	Total		Japan		All other	
	Quantity	Value	Quantity	Value	Quantity	Value
	1,000 pounds	1,000 dollars	1,000 pounds	1,000 dollars	1,000 pounds	1,000 dollars
1977:						
January-March	12,760	10,821	891	693	11,869	10,128
April-June	16,477	13,816	2,014	1,670	14,463	12,146
July-September	16,424	13,935	279	224	16,145	13,711
October-December	6,956	6,334	752	645	6,204	5,689
1978:						
January-March	10,468	9,271	1,296	1,283	9,172	7,988
April-June	18,946	15,880	4,839	3,748	14,107	12,132
July-September	20,254	17,505	4,145	3,797	16,109	13,708
October-December	24,496	20,353	3,420	3,381	21,076	16,972
1979:						
January-March	26,085	24,437	8,203	8,275	17,882	16,162
April-June	26,737	25,786	3,888	3,933	22,849	21,853
July-September	25,353	23,814	3,728	3,041	17,045	20,773
October-December	16,735	16,751	271	266	16,464	16,485
1980:						
January-March	26,581	25,541	2,632	2,667	23,949	22,874
April-June	35,387	36,030	12,816	12,578	22,571	23,452
July-September	18,765	20,897	2,068	2,375	16,697	18,522
October-December	18,434	21,618	1,152	1,251	17,282	20,367
1981:						
January-March	24,968	30,076	10,857	12,575	14,111	17,501
April-June	13,734	17,467	526	599	13,208	16,868
July-September	13,614	16,796	631	767	12,983	16,029
October-December	13,503	16,778	3,949	4,368	9,554	12,410
1982:						
January-March	22,120	26,068	8,211	7,813	13,909	18,255
April-June	16,388	21,676	1,275	1,391	15,113	20,285
July-September	20,932	26,543	6,318	6,647	14,614	19,897
October-December	15,123	18,266	5,771	5,695	9,352	12,571

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table A-17.--Primary magnesium: U.S. prices, by quarters, 1977-82

Period	Price
	Per pound
1977:	
January-March	$0.96
April-June	.96
July-September	.99
October-December	.99
1978:	
January-March	.99
April-June	1.01
July-September	1.01
October-December	1.01
1979:	
January-March	1.06
April-June	1.06
July-September	1.06
October-December	1.09
1980:	
January-March	1.07
April-June	1.16
July-September	1.16
October-December	1.25
1981:	
January-March	1.34
April-June	1.34
July-September	1.34
October-December	1.34
1982:	
January-March	1.34
April-June	1.34
July-September	1.34
October-December	1.34

Source: Metal Bulletin Journals, Ltd., Metal Bulletin.

Table A-18.--Primary magnesium: Japanese imports for consumption, total and from the United States, by quarters, 1977-82

Period	Total		United States		All other	
	Quantity	Value	Quantity	Value	Quantity	Value
	Kilograms	1,000 yen	Kilograms	1,000 yen	Kilograms	1,000 yen
1977:						
January-March	889,638	481,074	402,601	226,915	487,037	254,159
April-June	573,470	324,328	398,896	231,313	174,574	93,015
July-September	691,812	369,871	497,500	266,097	194,312	103,774
October-December	333,403	170,955	197,004	99,316	136,399	71,639
1978:						
January-March	777,945	387,098	477,656	238,690	300,289	148,408
April-June	2,227,000	1,073,230	1,654,622	800,108	572,378	273,122
July-September	3,217,967	1,353,968	2,154,889	906,008	1,063,078	447,960
October-December	2,597,058	1,170,570	1,386,735	665,769	1,210,323	504,801
1979:						
January-March	2,921,795	1,411,419	1,819,374	911,420	1,102,421	499,999
April-June	4,983,108	2,653,016	3,756,322	2,047,270	1,226,786	605,746
July-September	3,391,653	1,697,141	2,535,468	1,264,489	856,185	432,652
October-December	925,550	508,857	186,660	106,816	738,890	402,041
1980:						
January-March	1,359,968	779,521	457,902	251,052	902,066	528,469
April-June	8,167,839	4,939,292	7,027,216	4,263,827	1,140,623	675,465
July-September	1,567,929	958,544	669,436	431,034	898,493	527,510
October-December	1,380,464	801,326	518,321	307,977	862,143	493,349
1981:						
January-March	7,399,929	4,287,600	5,331,130	3,109,118	2,068,799	1,178,482
April-June	36,819	24,130	0	0	36,819	24,130
July-September	902,128	566,806	287,384	182,223	614,744	384,583
October-December	2,613,027	1,581,867	1,308,681	850,114	1,304,346	731,753
1982:						
January-March	5,623,016	2,905,605	4,213,619	2,138,994	1,409,397	766,611
April-June	1,486,253	848,948	365,752	250,128	1,120,501	643,820
July-September	3,126,731	1,747,359	2,394,624	1,303,396	732,107	443,963
October-December	3,473,594	1,911,726	2,855,569	1,527,727	618,025	383,999

Source: Compiled from data provided by the Japan Tariff Association, Japan Exports and Imports.

Table A-19.--Primary magnesium: EC production, apparent consumption, wholesale prices, and rates of duty, by quarters, 1977-82

Period	Production	Consumption	Wholesale price	Rate of duty
	Tons	Tons	Per pound	Percent ad val.
1977:				
January-March	4,231	7,846	f2.40	8.0
April-June	4,616	9,869	2.35	8.0
July-September	3,847	9,313	2.33	8.0
October-December	6,539	10,818	2.27	8.0
1978:				
January-March	4,408	9,484	2.34	8.0
April-June	3,807	9,666	2.20	8.0
July-September	4,008	9,949	2.16	8.0
October-December	7,815	13,058	2.38	8.0
1979:				
January-March	4,317	10,900	2.20	8.0
April-June	4,709	12,304	2.30	8.0
July-September	3,924	10,547	2.40	8.0
October-December	6,671	12,451	2.46	8.0
1980:				
January-March	1/ 4,175	11,836	2.39	7.7
April-June	1/ 4,554	11,471	2.51	7.7
July-September	1/ 3,795	9,709	2.60	7.7
October-December	1/ 6,451	12,222	2.90	7.7
1981:				
January-March	1/ 3,982	9,598	2.75	7.3
April-June	1/ 4,344	9,713	2.87	7.3
July-September	1/ 3,620	8,157	3.05	7.3
October-December	1/ 6,154	10,692	2.86	7.3
1982:				
January-March	1/ 3,584	9,380	3.02	7.0
April-June	1/ 3,910	9,587	-	7.0
July-September	1/ 3,258	7,823	-	7.0
October-December	1/ 5,538	2/	-	7.0

1/ Estimated.
2/ Not available.

Source: Production data compiled from data provided by L'industria Mineraria, except as noted; consumption was computed by adding imports to production and subtracting exports.

Table A-20.--Bicycles: U.S. production, apparent consumption, wholesale prices, and rates of duty, by quarters, 1977-82

Period	Production 1/	Consumption 2/	Wholesale price 3/	Rate of duty
	1,000 units	1,000 units	Per unit	Percent ad val.
1977:				
January-March	1,255	1,606	$94.45	6.2
April-June	2,342	2,875	94.83	6.6
July-September	2,053	2,644	94.83	6.9
October-December	1,834	2,287	96.18	7.6
1978:				
January-March	1,475	1,860	100.00	6.2
April-June	2,350	2,972	100.00	6.3
July-September	1,887	2,409	100.00	6.8
October-December	1,782	2,137	100.49	8.2
1979:				
January-March	1,675	1,956	108.08	6.9
April-June	2,589	3,079	112.55	6.6
July-September	2,548	3,008	114.41	7.2
October-December	2,226	2,810	115.46	7.5
1980:				
January-March	1,817	2,309	121.95	6.5
April-June	2,018	2,613	124.00	6.6
July-September	1,675	2,134	129.51	6.5
October-December	1,432	1,949	129.51	6.8
1981:				
January-March	1,462	1,996	130.25	6.0
April-June	2,364	3,058	131.56	6.3
July-September	1,894	2,409	137.01	6.9
October-December	1,114	1,503	137.09	8.3
1982:				
January-March	1,264	1,582	143.62	6.6
April-June	1,484	1,998	143.62	6.8
July-September	1,209	1,653	147.59	7.4
October-December	1,112	1,512	148.25	8.5

1/ Data provided by the Bicycle Manufacturers Association of America, Inc.
2/ Compiled from official statistics of the U.S. Department of Commerce.
3/ Data provided by the U.S. Bureau of Labor Statistics.

Table A-21.--Bicycles: U.S. imports for consumption, total and from Japan, by quarters, 1977-82

Period	Total		Japan		All other	
	Quantity	Value	Quantity	Value	Quantity	Value
	Units	1,000 dollars	Units	1,000 dollars	Units	1,000 dollars
1977:						
January-March	357,583	21,125	177,147	12,062	180,436	9,063
April-June	543,413	29,703	194,408	13,846	349,005	15,857
July-September	597,722	30,665	167,198	11,897	430,524	18,768
October-December	469,083	20,515	98,858	6,952	370,225	13,563
1978:						
January-March	408,197	25,162	169,347	13,330	238,850	11,832
April-June	634,610	39,597	185,261	15,443	449,349	24,154
July-September	536,714	29,121	99,297	8,705	437,417	20,416
October-December	380,375	15,677	22,329	1,692	358,046	13,985
1979:						
January-March	291,777	16,080	44,157	3,616	247,620	12,464
April-June	499,150	30,590	79,013	6,650	420,137	23,940
July-September	471,466	27,763	69,664	6,182	401,802	21,581
October-December	604,052	31,948	100,413	7,951	503,639	23,997
1980:						
January-March	502,513	33,157	154,232	13,140	348,341	20,017
April-June	614,520	43,077	168,630	15,055	445,890	28,022
July-September	486,511	36,287	155,614	15,483	330,847	20,804
October-December	551,397	38,157	141,672	15,903	409,725	22,254
1981:						
January-March	542,324	51,532	210,025	26,273	332,299	25,259
April-June	716,075	65,134	254,510	31,720	461,565	33,414
July-September	544,657	43,256	160,543	19,135	384,114	24,121
October-December	421,199	24,710	36,029	4,301	385,170	20,409
1982:						
January-March	323,653	27,643	81,893	10,665	241,760	16,978
April-June	527,317	40,828	113,035	12,860	414,282	27,968
July-September	459,544	30,478	80,297	8,450	379,247	22,028
October-December	415,437	24,336	65,673	6,462	349,764	17,874

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table A-22.--Bicycles: U.S. and Japanese producer price indexes, by quarters, 1977-82

(1977=100)

Period	United States	Japan
1977:		
January-March	98.9	101.4
April-June	100.0	99.8
July-September	100.0	98.9
October-December	101.1	99.9
1978:		
January-March	105.3	99.9
April-June	105.3	99.9
July-September	105.3	100.0
October-December	106.3	99.5
1979:		
January-March	113.7	96.2
April-June	118.9	96.2
July-September	120.0	96.2
October-December	121.1	104.6
1980:		
January-March	128.4	106.9
April-June	130.5	108.6
July-September	136.5	108.1
October-December	136.8	108.1
1981:		
January-March	136.8	108.8
April-June	138.9	109.1
July-September	144.2	109.1
October-December	144.2	109.5
1982:		
January-March	151.6	109.7
April-June	151.6	110.2
July-September	155.8	110.2
October-December	155.8	-

Source: Compiled from official statistics of the U.S. Bureau of Labor Statistics and from the Bank of Japan's official price index for bicycles.

Table A-23.--Bicycles: Japanese exports of domestic merchandise, total and to the United States, by quarters, 1977-82

Year	Total	United States					Ratio of exports to the United States to total
		January-March	April-June	July-September	October-December	Total	
	Quantity (units)						
1977	1,103,280	170,752	194,267	133,080	144,035	642,134	58.2
1978	640,121	178,899	159,204	38,230	22,572	398,905	62.3
1979	570,134	65,230	65,373	63,143	129,266	323,012	56.7
1980	1,128,196	152,065	169,863	151,306	150,557	623,791	55.3
1981	1,057,603	267,514	223,390	63,613	59,528	614,045	58.1
1982	674,365	101,275	92,240	64,539	83,512	341,566	50.7
	Value (1,000 yen f.o.b.)						
1977	19,720,579	3,414,312	3,851,804	2,530,430	2,794,970	12,591,516	63.8
1978	11,341,189	3,466,392	3,030,487	708,972	340,721	7,546,572	66.5
1979	10,273,262	1,143,894	1,206,482	1,206,920	2,530,426	6,087,722	59.3
1980	23,482,759	3,196,341	3,688,286	3,489,158	3,694,614	14,068,399	59.9
1981	26,568,325	6,962,270	5,869,318	1,870,262	1,692,383	16,394,233	61.7
1982	16,073,455	2,986,136	2,486,962	1,708,610	2,208,357	9,390,065	58.4

Source: Compiled from data provided by the Japan Tariff Association, Japan Exports and Imports: Commodity by Country.

Table A-24.--Brass strip: U.S. shipments, apparent consumption, wholesale prices, and rates of duty, by quarters, 1977-82

Period	Shipments 1/		Consumption 2/		Wholesale price 3/	Rate of duty
	Quantity	Value	Quantity	Value		
	1,000 pounds	1,000 dollars	1,000 pounds	1,000 dollars	Per pound	Percent ad val.
1977:						
January-March	112,825	126,364	125,859	132,919	1.12	2.0
April-June	121,264	135,816	133,764	143,493	1.12	2.0
July-September	117,204	125,408	129,554	133,145	1.07	2.0
October-December	84,804	89,044	95,402	94,563	1.05	2.0
1978:						
January-March	92,803	100,227	122,096	121,839	1.08	2.1
April-June	129,343	143,571	154,822	162,037	1.11	2.1
July-September	115,112	131,228	138,478	148,481	1.14	2.1
October-December	126,986	151,113	148,430	167,352	1.19	2.1
1979:						
January-March	138,168	186,527	157,353	201,936	1.35	1.7
April-June	130,810	175,285	151,081	193,075	1.34	1.7
July-September	104,986	145,931	123,109	162,808	1.39	1.7
October-December	104,298	154,361	121,650	171,386	1.48	1.7
1980:						
January-March	118,022	178,213	132,688	193,645	1.51	2.0
April-June	102,915	148,198	118,273	165,804	1.44	2.0
July-September	75,067	108,847	85,267	119,746	1.45	2.0
October-December	103,376	151,963	113,952	163,486	1.47	2.0
1981:						
January-March	117,125	173,345	135,255	192,715	1.48	2.0
April-June	120,291	181,639	141,452	202,799	1.51	2.0
July-September	110,833	168,466	132,237	189,198	1.52	2.0
October-December	98,186	149,243	119,443	169,073	1.52	2.0
1982:						
January-March	93,273	139,910	114,016	159,485	1.50	2.0
April-June	98,845	143,325	115,895	158,953	1.45	2.0
July-September	84,185	122,068	99,540	135,185	1.45	2.0
October-December	63,844	93,851	75,984	104,988	1.47	2.0

1/ Data were provided by the Copper Development Association Market Data. Data shown represent 70 percent of the category including brass and remaining alloys for strips, sheet, and plate.

2/ Compiled from official statistics of the U.S. Department of Commerce.

3/ Data for 1977 and 1978 were estimated by the Commission staff. Data for 1979 through 1982 were provided by the Copper and Brass Fabricators Council, Copper Alloy Strip Industry Pricing, table 4-A.

Table A-25.--Brass strip: West German exports of domestic merchandise, total and to the United States, by quarters, 1977-82

Period	Total		United States		All other	
	Quantity	Value	Quantity	Value	Quantity	Value
	1,000 kilograms	1,000 deutsche marks	1,000 kilograms	1,000 deutsche marks	1,000 kilograms	1,000 deutsche marks
1977:						
January-March	108,135	52,235	24,615	10,663	83,520	41,572
April-June	103,718	51,048	16,558	7,323	87,160	43,725
July-September	109,600	50,857	23,274	10,035	86,326	40,822
October-December	99,234	45,198	20,512	8,225	78,722	36,973
1978:						
January-March	69,950	26,611	20,189	6,654	49,761	19,957
April-June	101,927	37,498	37,786	11,593	64,141	25,905
July-September	92,583	34,138	35,937	10,992	56,646	23,146
October-December	113,755	41,293	43,566	13,140	70,189	28,153
1979:						
January-March	97,609	37,487	32,099	10,161	65,510	27,326
April-June	100,494	42,190	26,541	9,591	73,953	32,599
July-September	84,141	36,305	21,026	7,722	63,115	28,583
October-December	92,204	40,669	15,487	5,668	76,717	35,001
1980:						
January-March	91,989	43,756	17,376	7,118	74,613	36,638
April-June	98,836	47,625	19,505	8,939	79,331	38,686
July-September	99,521	44,985	16,385	6,623	83,136	38,362
October-December	94,242	43,070	25,791	10,802	68,451	32,268
1981:						
January-March	130,384	60,067	40,966	17,388	89,418	42,679
April-June	128,501	60,651	39,774	18,044	88,727	42,607
July-September	122,672	62,980	46,056	22,870	76,616	40,110
October-December	140,795	66,135	56,854	24,918	83,941	41,217
1982:						
January-March	140,561	68,760	47,731	21,470	92,830	47,290
April-June	119,958	56,932	28,548	12,526	91,410	44,406
July-September	116,631	55,010	31,482	14,077	85,149	40,933
October-December	199,837	57,360	30,772	14,204	89,065	43,156

Source: Compiled from data provided by Federal Statistics Office, Foreign Trade Senes 2: Trade by Commodities and Countries (special trade).

Table A-26.--Brass strip: U.S. imports for consumption, by specified sources and by quarters, 1977-82

Year and source	Quantity				Value			
	January-March	April-June	July-September	October-December	January-March	April-June	July-September	October-December
	1,000 pounds				1,000 dollars			
1977: 1/								
West Germany	4,276	2,509	3,244	2,104	3,467	2,138	2,745	1,807
Japan	6,035	5,712	6,937	5,261	4,571	4,242	5,365	3,860
All other	5,070	5,948	5,010	5,002	4,162	5,041	4,238	3,922
Total	15,381	14,169	15,191	12,367	12,200	11,421	12,348	9,589
1978:								
West Germany	7,289	4,622	5,977	5,255	5,391	3,249	4,261	3,785
Japan	10,303	10,484	8,199	5,949	7,159	7,303	5,888	4,421
All other	11,817	10,529	9,323	10,433	9,434	8,443	7,550	8,727
Total	29,409	25,635	23,499	21,637	21,984	18,995	17,699	16,933
1979:								
West Germany	3,721	4,342	3,949	3,866	3,058	3,689	3,525	3,548
Japan	4,217	3,659	3,693	3,627	3,301	3,286	3,684	3,674
All other	11,465	12,543	10,650	10,040	9,838	11,806	10,517	10,633
Total	19,404	20,546	18,292	17,533	16,198	18,782	17,726	17,855
1980:								
West Germany	4,115	4,329	3,727	3,443	4,462	5,190	3,979	3,719
Japan	3,864	4,309	2,676	2,541	4,127	5,179	3,062	2,726
All other	6,896	6,951	4,020	5,142	7,846	8,215	4,715	5,943
Total	14,875	15,589	10,423	11,126	16,435	18,584	11,756	12,388
1981:								
West Germany	6,353	6,043	7,940	6,789	6,887	5,982	7,624	6,387
Japan	3,663	4,969	3,956	4,214	3,848	5,058	3,984	3,965
All other	8,876	10,884	9,803	10,462	9,661	11,244	9,852	10,306
Total	18,892	21,896	21,699	21,466	20,396	22,284	21,460	20,658
1982:								
West Germany	6,473	4,164	3,865	4,933	6,043	3,917	3,638	4,566
Japan	3,956	3,001	2,644	1,913	3,963	2,844	2,353	1,650
All other	10,507	10,136	9,028	5,485	10,447	9,764	7,937	5,593
Total	20,936	17,301	15,537	12,331	20,453	16,525	13,928	11,809

1/ The data shown represent 70 percent of trade under TSUS item 612.39. In 1977 this item included other articles besides brass strip.

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table A-27.--Brass strip: Japanese exports of domestic merchandise, total and to the United States, by quarters, 1977-82

Period	World		United States		All other	
	Quantity	Value	Quantity	Value	Quantity	Value
	Metric tons	1,000 yen	Metric tons	1,000 yen	Metric tons	1,000 yen
1977:						
January-March	9,484	4,751,312	3,569	1,748,822	5,915	3,002,490
April-June	9,814	4,889,322	3,824	1,838,127	5,990	3,051,195
July-September	10,066	4,920,149	4,394	2,005,674	5,672	2,914,475
October-December	11,616	4,771,613	4,902	1,993,670	6,714	2,777,943
1978:						
January-March	10,281	4,009,776	4,896	1,870,050	5,385	2,139,726
April-June	10,562	3,903,095	4,794	1,727,132	5,768	2,175,963
July-September	9,374	3,299,985	3,776	1,255,970	5,598	2,044,015
October-December	8,806	3,310,507	2,681	912,876	6,125	2,397,631
1979:						
January-March	8,712	3,635,663	2,216	872,012	6,496	2,763,651
April-June	8,358	4,189,975	1,910	896,250	6,448	3,293,725
July-September	7,788	4,259,664	1,773	917,614	6,015	3,342,050
October-December	9,936	5,992,686	2,294	1,301,248	7,642	4,691,438
1980:						
January-March	8,706	5,489,322	2,102	1,300,220	6,604	4,189,102
April-June	10,818	7,165,424	2,377	1,545,204	8,441	5,620,220
July-September	8,894	5,343,857	1,258	696,860	7,636	4,646,997
October-December	10,198	5,668,479	1,797	963,879	8,401	4,704,600
1981:						
January-March	9,541	4,843,068	2,383	1,161,395	7,158	3,681,673
April-June	10,704	5,637,217	2,570	1,298,377	8,134	4,338,840
July-September	9,017	4,946,338	2,386	1,241,648	6,631	3,704,690
October-December	8,910	4,875,771	3,108	1,577,345	5,802	3,298,426
1982:						
January-March	7,457	4,009,539	1,653	854,951	5,804	3,154,588
April-June	8,739	4,944,008	1,650	903,493	7,089	4,040,515
July-September	9,492	5,158,812	1,894	1,023,810	7,598	4,135,002
October-December	9,107	4,957,354	2,386	1,292,329	6,721	3,665,025

Source: Compiled from data provided by the Japan Tariff Association, Japan Exports and Imports.

Table A-28.--Pianos: U.S. imports for consumption from West Germany and West German exports of domestic merchandise to the United States, by quarters, 1977-82

Period	U.S. imports		West German exports	
	Quantity	Value	Quantity	Value
	Units	1,000 dollars	Units	1,000 deutsche marks
1977:				
January-March	51	192	21	216
April-June	69	250	56	659
July-September	48	249	43	490
October-December	90	366	110	1,055
1978:				
January-March	61	219	37	351
April-June	110	497	162	1,563
July-September	87	440	61	499
October-December	69	341	105	976
1979:				
January-March	82	434	37	432
April-June	131	663	113	1,003
July-September	32	191	33	423
October-December	109	377	60	645
1980:				
January-March	50	279	34	296
April-June	103	311	47	622
July-September	71	341	45	518
October-December	43	265	61	645
1981:				
January-March	38	269	31	349
April-June	31	242	43	447
July-September	51	401	64	1,089
October-December	78	569	51	712
1982:				
January-March	57	253	11	138
April-June	45	336	39	811
July-September	49	391	45	763
October-December	61	417	136	1,819

Source: Compiled from official statistics of the U.S. Department of Commerce and data provided by Statistisches Bundesamt, Aussenhandel. Reihe 2, Aussenhandel nach Waren und Landern (Spezial handel).

Table A-29.--Pianos: U.S. imports for consumption from Japan and Japanese exports of domestic merchandise to the United States, by quarters, 1977-82

Period	U.S. imports		Japanese exports	
	Quantity	Value	Quantity	Value
	Units	1,000 dollars	Units	1,000 yen
1977:				
January-March	5,320	4,802	5,027	1,342,464
April-June	5,046	4,546	5,040	1,317,028
July-September	5,304	5,124	4,857	1,316,584
October-December	4,805	4,868	5,834	1,479,620
1978:				
January-March	5,491	5,879	4,828	1,274,825
April-June	4,754	5,233	5,455	1,411,506
July-September	5,727	6,665	5,711	1,384,771
October-December	5,988	7,416	6,285	1,519,194
1979:				
January-March	4,986	6,411	5,254	1,376,048
April-June	5,884	7,638	5,904	1,611,904
July-September	4,690	5,659	5,147	1,521,222
October-December	6,397	7,888	5,054	1,549,379
1980:				
January-March	5,112	6,167	5,729	1,742,273
April-June	5,501	7,049	5,286	1,589,251
July-September	5,260	6,356	5,022	1,421,154
October-December	5,841	6,815	5,314	1,529,768
1981:				
January-March	5,470	7,140	5,427	1,601,977
April-June	5,616	8,371	6,018	2,061,284
July-September	5,591	8,410	7,023	2,424,322
October-December	7,347	10,381	8,397	2,823,696
1982:				
January-March	8,660	12,221	7,440	2,630,183
April-June	8,197	12,397	7,806	3,109,241
July-September	7,004	11,451	6,163	2,595,304
October-December	4,358	7,361	5,294	2,344,293

Source: Compiled from official statistics of the U.S. Department of Commerce and data provided by the Japan Tariff Association, Japan Exports and Imports.

Table A-30.--Pianos: U.S. production, apparent consumption, wholesale prices, and rates of duty, by quarters, 1977-82

Period	Production 1/		Consumption 2/		Wholesale price 3/	Rate of duty
	Quantity	Value	Quantity	Value		
	Units	1,000 dollars	Units	1,000 dollars	Per unit	Percent ad val.
1977:						
January-March	55,579	42,014	59,299	45,336	$1,259	8.5
April-June	45,744	37,203	48,794	41,558	1,279	8.5
July-September	55,958	43,263	59,048	58,358	1,316	8.5
October-December	58,871	47,053	61,900	61,509	1,348	8.5
1978:						
January-March	58,054	47,793	61,220	52,063	1,567	8.5
April-June	50,740	44,655	53,107	48,684	1,720	8.5
July-September	59,577	50,876	61,603	55,277	1,676	8.5
October-December	67,256	59,959	68,778	64,516	1,707	8.5
1979:						
January-March	60,534	56,115	62,642	60,809	1,683	8.5
April-June	54,161	53,307	56,547	58,790	1,896	8.5
July-September	57,400	55,427	58,293	58,464	1,907	8.5
October-December	58,501	59,182	60,077	63,083	2,011	8.5
1980:						
January-March	55,714	57,585	57,844	61,063	1,905	8.1
April-June	35,146	39,492	36,266	42,327	2,050	8.1
July-September	49,813	52,975	51,812	56,456	1,889	8.1
October-December	54,680	60,680	54,977	62,325	2,010	8.1
1981:						
January-March	49,176	56,265	49,476	58,903	2,070	7.7
April-June	43,022	51,698	43,731	55,364	2,304	7.7
July-September	47,107	56,270	49,803	62,184	2,076	7.7
October-December	47,057	58,749	52,661	67,852	2,676	7.7
1982:						
January-March	42,337	53,476	50,300	65,579	2,547	7.3
April-June	37,297	47,013	45,320	59,836	2,915	7.3
July-September	37,681	46,442	43,868	58,202	2,763	7.3
October-December	42,447	53,564	46,778	62,247	2,904	7.3

1/ Production data were provided by the National Piano Manufacturers of America, Inc.
2/ Consumption data are based on domestic production plus imports minus exports.
3/ Based on c.i.f. value of imports plus duty rate plus 10 percent markup.

Source: Compiled from official statistics of the U.S. Department of Commerce, except as noted.

Appendix B

General Description of Econometric Model

This appendix describes the econometric model that was used to examine the effects of exchange-rate changes on trade flows in selected commodities. The estimation results are also presented and briefly analyzed. More descriptive analysis is contained in the main text of the study.

To capture the effects of exchange rate changes, the model must link the changing value of the dollar to the trade flows of exports and imports. Many factors should be included in the model to correctly estimate the effects of exchange rates on trade flows. Some allowance should be made for the fact that not all exchange rate changes are completely passed through as price changes, and that price effects of exchange rate changes often occur only after a lag. Other factors that may influence prices and trade flows, such as the costs of production, domestic prices and other foreign prices of competing products, demand conditions in the importing country, and other activity variables should be included whenever possible.

The model used to include these factors has been adapted from economic models applied to aggregate trade flows. 1/ These aggregate models first attempt to account for supply effects and price setting behavior by estimating the determinants of import and export prices. The estimated prices are then used, along with other determinants, to estimate real imports and exports.

The adapted model concentrates on the six products chosen for closer study, and the variables relevant to trade in those six products. The model was chosen because it was easily adapted to each of the products, it highlighted the exchange-rate effects, and it permitted reasonable control for other factors that also may affect trade flows, given the available data. A major problem affecting the explanatory power of most models of trade in a specific product is the shortage of time series data for the variables that determine trade. The model used in this study also suffers from this limitation. As a result, proxies were utilized in place of desired variables, thus limiting the explanatory power of the model, particularly the volume estimates. However, in some cases, additional variables, omitted from the model because no data were available, appeared to be correlated with the exchange rate, and caused unexpected results. Further efforts to collect more data and to capture more completely the relationships between the variables should yield models with greater explanatory power.

1/ For a representative selection of studies of exchange rate effects on aggregate trade flows, see: Robert M. Stern, Christopher F. Baum and Mark N. Greene, "Evidence on Structural Change in the Demand for Aggregate U.S. Imports and Exports", Journal of Political Economy, Vol. 87, no. 1, 1979; John F. Wilson and Wendy E. Takacs, Expectations and the Adjustment of Trade Flows Under Floating Exchange Rates, International Finance Discussion Papers No. 160, April 1980, Board of Governors of the Federal Reserve; and Kenneth Bernauer, "Effectiveness of Exchange-Rate Changes on the Trade Account: The Japanese Case", Economic Review, Federal Reserve Bank of San Francisco, Fall 1981, as well as the numerous studies referenced in these papers.

To include the factors that may affect trade flows, the following, two-equation model for each bilateral trade flow has been estimated.

$$(1)\quad P_t = a + \sum_i b_i ER_{t-i} + \sum_i c_i HP_{t-i} + \sum_i d_i DP_{t-i} + eNP_t;$$

$$(2)\quad M_t = a + \sum_i b_i ER_{t-i} + cPHAT_t + \sum_i d_i DP_{t-i} + eAC_t + fNP_t.$$

Equation (1) estimates the price (P) of U.S. imports (or exports) in units of the currency of the origin country 1/ as a function of the exchange rate (ER) in foreign currency per dollar, the foreign (or U.S. for exports) home-market price (HP), the weighted price of the competing U.S. (or foreign for exports) domestic and imported product (DP),2/ and U.S. and foreign nonprice variables (NP) that may influence import (or export) prices. Equation (2) estimates real imports (or exports) as a function of the exchange rate in units of foreign currency per dollar, the estimated import (or export) price (PHAT) from equation (1), the weighted price of the competing U.S. (or foreign for exports) domestic and imported product, a demand variable such as apparent consumption (AC), and other U.S. and foreign nonprice variables that may influence imports (or exports). The price and exchange rate variables were lagged to include any lagged effects on trade flows, and i denotes the lag quarter from time period t. Because of the limited number of observations available, the estimated price was not lagged in equation (2).

In the equation for import and export prices, a variable often used to represent nonprice factors that affect price is inventories. 3/ Unfortunately, this variable was not available on a quarterly basis for the products considered. Instead, indexes of domestic and foreign production of the specific products were used to represent these nonprice factors. Given the level of demand, higher production levels were expected to reduce import and export prices. Because a more appropriate variable was not available, wholesale prices of individual products were used as a proxy for domestic costs. 4/ However, wholesale prices may also reflect demand pressures. In either case, higher wholesale prices were expected to increase import and export prices.

Exporters, both foreign and domestic, were expected to react to changes in the dollar's value by altering their home-currency prices so as to maintain a relatively stable foreign market price of their product. 5/ For example, exporters were expected to lower home-currency prices of their exports as their currency appreciated to remain competitive in foreign markets. With complete adjustment, the elasticity of the home currency price with respect to the exchange rate is 1 in absolute value. When exporters let the foreign market price increase by lowering their foreign currency price by less than the amount necessary to offset the appreciation, the elasticity is between 0

1/ Unit values were used for import and export prices.

2/ The weights were based on the relative magnitudes of domestic production and other foreign imports.

3/ See, for example, Peter Hooper, Forecasting U.S. Export and Import Prices and Volumes in a Changing World Economy, International Finance Discussion Papers No. 99, December 1976, Board of Governors of the Federal Reserve System.

4/ See, for example, Bernauer, op. cit., who also used wholesale prices.

5/ For an example of a similar approach, see Hooper, op. cit.

and 1. At the extreme, the elasticity in this latter case will be 0. To remain competitive, exporters were expected to lower home-currency prices as competitors' prices at destination declined.

In the equation for import and export volumes, capacity utilization has often been used to represent nonprice factors that affect volumes. However, this variable was not available on a quarterly basis for the products considered. 1/ Instead, for the three exported products, indexes of domestic production were used to represent the effects of nonprice factors and, for the three imported products, real gross national product or aggregate demand was used. Since the emphasis of the study has been placed on the influence exerted by exchange rates, these nonprice factors were not refined further. 2/

The volume of imports was expected to increase and the volume of exports was expected to decrease as the dollar appreciated. To the extent that import and export prices were adjusted to maintain relatively constant foreign-market prices, the effect of the exchange rate on volume was expected to be reduced. Import and export volumes were expected to increase as competitors' prices at destination increased, but this effect was also expected to be reduced if prices were adjusted to remain constant relative to competitors' prices.

Both equations are estimated in double logarithmic form. The equations were first estimated with ordinary least squares (OLS) and no distributed lags. OLS estimates with second-degree Almon lags were also run with the far end point constrained to zero. Preliminary results indicated the presence of autocorrelation, and a Cochrane-Orcutt iterative procedure was used to correct the estimates. The results of the lagged OLS estimates, corrected for autocorrelation, are reported.

The data

The specific data series used for each commodity that was examined are contained in Appendix A. In each case, the model was estimated using quarterly data for the period 1977:1 to 1982:4. In some cases the fourth quarter of 1982 was unavailable. The data were obtained from many sources, and the reader should refer to the tables in Appendix A for these sources.

Unit values were used in place of prices in many instances. The reader is cautioned that use of unit values may bias the results, primarily because changes in commodity composition as well as actual price changes may cause unit values to change. Although the commodities were derived from 7-digit schedule B and TSUS classifications, some of the commodities were grouped

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1/ For an example of the use of capacity utilization, see Hooper, op. cit.

2/ As is often done in the literature, no a priori assumptions were made about the expected effect of nonprice factors on trade volumes. See, for example, Wilson and Takacs, op. cit.

across these 7-digit classifications. As a result, changes in the composition of the commodities has introduced an unknown element of bias. 1/

Empirical results

The model was estimated for U.S. imports of brass strip from Japan and West Germany, U.S. imports of bicycles from Japan, U.S. imports of pianos from Japan and West Germany, U.S. exports of denim to Italy and the United Kingdom, U.S. exports of magnesium to Japan and the European Communities (EC), and U.S. exports of polyester staple to Canada and Hong Kong. Different lag lengths were tried for the exchange rate and the competitors' price terms. Because of the limited number of observations available, the estimated import and export price terms were not lagged in the import and export equations. The results reported in the tables were the most satisfactory based on coefficient signs, significance levels, and coefficient behavior in the distributed lags.

Prices.--The price equations explained more of the variation in the dependent variable than the volume equations. The long-run coefficient on the exchange rate had the expected sign in each of the price equations for imports, but it had the expected sign in only half of the price equations for exports. Not all coefficients were significant at the 95-percent level. The overall results suggest that U.S. and foreign exporters will reduce home-currency prices to offset, at least to some degree, unfavorable exchange rate changes, possibly to maintain market share, and will increase home-currency prices to take advantage of favorable exchange rate changes, possibly to boost profit margins. A more comprehensive modeling of this process may prove fruitful to an analysis of the effects of exchange rates on trade flows. In addition, the use of forward markets to diminish the effects of exchange rates is apparently increasing, and the ability of traders in specific products to participate in these markets is another area worthy of additional research.

The analysis also might be beneficially extended in two other directions. It may be extended to include more products to see if different responses to exchange rate changes exist within and between industries. The results also suggest that exporters can respond to exchange-rate changes by changing the export price or by changing nonprice factors, such as quality. The analysis may also be extended to consider the ability of the domestic producers of competing products to adjust to imports which may continue to sell at similar prices, but better quality, after an appreciation of the home currency.

The coefficient on the competitors' price term had the expected sign in four of the five price equations for imports, and five of the six price

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1/ For a brief discussion of this problem as well as some of the difficulties encountered in empirical research based on unit value data, see Irving B. Kravis and Robert E. Lipsey, "Prices and Market Shares in the International Machinery Trade," Review of Economics and Statistics, Vol 64, No. 1, February 1982, as well as the references contained in this study.

equations for exports. 1/ Not all coefficients were significant at the 95 percent confidence level. Although the degree of influence differed by commodity, the results suggest that both U.S. and foreign exporters will adjust prices to conform with price adjustments by their competitors in the destination market.

The signs of the coefficients on the activity variables included in the price equations were not as expected in all cases, and usually were not significant. Additional measures of production costs were included when they could be obtained. These measures were cotton prices in the denim equations, copper prices in the brass strip equations, and producer prices in the bicycles and all of the export price equations. The coefficients on these variables were generally positive and significant, and suggest that production costs do affect price, but that more specific measures of costs are needed to capture the effect.

The estimated lags for the exchange rate and competitors' price terms in the price equations were shorter than expected in most cases. 2/ For those products with short order-to-delivery times, changes in exchange rates and competitors' prices can be readily incorporated into contract terms with only slight delays. The results suggest that exporters with longer order-to-delivery times, such as pianos, are also able to adjust quickly to these price and exchange rate changes, perhaps either by adjusting contract terms or by using forward markets, or both. Future research efforts on the ability of producers to adjust quickly to price and exchange rate changes in international trade may prove fruitful. The results suggest that the speed of adjustment has become more rapid than prior studies would indicate.

Based on the adjusted coefficient of determination, the model was able to explain 90-percent or more of the total variation in the import or export price for 8 of the 11 bilateral trade flows examined. The amount of explanation ranged from 98-percent of the variation in import price for brass strip imports from Japan to 53-percent of the variation in import price for piano imports from West Germany.

Volumes.--Exchange rate changes were expected to positively influence imports and negatively influence exports, and the results suggest that exchange rate changes do affect imports and exports. However, only three of the six coefficients with significant signs also had the expected sign. Unexpected results were obtained for brass strip imports from West Germany, polyester staple exports to Canada, and magnesium exports to the EC. Nonprice factors appear to be important in the EC's market for magnesium. The Canadian market for polyester staple may be atypical because of business ties between U.S. and Canadian firms. In the brass strip equation for West Germany, product characteristics as well as market conditions may be equally or more

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1/ Due to data constraints, the U.K. wholesale price of denim was used in the U.K. model, and probably did not adequately capture prices of denim from alternative foreign sources. Also, because the influence of U.S. export prices on the wholesale price of denim in the United Kingdom could not be removed, the results in this case may have been adversely affected.

2/ This result conforms with results obtained by Hooper, op. cit., but not those obtained by Stern, op. cit., which were estimated from data more aggregated than that used by Hooper or that used in this study.

important determinants of changes in volumes. In these three cases, omitted variables may have caused the surprising results. These variables are suspected to be correlated with the exchange rate and the volume of trade, and sufficiently important determinants of trade to cause the unexpected results. A more complete model of these three trade flows was beyond the scope of this study.

For imports of Japanese bicycles and West German pianos and for exports of denim to Italy, the coefficients on the exchange rate term were significant and had the expected sign. In the bicycle case, Japanese exporters offset exchange rate changes by raising home-currency prices when the dollar appreciates, yet the exchange rate also significantly affected import volume. Although the Japanese maintain a relatively constant dollar price of bicycles, they may use nonprice factors, such as greater servicing and better quality, to increase sales when the dollar appreciates. West German piano exporters did not adjust home-currency prices as exchange rates changed, so the exchange rate effect occurred directly in the volume equation. U.S. export prices of denim increased as the dollar appreciated, and export volume declined. Although the effect on prices was not expected, the exchange rate effect on volume is consistent with its effect on prices.

Competitors' prices were expected to positively affect import and export volumes. The results indicate no clear pattern from the effect of competitors' prices on export volumes nor on import volumes. The results may be partially explained by the adjustment of import and export prices to competitors' prices. Also, the competitors' price term was a weighted average of the domestic price and the unit value of imports from all other foreign sources. To preserve degrees of freedom, these two prices were not entered separately. If the commodities studied are not sufficiently close substitutes across the three possible sources (the United States, the country in question, and all other countries), then the price term used in this study may not adequately capture the effects of each group of competitors' prices. In addition, variables such as credit terms, advertising, and other marketing techniques and services may also be important determinants of export and import volumes. To the extent that these other variables differ across competitors, they, like price, will help to allocate market demand, and should be included in the model to remove any specification bias that may affect the price terms. Unfortunately, data on these additional variables were not available.

Apparent consumption was included as a proxy for market demand for the commodity. The coefficient on this variable was positive and significant in five cases. Three cases had negative signs, but insignificant coefficients. The results support the hypothesis that U.S. imports and U.S. exports rise and fall with market demand.

Import and export prices generally affected imports and exports in the expected way. Ten of the eleven coefficients were negative, and four of these were significant. The only "wrong" sign occurred in the denim equation for the United Kingdom.

The nonprice variables were significant in 5 of the 11 cases. Japanese domestic demand was used in place of Japanese GNP in the import equations to

capture the suspected increase in Japanese exports during times of lower Japanese domestic demand. The significant results for coefficients on Japanese domestic demand and West German GNP had both positive and negative signs. When significant, the sign on the coefficient of U.S. production was negative. Future efforts to include more specific measures of the nonprice factors as data become available may provide models with greater explanatory power.

Although the model did not explain the total variation in import and export volumes as well as the variation in import and export prices, it was able to explain between 80- and 90-percent of the variation in the import or export volume for 4 of the 11 bilateral trade flows examined. The model explained 70- to 80-percent of the variation in 5 of the remaining 7 flows. The amount of explanation ranged from 88-percent for brass strip imports from Japan to 56-percent for piano imports from Japan.

Table B-1.--Denim: Coefficient estimates for U.S. exports to Italy and the United Kingdom, based on quarterly data for 1977-82 1/

Country	Variable	Coefficient estimate	Lag coefficient					
			t-0	t-1	t-2	t-3	t-4	t-5
	Export price equation							
Italy	Constant	-6.6747						
		(-3.72)						
	U.S. production	-0.2507						
		(-4.44)						
	U.S. price	1.4854						
		(11.49)						
	World cotton price	1.3244						
		(5.15)						
	Italian production	-0.9536						
		(-5.99)						
	Italian price	-0.6814	-0.1078	-0.3048	-0.2688			
		(-2.83)	(-0.61)	(-3.95)	(-4.06)			
	Exchange rate	1.4526	-1.812	1.330	1.934			
		(3.67)	(-4.44)	(4.08)	(4.22)			
	$\bar{R}^2$ = 0.9681 SER = 0.0255 F(8,11) = 73.1163 D.W. = 2.5337 Rho = -0.6839							
United Kingdom	Constant	8.9095						
		(1.91)						
	U.S. production	-0.1517						
		(-0.64)						
	U.S. price	0.2769						
		(0.50)						
	World cotton price	-0.3966						
		(-1.50)						
	U.K. production	0.0774						
		(0.71)						
	U.K. price	0.4774						
		(1.43)						
	Exchange rate	-1.1803	0.8883	-0.3541	-0.9162	-0.7982		
		(-1.89)	(2.28)	(-1.89)	(-2.50)	(-2.54)		
	$\bar{R}^2$ = 0.7281 SER = 0.0899 F(7,15) = 9.417 D.W. = 1.9144 Rho = -0.0143							

Table B-1.--Denim: Coefficient estimates for U.S. exports to Italy and the United Kingdom, based on quarterly data for 1977-82 1/--Continued

Country	Variable	Coefficient estimate	Lag coefficient t-0	t-1	t-2	t-3	t-4	t-5
	Export volume equation							
Italy	Constant	10.1435						
		(1.05)						
	U.S. production	0.4070						
		(0.56)						
	Export price	-1.8249						
		(-1.83)						
	Apparent Italian consumption	0.5909						
		(3.16)						
	Italian price	4.1004	1.030	1.230	1.125	0.7152		
		(2.26)	(0.95)	(2.26)	(1.66)	(1.27)		
	Exchange rate	-4.5269	-2.322	-1.358	-0.6496	-0.1970		
		(-3.06)	(-1.57)	(-3.06)	(-0.60)	(-0.20)		
	$\bar{R}^2$ = 0.7868 SER = 0.2488 F(7,11) = 10.4873 D.W. = 1.9678 Rho = -0.1836							
United Kingdom	Constant	-31.0986						
		(-0.54)						
	U.S. production	6.0560						
		(2.10)						
	Export price	1.9132						
		(0.34)						
	U.K. apparent consumption	-0.1929						
		(-1.42)						
	U.K. price	-7.3381	-2.642	-2.201	-1.614	-0.8804		
		(-2.00)	(-0.67)	(-2.00)	(-0.83)	(-0.48)		
	Exchange rate	7.6305	-4.453	2.289	5.279	4.516		
		(1.26)	(-0.75)	(1.26)	(1.05)	(1.01)		
	$\bar{R}^2$ = 0.7292 SER = 0.5804 F(7,12) = 8.3100 D.W. = 2.2290 Rho = -0.4522							

1/ T-ratios in parentheses. For the export price equations, the coefficient is significant at the 1-percent level if the t-ratio exceeds 3.106 for Italy and 2.947 for the United Kingdom, and at the 5-percent level if it exceeds 2.201 for Italy and 2.131 for the United Kingdom. For the export volume equations, the coefficient is significant at the 1-percent level if the t-ratio exceeds 3.106 for Italy and 3.055 for the United Kingdom, and at the 5-percent level if it exceeds 2.201 for Italy and 2.179 for the United Kingdom. The exchange rate was expressed in units of foreign currency per U.S. dollar. The Italian (U.K.) price was a weighted average price for Italian (U.K.) and other foreign sources of denim, with weights based on production and import levels. The export price is the estimated price based on the price equation.

Table B-2.--Pianos: Coefficient estimates for U.S. imports from Japan and West Germany, based on quarterly data for 1977-82 1/

Country	Variable	Coefficient estimate	Lag coefficient t-0	t-1	t-2	t-3	t-4	t-5
	Import price equation							
Japan	Constant	0.5844						
		(0.29)						
	U.S. production	-0.0383						
		(-0.33)						
	Japanese production	-0.2628						
		(-1.27)						
	U.S. price	0.5703	0.2254	0.2100	0.1348			
		(4.75)	(1.39)	(3.43)	(1.37)			
	Exchange rate	0.6101	0.7035	0.0706	-0.1639			
		(3.69)	(4.27)	(0.92)	(-1.66)			
	$\bar{R}^{-2}$ = 0.9626 SER = 0.0337 F(6,14) = 86.8442 D.W. = 1.7161 Rho = -0.3509							
West Germany	Constant	4.4598						
		(1.15)						
	U.S. production	-0.7151						
		(-2.12)						
	West German production	0.0539						
		(0.13)						
	U.S. price	0.2743						
		(1.36)						
	Exchange rate	0.4074	0.0686	0.1222	0.1287	0.0879		
		(1.46)	(0.16)	(1.46)	(0.63)	(0.44)		
	$\bar{R}^{2}$ = 0.5268 SER = 0.1534 F(5,17) = 5.8985 D.W. = 2.0843 Rho = -0.2258							
	Import volume equation							
Japan	Constant	0.0825						
		(0.02)						
	Japanese domestic demand	0.0560						
		(2.18)						
	Apparent U.S. consumption	0.4767						
		(1.61)						
	U.S. price	1.4544	0.3897	0.4363	0.3869	0.2414		
		(1.60)	(0.81)	(1.60)	(1.32)	(1.04)		
	Import price	-0.4693						
		(-0.46)						
	Exchange rate	-0.6504	-0.0630	-0.1139	-0.1403	-0.1420	-0.1193	-0.0719
		(-0.63)	(-0.12)	(-0.39)	(-0.72)	(-0.71)	(-0.61)	(-0.54)
	$\bar{R}^{2}$ = 0.5646 SER = 0.1026 F(7,12) = 4.5202 D.W. = 1.6738 Rho = -0.6276							

Table B-2.--Pianos: Coefficient estimates for U.S. imports from Japan and West Germany, based on quarterly data for 1977-82 1/--Continued

Country	Variable	Coefficient estimate	Lag coefficient					
			t-0	t-1	t-2	t-3	t-4	t-5
	Import volume equation--Continued							
West Germany	Constant	15.2725						
		(2.02)						
	West German GNP	-0.2137						
		(-3.04)						
	U.S. Apparent consumption	-2.3259						
		(-1.57)						
	U.S. price	-0.4421	-3.589	-0.1326	1.618	1.662		
		(-0.51)	(-2.44)	(-0.51)	(2.40)	(2.47)		
	Import price	-4.6463						
		(-2.62)						
	Exchange rate	5.5808	1.914	1.435	1.02	0.6694	0.3824	0.1592
		(3.42)	(2.87)	(3.48)	(3.15)	(2.08)	(1.29)	(0.82)
	$\bar{R}^2$ = 0.6822 SER = 0.2512 F(7,12) = 6.8261 D.W. = 2.6088 Rho = -0.1218							

1/ T-ratios in parentheses. For the import price equations, the coefficient is significant at the 1-percent level if the t-ratio exceeds 2.977 for Japan and 2.898 for West Germany, and at the 5-percent level if it exceeds 2.145 for Japan and 2.110 for West Germany. For the import volume equations, the coefficient is significant at the 1-percent level if the t-ratio exceeds 3.055 and at the 5-percent level if it exceeds 2.179. The exchange rate was expressed in units of foreign currency per U.S. dollar. The U.S. price was a weighted average price for U.S. and other foreign sources of pianos, with weights based on production and import levels. The import price is the estimated value based on the price equation.

Table B-3.--Magnesium: Coefficient estimates for U.S. exports to Japan and the European Community, based on quarterly data for 1977-82 1/

Country or area	Variable	Coefficient estimate	Lag coefficient t-0	t-1	t-2	t-3	t-4	t-5
	Export price equation							
Japan	Constant	-2.7542						
		(-0.71)						
	Japanese production	0.5737						
		(2.59)						
	U.S. production	-0.5851						
		(-2.19)						
	U.S. price	0.9746						
		(1.87)						
	Price of other foreign sources in Japan	1.4837						
		(2.89)						
	Exchange rate	-0.8473	-0.8457	-0.4029	-0.0809	0.1204	0.2010	0.1608
		(-1.96)	(-2.95)	(-2.63)	(-1.21)	(2.27)	(3.12)	(3.25)
	R^{-2} = 0.7362 SER = 0.0660 F(6,15) = 10.7697 D.W. = 2.6052 P = -0.5696							
European Community	Constant	1.6087						
		(0.76)						
	EC production	-0.4488						
		(-2.09)						
	U.S. production	-1.0911						
		(-4.44)						
	U.S. price	0.7523						
		(2.67)						
	Price of other foreign sources in the EC	-0.5035	0.0267	-0.0341	-0.0430			
		(-0.27)	(0.34)	(-0.44)	(-0.70)			
	Exchange rate	1.4945	0.0265	0.2223	0.3381	0.3737	0.3292	0.2047
		(3.54)	(0.13)	(2.20)	(3.60)	(3.11)	(2.76)	(2.56)
	R^{-2} = 0.9609 SER = 0.4658 F(7,13) = 71.2376 D.W. = 1.8498 Rho = -0.1823							

Table B-3.--Magnesium: Coefficient estimates for U.S. exports to Japan and the European Community, based on quarterly data for 1977-82 1/--Continued

Country or area	Variable	Coefficient estimate	Lag coefficient t-0	t-1	t-2	t-3	t-4	t-5
	Export volume equation							
Japan	Constant	22.0065						
		(1.21)						
	Apparent Japanese consumption	1.8007						
		(6.72)						
	U.S. production	-2.1123						
		(-2.81)						
	Price of other foreign sources in Japan	2.1994						
		(0.86)						
	Export price	-0.7662						
		(-0.30)						
	Exchange rate	-4.9604						
		(-1.55)						
	R^{-2} = 0.7749 SER = 0.4890 F(5,15) = 14.7682 D.W. = 1.8435 P = -0.4176							
European Community	Constant	6.3426						
		(0.80)						
	Apparent EC consumption	-0.7854						
		(-0.99)						
	U.S. production	-11.1899						
		(-4.63)						
	Price of other foreign sources in the E.C.	0.3053	-0.1801	0.2127	0.2727			
		(0.78)	(-0.64)	(0.69)	(1.13)			
	Export price	-4.2350						
		(-4.43)						
	Exchange rate	15.7045	0.8179	4.711	6.691	5.120		
		(4.25)	(-0.66)	(4.23)	(4.38)	(4.28)		
	R^{-2} = 0.7917 SER = 0.1576 F(7,12) = 11.3172 D.W. = 2.2752 Rho = 0.3451							

1/ T-ratios in parentheses. For the export price equations, the coefficient is significant at the 1-percent level if the t-ratio exceeds 2.947 for Japan and 3.01 for the EC, and at the 5-percent level if it exceeds 2.131 for Japan and 2.16 for the EC. For the export volume equations, the coefficient is significant at the 1-percent level if the t-ratio exceeds 2.947 for Japan and 3.06 for the EC, and at the 5-percent level if it exceeds 2.131 for Japan and 2.18 for the EC. The exchange rate was expressed in units of foreign currency per U.S. dollar. The Japanese and EC price was a weighted average price for Japanese, EC, and other foreign sources of magnesium, with weights based on production and import levels. The export price is the estimated value based on the price equation.

Table B-4.--Polyester staple fiber: Coefficient estimates for U.S. exports to Canada and Hong Kong, based on quarterly data for 1977-82 1/

Country	Variable	Coefficient estimate	Lag coefficient								
			t-0	t-1	t-2	t-3	t-4	t-5	t-6	t-7	t-8	t-9
	Export price equation											
Canada	Constant	-1.4598										
		(-0.82)										
	U.S. production	0.2507										
		(2.56)										
	Canadian production	2/										
	U.S. price	0.0238										
		(0.09)										
	Canadian price	2/	2/	2/	2/							
	Exchange rate	0.2894	0.9123	0.4803	0.1391	-01112	-0.2707	-0.3393	-0.3170	-0.2030		
		(0.63)	(2.32)	(1.99)	(1.10)	(-1.64)	(-3.36)	(-3.39)	(-3.31)	(-3.24)		
	R^{-2} = 0.9601 SER = 0.0297 F(7,13) = 69.716 D.W. = 2.2957 Rho = -0.6643											
Hong Kong	Constant	-8.3126										
		(-1.91)										
	U.S. production	0.2703										
		(0.92)										
	U.S. price	-0.0305										
		(-0.11)										
	Hong Kong price	0.4600	0.1907	0.1665	0.1029							
		(1.83)	(1.22)	(1.49)	(0.84)							
	Exchange rate	2.1035	-0.2116	0.2300	0.5090	0.6255	0.5795	0.3710				
		(2.44)	(-0.74)	(1.35)	(2.63)	(2.74)	(2.70)	(2.65)				
	R^{-2} = 0.9199 SER = 0.0748 F(6,14) = 39.2692 D.W. = 2.0671 Rho = -0.7202											
	Export volume equation											
Canada	Constant	-30.5787										
		(-3.83)										
	U.S. production	0.7173										
		(1.45)										
	Apparent Canadian consumption	2/										
	Canadian price	2/										
	Export price	-2.4749										
		(-1.98)										
	World cotton price	0.0926										
		(0.34)										
	Exchange rate	8.4649	7.3380	1.7860	-0.6597							
		(4.16)	(3.65)	(1.97)	(-0.54)							
	$\bar{R}^2$ = 0.8000 SER = 0.1052 F(7,12) = 11.8573 D.W. = 2.2816 Rho = -0.6611											

Table B-4.--Polyester staple fiber: Coefficient estimates for U.S. exports to Canada and Hong Kong, based on quarterly data for 1977-82 1/--Continued

Country	Variable	Coefficient estimate	Lag coefficient									
			t-0	t-1	t-2	t-3	t-4	t-5	t-6	t-7	t-8	t-9
			Export volume equation--Continued									
Hong Kong	Constant	-9.7521										
		(-0.27)										
	U.S. production	1.4141										
		(0.70)										
	Apparent Hong Kong consumption	0.9779										
		(2.11)										
	Hong Kong price 2/	-2.1516										
		(-1.48)										
	Export price	-3.8831										
		(-2.43)										
	World cotton price	6.8009										
		(4.26)										
	Exchange rate	-0.5393	8.5750	5.1160	2.2340	-0.0686	-1.7930	-2.940	-3.508	-3.499	-2.911	-1.744
		(-0.08)	(3.01)	(2.78)	(1.96)	(-0.08)	(-1.69)	(-2.33)	(-2.60)	(-2.73)	(-2.81)	(2.86)
	$\bar{R}^2$ = 0.8322 SER = 0.5064 F(7,12) = 14.4629 D.W. = 2.2384 Rho = -0.0525											

1/ T-ratios in parentheses. For the export price equations, the coefficient is significant at the 1-percent level if the t-ratio exceeds 3.012 for Canada and 2.977 for Hong Kong, and at the 5-percent level if it exceeds 2.160 for Canada and 2.145 for Hong Kong. For the export volume equations, the coefficient is significant at the 1-percent level if the t-ratio exceeds 3.055 and at the 5-percent level if it exceeds 2.179. The exchange rate was expressed in units of foreign currency per U.S. dollar. The Canadian (H.K.) price was a weighted average price for Canadian (H.K.) and other foreign sources of polyester staple, with weights based on production and import levels. The export price is the estimated price based on the price equation.

2/ Data suppressed because of business confidentiality.

Table B-5.--Brass Strip: Coefficient estimates for U.S. imports from Japan and West Germany, based on quarterly data for 1977-82 1/

Country	Variable	Coefficient estimate	Lag coefficient t-0	t-1	t-2	t-3	t-4	t-5	t-6	t-7	t-8	t-9
	Import price equation											
Japan	Constant	-1.8077										
		(-1.50)										
	U.S. production	-0.0853										
		(-1.69)										
	Copper price	0.6594										
		(11.49)										
	Japanese production	-0.5389										
		(-2.28)										
	U.S. price	0.6226	-0.6992	0.5444	0.7774							
		(5.03)	(-2.37)	(7.93)	(4.92)							
	Exchange rate	0.7303	0.5915	0.1680	-0.0291							
		(5.95)	(5.14)	(2.49)	(-0.32)							
	$\bar{R}^2$ = 0.9828 SER = 0.0251 F(7,13) = 164.728 D.W. = 2.5697 Rho = -0.6586											
West Germany	Constant	-4.3381										
		(-2.92)										
	U.S. production	-0.0815										
		(-0.96)										
	Copper price	1.0932										
		(5.37)										
	West German production	-0.1610										
		(-0.93)										
	U.S. price	-0.3501	-2.028	0.5008	1.177							
		(-1.23)	(-5.39)	(4.27)	(5.98)							
	Exchange rate	1.4341	1.141	0.4302	0.0304	-0.1404						
		(5.40)	(5.99)	(5.40)	(0.03)	(-1.72)						
	$\bar{R}^2$ = 0.92 SER = 0.0431 F(7,13) = 35.287 D.W. = 2.352 Rho = -0.3776											
	Import volume equation											
Japan	Constant	29.8099										
		(1.46)										
	Japanese domestic demand	-7.9869										
		(-3.27)										
	Apparent U.S. consumption	1.4475										
		(4.01)										
	U.S. price	-0.4961										
		(-0.92)										
	Import price	-0.4229										
		(-0.70)										
	Exchange rate	2.0992	0.6814	0.5156	0.3729	0.2532	0.1565	0.0829	0.0322	0.0460		
		(1.59)	(2.07)	(2.12)	(1.77)	(1.21)	(0.74)	(0.42)	(0.20)	(0.05)		
	$\bar{R}^2$ = 0.8837 SER = 0.1192 F(6,12) = 23.79 D.W. = 2.4541 Rho = -0.5098											

Table B-5.--Brass strip: Coefficient estimates for U.S. imports from Japan and West Germany, based on quarterly data for 1977-82 1/--Continued

Country	Variable	Coefficient estimate	Lag coefficient									
			t-0	t-1	t-2	t-3	t-4	t-5	t-6	t-7	t-8	t-9
	Import volume equation--Continued											
West Germany	Constant	-13.3829										
		(-0.52)										
	West German GNP	13.1588										
		(1.80)										
	Apparent U.S. consumption	0.8665										
		(3.05)										
	U.S. price	-4.2479										
		(-2.60)										
	Import price	-3.3363										
		(-4.59)										
	Exchange rate	-2.5903	2.065	1.097	0.2994	-0.3297	-0.7897	-1.081	-1.203	-1.155	-0.9394	-0.5542
		(-3.28)	(9.82)	(9.64)	(4.15)	(-3.28)	(-5.69)	(-6.61)	(-7.08)	(-7.35)	(-7.53)	(-7.66)
	$\bar{R}^2$ = 0.856 SER = 0.1498 F(6,12) = 18.8288 D.W. = 2.3271 Rho = -0.4927											

1/ T-ratios in parentheses. For the import price equations, the coefficient is significant at the 1-percent level if the t-ratio exceeds 3.012 and at the 5-percent level if it exceeds 2.160. For the import volume equations, the coefficient is significant at the 1-percent level if the t-ratio exceeds 3.055 and at the 5-percent level if it exceeds 2.179. The exchange rate was expressed in units of foreign currency per U.S. dollar. The U.S. price was a weighted average price for U.S. and other foreign sources of brass strip, with weights based on production and import levels. The import price is the estimated value based on the price equation.

Table B-6.--Bicycles: Coefficient estimates for U.S. imports from Japan, based on quarterly data for 1977-82 1/

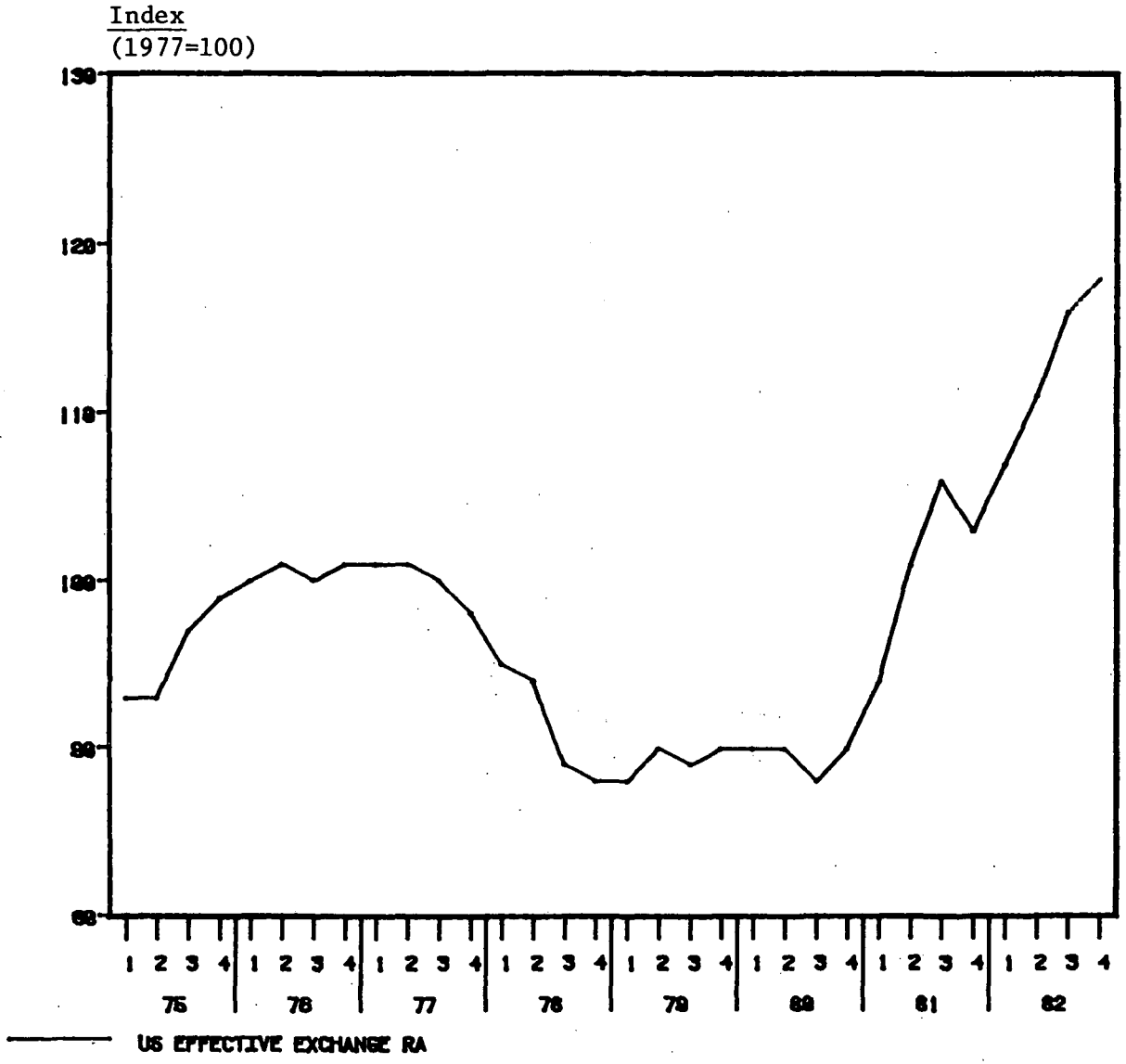
Country	Variable	Coefficient estimate	Lag coefficient							
			t-0	t-1	t-2	t-3	t-4	t-5	t-6	t-7
Import price equation										
Japan	Constant	-11.9072								
		(-4.14)								
	Producer price in Japan	-0.1502								
		(-0.23)								
	U.S. production	0.2103								
		(1.76)								
	Japanese production	-0.0212								
		(-0.45)								
	U.S. price	2.0740								
		(5.73)								
	Exchange rate	1.4488	0.1508	0.1961	0.2231	0.2318	0.2221	0.1941	0.1477	0.0830
		(4.68)	(1.68)	(3.16)	(4.48)	(4.72)	(4.38)	(3.99)	(3.68)	(3.45)
	$\bar{R}^2$ = 0.9131 SER = 0.0555 F(6,15) = 37.7875 D.W. = 1.9374 Rho = -0.0356									
Import volume equation										
Japan	Constant	-36.1431								
		(-1.40)								
	Japanese domestic demand	-5.3064								
		(-1.20)								
	Apparent U.S. consumption	2.5795								
		(6.95)								
	Import price	-1.8217								
		(-0.95)								
	U.S. price	6.4707	8.502	0.401	-2.432					
		(2.20)	(2.65)	(0.34)	(-1.44)					
	Exchange rate	6.8867	1.086	1.346	1.429	1.336	1.067	0.622		
		(3.94)	(2.12)	(3.64)	(3.88)	(3.48)	(3.13)	(2.88)		
	$\bar{R}^2$ = 0.7167 SER = 0.2938 F(7,12) = 7.8656 D.W. = 2.7774 Rho = -0.5563									

1/ T-ratios in parentheses. For the import price equation, the coefficient is significant at the 1-percent level if the t-ratio exceeds 2.947 and at the 5-percent level if it exceeds 2.131. For the import volume equation, the coefficient is significant at the 1-percent level if the t-ratio exceeds 3.055 and at the 5-percent level if it exceeds 2.179.

Appendix C

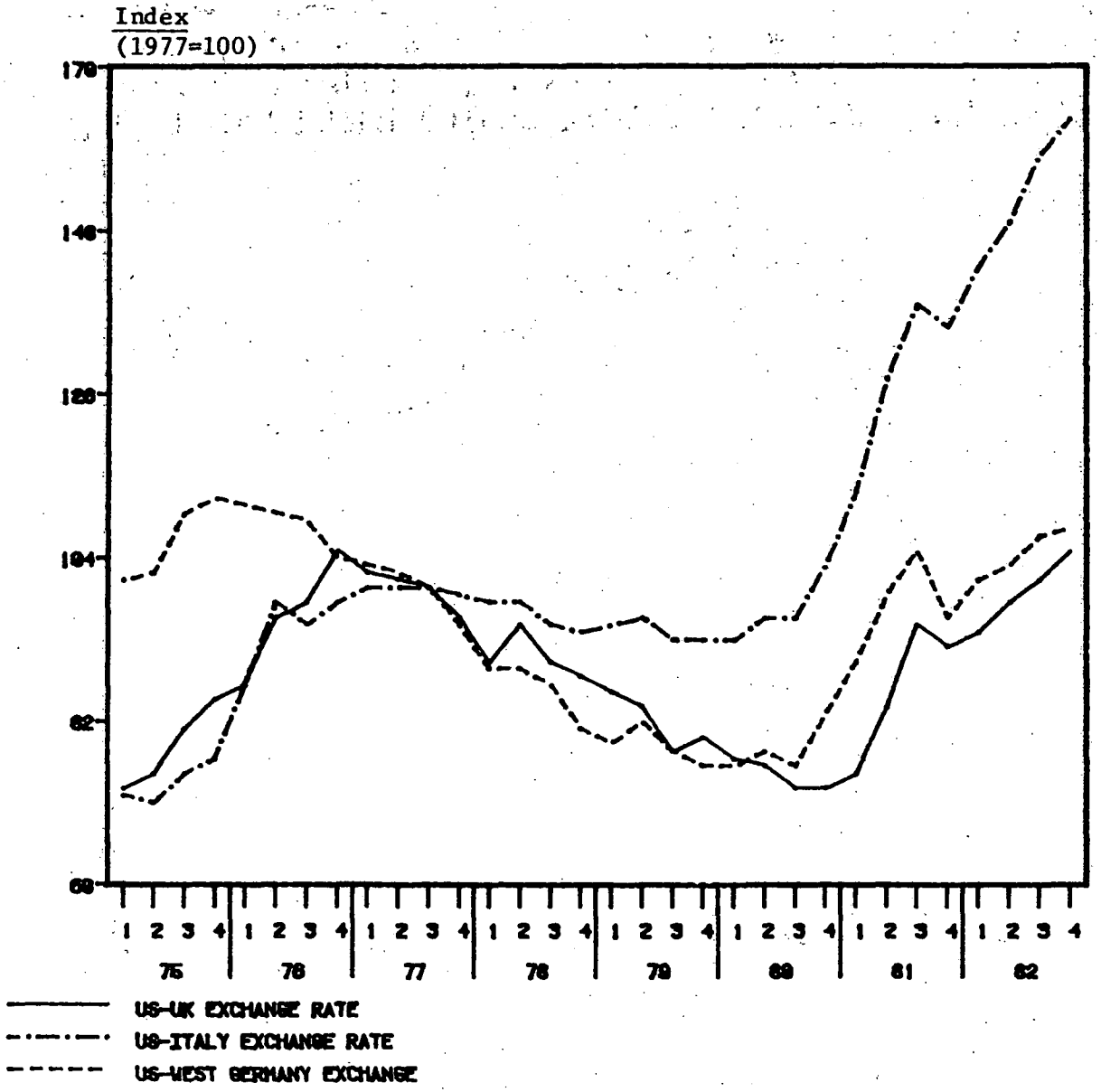
Figures

Figure 1.--Trend of the dollar's effective exchange rate, by quarters, 1975-82.



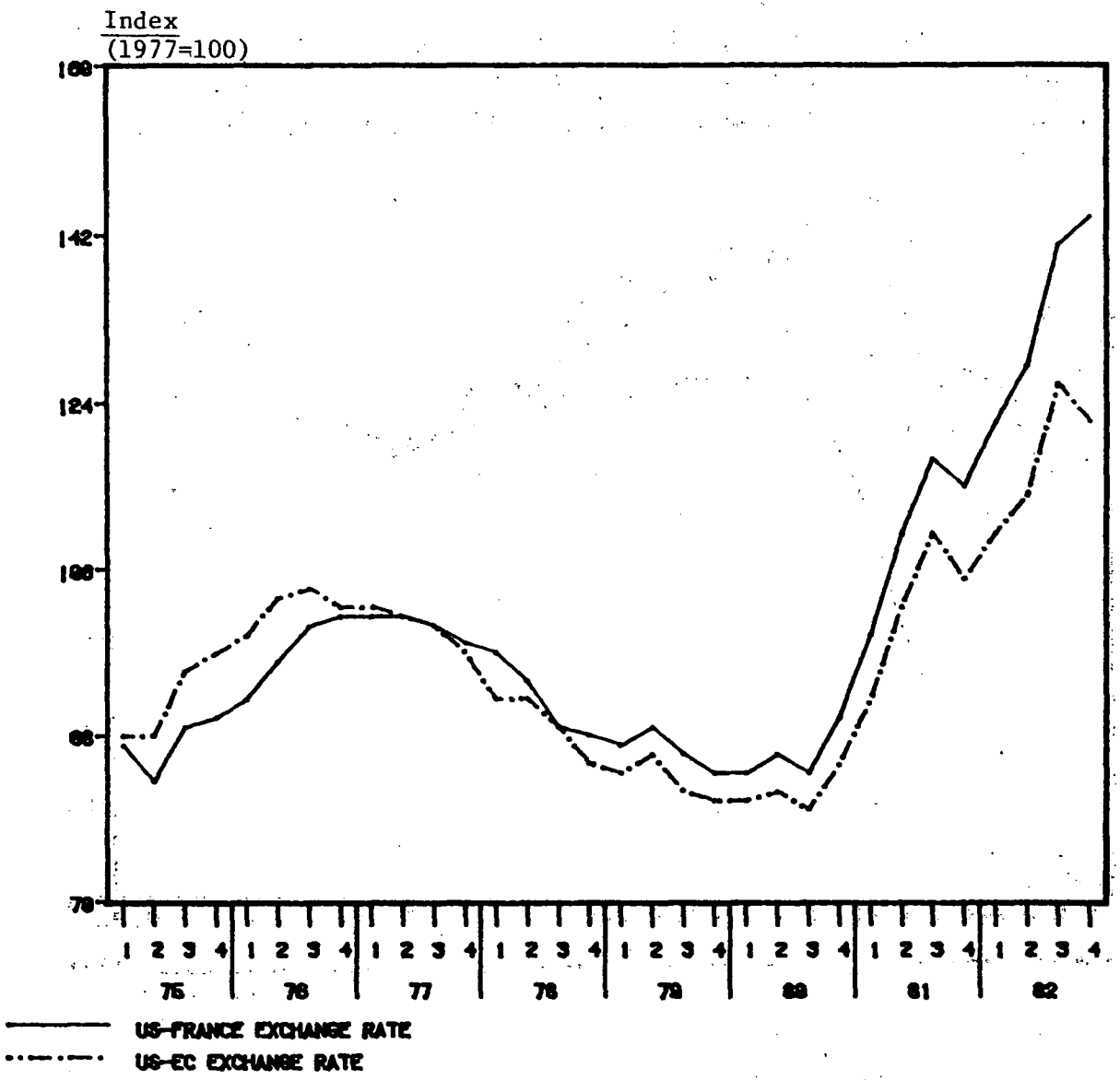
Source: IMF, International Financial Statistics.

Figure 2.--Trends in bilateral exchange rates between the United Kingdom, Italy, and West Germany, by quarters, 1975-82.



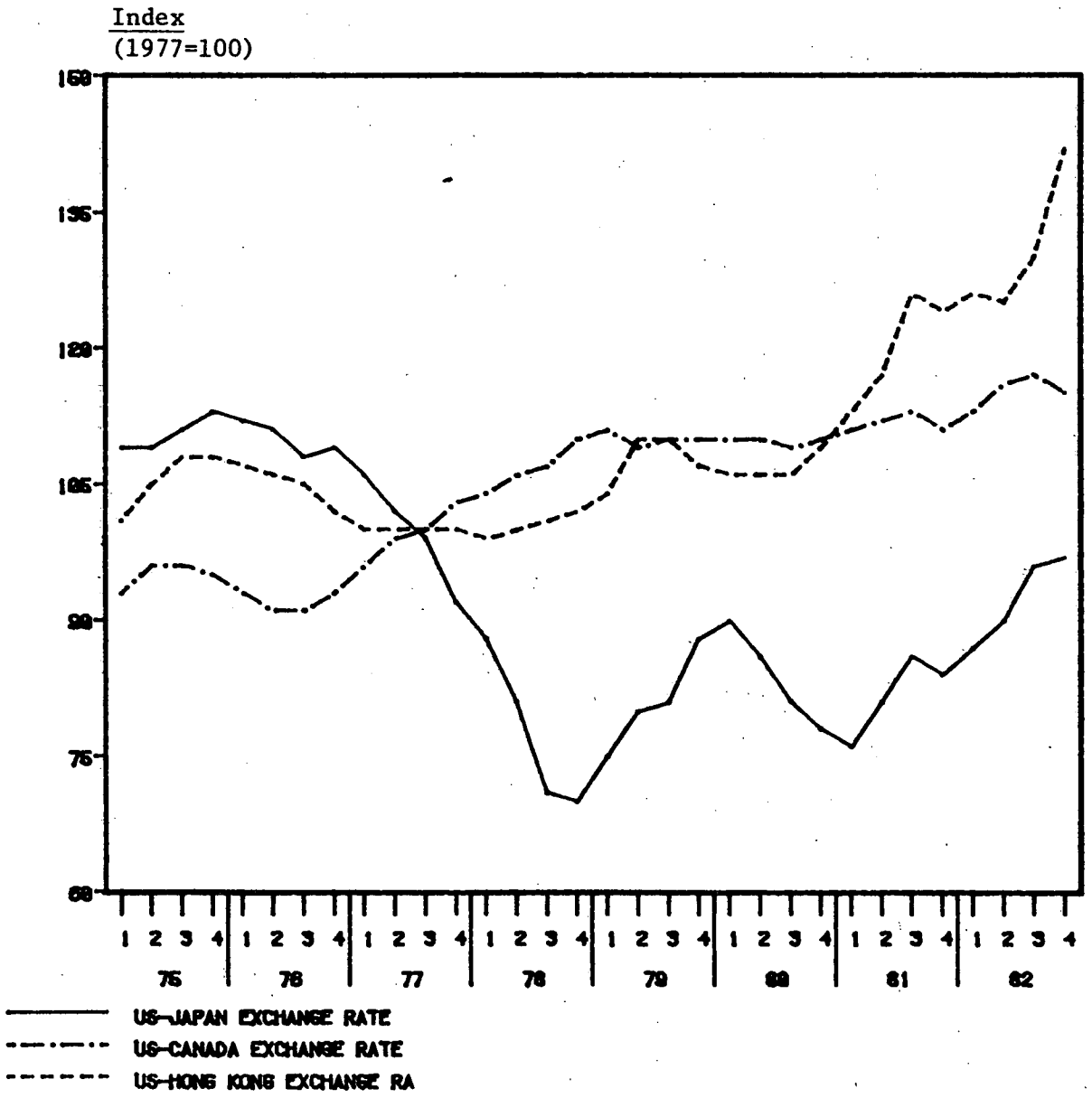
Source: IMF, International Financial Statistics.

Figure 3.--Trends in bilateral exchange rates between the United States and France and the EC, by quarters, 1975-82.



Source: IMF, International Financial Statistics.

Figure 4.--Trends in bilateral exchange rates between the United States and Japan, Canada, and Hong Kong, by quarters, 1975-82.



Source: IMF, International Financial Statistics.

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