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PREFACE

In 1991, the United States International Trade Commission initiated its current *Industry and Trade Summary* series of informational reports on the thousands of products imported into and exported from the United States. Each summary addresses a different commodity/industry and contains information on product uses, U.S. and foreign producers, and customs treatment. Also included is an analysis of the basic factors affecting trends in consumption, production, and trade of the commodity, as well as those bearing on the competitiveness of U.S. industries in domestic and foreign markets.[1]

This report on construction and mining equipment covers the period 1986 through 1990 and represents one of approximately 250 to 300 individual reports to be produced in this series during the first half of the 1990s. Listed below are individual summary reports published to date on the machinery and equipment sector.

USITC publication number	*Publication date*	*Title*
2430 (ME–1)	November 1991	Aircraft, Spacecraft, and Related Equipment
2505 (ME–2)	April 1992	Construction and Mining Equipment

[1] The information and analysis provided in this report are for the purpose of this report only. Nothing in this report should be construed to indicate how the Commission would find in an investigation conducted under statutory authority covering the same or similar subject matter.

CONTENTS

INTRODUCTION

This report discusses key aspects of the global construction and mining equipment industry during 1986-90. Included are discussions of the U.S. and foreign industries, U.S. and foreign markets, and U.S. and foreign trade measures. Construction equipment, as defined in this summary, includes machinery that digs, loads, unloads, carries, and compacts. Some of these articles are also used in mining activity, particularly in surface mining. Not included are cranes, off-highway trucks, mixers, pavers, rough-terrain forklifts, aerial work platforms, and materials handling equipment.

Mining equipment includes a variety of machines that either drill, bore, or cut into earth, mineral, or ore. These articles may also find use in construction activity. Not included are mineral processing equipment, trucks, and shuttle cars.

The equipment covered in this summary is classified in Harmonized Tariff Schedule of the United States (HTS) headings 8429, 8430, and 8431. The principal types of equipment classified in these HTS headings and their uses are as follows:

- *Bulldozers and angledozers* consist of a propelling base, often track-laying, with a large blade mounted in front, forming an integral mechanical unit. They are principally used for removing debris and for rough levelling.
- *Graders and levellers* are designed for earth levelling or smoothing by means of an adjustable grading blade, usually mounted within the wheel base.
- *Scrapers* incorporate a sharp cutting edge designed to slice off a layer of top soil which is then passed into the scraper body or discharged by a conveyor. Only scrapers in which the motor propulsion unit and the scraper form an integral unit, and articulated scrapers are included here.
- *Mechanical shovels* are boom, jib, or cable type, and are designed to dig into soil, above or below machine level, by means of an excavating bucket or grab, operated either directly from the end of a boom or jib (shovel excavators or drag shovels) or, to increase working range, on a cable or by means of a hydraulic jack suspended from the jib (draglines). In long-range excavators (slackline draglines), the bucket is operated on a cable running between two movable structures set some distance apart.
- *Multi-bucket excavators* have digging buckets fitted on endless chains or on rotating wheels. These machines often incorporate conveyors for discharging the excavated soil, and they are mounted on wheeled or track-laying chassis. Special models are designed for digging or cleaning out trenches, drainage channels, ditches for use in open-cast mines, and other uses.
- *Self-propelled shovel loaders* are wheeled or crawler machines with a front-mounted bucket that pick up material through motion of the machine, transport, and discharge it. Some shovel loaders are able to dig into the soil. When the bucket is in the horizontal position, it is capable of being lowered below the level of the wheels or tracks. Also covered are self-propelled shovel loaders having an articulated arm with a bucket, mounted on the rear.
- *Loader transporters* are used in mines. These machines, the main function of which is handling and not transport, are equipped with a front-mounted bucket that picks up bulk materials and discharges them into the body of the machine.
- *Coal or rock cutters* are designed to cut or break down coal, ores, and other materials. They consist of an endless cutting chain running around a metal jib that may be adjustable for level and angle of cut, or of a bar or disc fitted with picks. They may be mounted on self-propelled wheeled or track-laying chassis. Some may be very large, incorporating a number of cutting chains and a built-in conveyor for loading the cut material onto the face of the conveyor or into tubs
- *Well-sinking or boring machines* are designed primarily to extract petroleum, natural gases, and sulphur; to raise strata samples in mining and oil well prospecting; and to sink artesian wells. Fixed platforms used for the discovery or exploration of offshore deposits of oil or natural gas are also classified here.

The types, applications, sizes, and attachments of construction equipment are numerous. For example, hydraulic excavators range in size from under 10 to over 2,100 horsepower. Standard bucket capacity ranges from .02 to 40 cubic yards, and operating weight ranges from just under 1 ton to 600 tons. The typical primary production life, measured in hours, for excavators ranges from 8,000 to 14,000, and prices range from $70,000 to over $600,000. Wheel loaders range in size from 22 to 1,250 horsepower. Bucket capacity in cubic yards ranges from under 0.5 to nearly 30, and operating weight ranges from 3,800 pounds to 390,000 pounds. Wheel loaders have a typical primary production life of 8,000 to 20,000 hours, and are priced from about $40,000 to over $900,000.[1] As an

[1] Information found in *Construction Equipment*, Nov. 1990, Feb. 1991, Mar. 1991, 1991 Specifications Guide (May 25, 1991), and July 1991 issues.

illustration of product variation, a recent product brochure on excavators manufactured by a leading U.S. company lists nearly 20 stick and boom options, 2 dozen varied bucket-types with several kinds of teeth, and some 30 other available attachments.

Longwall systems and continuous miners are used primarily in coal mining. These systems have rapidly gained popularity in the United States over the past decade, and are covered in part by this report.[2] Longwall mining systems are fully integrated coal cutting and conveyor systems that provide high productivity for coal mines. Portable hydraulic roof supports are included to prevent injury and damage resulting from roof collapse. These machines are substantially more costly than continuous miners, which also remove coal from seams and load it onto conveyor cars for transport to the surface. Some continuous miners are now equipped with roof bolters to reinforce mine ceilings. These two systems, due to their ability to increase worker safety, and mine productivity and efficiency, are replacing conventional mining equipment, such as cutting machines and drills.

The manufacture of construction and mining equipment generally involves state-of-the-art tools and manufacturing systems, including manufacturing cells to provide for constant quality control at the point of manufacture. Robotics have also played an increasingly important role in the manufacture of construction and mining equipment, as has computer-aided design (CAD). CAD enables engineers to create models of equipment on a computer faster and cheaper than building steel prototypes. Trends in manufacturing automation also include the use of automatic guided vehicles (AGVs).

U.S. INDUSTRY PROFILE

Industry Structure

Standard Industrial Classification (SIC) categories for construction and mining equipment covered in this summary include the following: construction bulldozers; road graders; construction scrapers; powered tampers; road rollers; shovel loaders; backhoes; power shovels; road drags (construction and road maintenance equipment); pile-driving equipment; piling extractors; snowplow attachments; snowblowers and throwers; cable, clamshell, crane, derrick, dragline, and power shovel excavators; vibratory soil compactors; clamshell, concrete, dragline, drag scraper, and shovel excavating buckets; blades for graders, scrapers, dozers, and snowplows: SIC 3531 (part); coal breakers, cutters, and pulverizers, SIC 3532 (part); oil and gas field machinery and equipment, SIC 3533 (part); and drilling and production platforms, floating, oil and gas, SIC 3731 (part).

More than 1,000 U.S. firms manufacture construction and mining equipment in the United States; however, production is highly concentrated. Many of the major U.S. producers of construction equipment also either manufacture mining equipment, or supply construction equipment to the mining industry.

The top four construction equipment manufacturers in terms of U.S. market share in 1989 were Caterpillar Inc., Komatsu Ltd. (headquartered in Japan), Deere and Company, and J.I. Case division of Tenneco, Inc.[3] Caterpillar is the leading producer in the world, manufacturing in 11 countries worldwide.[4] Caterpillar is believed to account for 45 percent of the U.S. market and 35 percent of world markets in tractors — which can be wheel- or track-mounted, and can be used with dozer, loader, and other attachments.[5] In 1988, the company reported that it accounted for 67 percent of the dozer market (90 hp and over) in the United States, and 50 percent of the same market on a global scale.[6] The percentage of total Caterpillar sales made outside the United States has increased from 46 percent in 1986 to 55 percent in 1990. From 1988 to 1990, exports to the Middle East/Africa region increased nearly 44 percent; exports to the Asia/Pacific region increased 43 percent.[7]

Komatsu formed a 50-50 U.S.-based joint venture, Komatsu Dresser, with Dresser Industries of the United States in 1988. Production began in 1989, and soon after Komatsu Dresser moved into the second-leading manufacturer spot behind Caterpillar in the United States. The Komatsu Dresser joint venture is reportedly essentially a North American manufacturing site for Komatsu. Komatsu Ltd. of Japan continues to manufacture separately, and sells its equipment globally. However, Komatsu only serves the North and South American markets through the U.S.-based joint venture. Dresser's construction equipment production is through Komatsu Dresser; the Komatsu Dresser facility manufactures Komatsu-brand equipment, and Dresser-brand equipment. Dresser's mining equipment production is under its Marion and Jeffrey divisions. In 1990, nearly 50 percent of Dresser's

[2] According to the U.S. Customs Service, the shearing equipment involved in longwall mining systems is imported with mining equipment under HTS heading 8430. The loading and conveying equipment may be imported with the shearing equipment under HTS heading 8430. However, the roof support system has been ruled to belong to HTS heading 8479.

[3] Manfredi and Associates.

[4] Caterpillar, Inc. Annual Report, 1990.

[5] Standard and Poors' *Industry Surveys,* "Steel and Heavy Machinery", Aug. 9, 1990.

[6] *Machinery Outlook,* Manfredi and Associates, vol. 88.07-88.08, Apr. 25, 1988.

[7] Caterpillar, Inc. Annual Report, 1990.

industrial operations revenues (70 percent of which is accounted for by Komatsu Dresser revenues and Dresser mining and construction revenues) was earned outside the United States. Fifteen percent of these revenues was earned in Europe.[8]

Deere and Company, the leading manufacturer of agricultural equipment in the United States, is also a large manufacturer of construction equipment. Overseas net sales (not including Canada) for all Deere products and services were 25 percent of consolidated net sales and revenues in 1990. Deere is a 50-percent partner in a U.S.-based joint venture with Japan's Hitachi Construction Machinery Co., Ltd., called Deere-Hitachi Construction Machinery Corp.

J.I. Case is a division of Tenneco, Inc. Case is a major producer of agricultural and construction equipment, and accounted for 37 percent of Tenneco's consolidated revenues in 1990. Case's primary construction equipment production is for the tractor/loader/backhoe market.

Important U.S. manufacturers of mining equipment include Joy Technologies, Inc., Jeffrey (division of Dresser Industries), Simmons Rand, Eimco (division of Tamrock), and Ingersoll-Rand in continuous miners and longwall equipment; Ingersoll-Rand, Marion (division of Dresser Industries), Gardner Denver (division of Harnischfeger Industries), and Bucyrus-Erie in drilling equipment; and Caterpillar, Marion, Ingersoll-Rand, Harnischfeger, and Bucyrus-Erie in surface mining equipment such as draglines.

During 1986-90, the estimated total number of workers employed by firms engaged in the manufacture of construction and mining equipment declined from 87,000 to 83,000 workers (table 1). During 1986-90, U.S. employment in the industry was concentrated in Illinois, Iowa, Pennsylvania, Wisconsin, and Virginia, due to factors of transportation, proximity to end users, and locality of related industies.

Employment in this sector has decreased slightly, partly because of increased automation in the production process. At the same time, workers employed by construction and mining equipment manufacturers are becoming increasingly skilled, and benefit in terms of productivity from such advances as robotics, computer monitoring systems, and AGVs (table 2).

[8] Dresser Industries, Inc. 1990 Annual Report.

There are three general ways that construction and mining equipment may be purchased: (1) factory-direct; (2) through a distributor; or (3) from a company-owned dealer. Factory-direct sales are more prevalent when a firm custom-orders machinery to meet its specific needs, and when large-scale orders from such organizations as governments, large engineering and contracting firms, and high-volume mining companies are placed. In general, the marketing method chosen should enable the manufacturer to provide parts and service to the customer at the highest possible level.

Independent distributors situated in areas of major construction and mining activity tend to sell the products of one or a few manufacturers only. In areas where there is not considerable construction and mining activity, distributors are more likely to carry the products of many manufacturers, as the sales of one line of products would not prove profitable for the distributor in this situation. Company-owned dealers carry the products of the parent company, along with a wide array of complimentary accessories, such as hydraulic fluids, surveying equipment, and safety items.

After the equipment is sold, the distributor/company-owned dealer continues to be involved with the customer through service and support activities. These activities are crucial, as down-time in construction and especially mining is often very costly. A recent development in the mining equipment industry is a just-in-time parts supply system whereby a distributor can now set up shop in a mine, allowing the mine to buy replacement parts immediately as needed. Greater interdependence between mine and dealer/distributor is now thought of as more economical and advantageous than the old ideal of self-sufficiency through large inventories and user repair. Because of the importance of service and support, distributors and dealers must maintain a highly trained service staff and an adequate inventory of parts. Moreover, manufacturers generally provide backup support and service staff to the distributors/dealers, as well as service on equipment sold factory-direct. Warranties on construction and mining equipment vary; some are based on a calendar timeframe, while others are based on hours of equipment operation.

Most mining equipment manufacturers market their products through company dealers or distributors. Some of the larger equipment (i.e., continuous miners), however, is made-to-order and sold factory-direct. Company representatives make subsequent visits for both repair and maintenance work and to anticipate future equipment needs.

Table 1
Construction and mining equipment: Total employment, 1986-90

	1986	*1987*	*1988*	*1989*	*1990*
Total employment	87,000	84,000	84,000	83,000	83,000

Source: Estimated by staff of the U.S. International Trade Commission, based on official statistics of the U.S. Department of Commerce.

Table 2
Construction and mining equipment: Output indexes per employee hour, 1986-89
(1982=100.0)

Type of equipment	*1986*	*1987*	*1988*	*1989*
Construction	123.3	119.1	123.2	129.1
Mining	113.9	119.0	117.4	n/a

Source: U.S. Department of Labor, Bureau of Labor Statistics, *Productivity Measures for Selected Industries and Government Services,* May 1991.

Unlike the past, when financing was most commonly arranged separately between a purchaser and a bank, and with the distributor occasionally helping to arrange bank financing, manufacturers today are responding to purchasers' needs by offering factory-sponsored finance programs and finance training. These programs evolved in the early to mid-1980s. While factory-sponsored financing has not entirely replaced other forms of financing, it is an important competitive advantage for those firms that offer it. Moreover, today contractors have a wide variety of finance options that increase their purchasing power considerably. Among these finance options are traditional financing, rental financing, lease financing, and tailor-made finance plans. The rental and lease markets gain in popularity in slow construction years, when contractors prefer to rent equipment as a job expense rather than make large outlays for purchases.

On the average, construction equipment manufacturers tend to devote less than 5 percent of total sales on research and development (R&D). Individual proprietary research and development efforts predominate in this industry; R&D consortiums, university-conducted R&D, and Federal R&D efforts play a minimal role in the continuing evolution of construction equipment. This may be due to a distinct separation of private industry from the public sector, and an unwillingness on the part of individual firms to share information. The Bureau of Mines performs a substantial amount of R&D for the mining equipment industry, but is not charged with mandating safety and other developments. The Bureau also funds an institute that performs university-conducted R&D.

Improvements in construction and mining equipment, both in terms of product and manufacturing processes, have come slowly. In past years, the main thrust of R&D efforts has been on increasing horsepower and developing sophisticated transmissions, hydraulics, and electronics. Hydraulics is an area that is currently receiving a large degree of research and development effort. Hydraulic research is focusing on making hydraulic devices quicker, smaller, and able to work at much higher operating pressures. Improving load sensitivity is also important. Load sensing hydraulics, found in most new excavators, automatically adjust the flow of oil to the load, while at the same time apportioning hydraulic power to all functions as needed. Electronics will increasingly serve to allow for remote operation of equipment. In addition, increasing the use of microprocessors and other electronics will improve fuel and engine efficiency, safety, performance tracking, and troubleshooting and preventive maintenance procedures. Ultimately, electronic systems will be able to warn operators of impending mechanical failures on a fleet-wide basis, and will allow operators to monitor performance trends over the life of the machine. Other areas of interest for research and development are increasing the reliability, serviceability, and interchangeability of component parts; increasing the use of composites — which are non-metallic, lightweight and strong — in the manufacture of construction and mining equipment; and computerizing plants to provide for greater speed and efficiency in production.

Perhaps the latest development effort is the construction robot, which in the short term will include automated, or "smart" tools, and teleoperated machinery. Some robotic devices can be programmed to perform repetitive tasks at a construction job site, such as painting and drilling blast holes in tunnel work. The most advanced construction robots will be able to interpret and evaluate their environment, and alter their programming accordingly.

Technological developments in the mining equipment industry have come more slowly, owing to the unpredictable and dangerous underground environment in which this equipment is utilized. Because of this environment, automation is not extensively employed, as it does not have the reactive abilities of a human machine operator. However, there have been some development efforts in computer-controlled drilling and blasting equipment, and remote-control technology. Furthermore, a project is underway to create a protective underground environment, with the goal of minimizing risks to miners. General developments using computers, robotics technology, and sonar and laser guidance systems are expected.

The Bureau of Mines, as part of its health and safety research program, has developed a system employing Doppler radar sensors to decrease the number of collision accidents involving large surface mining equipment. This system is to act as a warning to miners on the ground and equipment operators, while aiding the operator in avoiding rear-end collisions and damage to tires. This, in turn, minimizes the cost of both replacing the tire and down time.[9]

[9] "Anti-Collision Technology: The Search for Safer Mine Operations Continues," *Engineering and Mining Journal,* Mar. 1991, pp. 16Y-16FF.

While the Bureau of Mines does not mandate developments such as this, industry often finds it to its advantage to further develop and employ these findings. The use of Doppler and other acoustic sensor systems is on the rise in the mining equipment industry.

Developments in construction and mining equipment also involve increasing operator comfort and decreasing operational obstacles. These changes contribute as well to increased equipment productivity.

Product liability and insurance costs are important concerns for the manufacturers of construction and mining equipment. According to a major U.S. producer of construction equipment, the essence of the product liability problem is that equipment lifespan has increased — in some cases, to 20 years or more. However, malfunctions of all equipment, regardless of age, are judged against current product performance safety standards. Therefore, product improvements must be weighed against possible product liability problems. Some manufacturers report that they have well over 100 product liability cases pending at any given time. U.S. manufacturers regard this as a serious detriment, especially in view of the fact that these cases virtually do not occur in Japan.[10] Product liability insurance costs reached crisis proportions during the 1980s according to industry sources; these rates stabilized somewhat at the end of the decade.

U.S. Government programs such as Export-Import Bank financing assist the U.S. and foreign-owned U.S.-based construction and mining equipment industry in its export competitiveness. During 1986-90 (fiscal years ending September 30), the Export-Import Bank authorized over $190 million for medium-term credits and guarantees, regular loans, intermediary loans, small business credits, and medium- and short-term insurance policies for construction equipment (SIC 3531) exports. The corresponding amount for mining equipment (SIC 3532) was over $525 million.[11] Principal beneficiaries of construction equipment authorizations included Caterpillar Overseas and Caterpillar Tractor Co., J.I. Case Co., John Deere Intercontinental, and Komatsu Dresser Co. Principal beneficiaries of mining equipment authorizations included Harnischfeger Corp., Ingersoll-Rand Co., Dresser Industries, Joy Manufacturing Inc., and Eimco Mining Machinery International.

Consumer Characteristics and Factors Affecting Demand

The purchasers of construction equipment include construction and engineering firms, housing contractors, mine operators, and Federal and State Governments. Purchasers of mining equipment include mine operators as well as construction firms.

[10] "Product Liability Claims Hard to Win in Japan," *Journal of Commerce*, Aug. 9, 1991.

[11] Data provided by the Export–Import Bank of the United States.

Demand for construction equipment is cyclical, reflecting trends both in U.S. construction activity, which is directly influenced by the overall health of the national economy, and construction activity worldwide. Construction activity includes the level of private housing construction; public and private non-residential construction; highway, street, and railroad construction; and other public works construction. Figure 1 presents the value of new construction, private and public, in the United States during 1986-90.

Private sector construction provides the principal market for construction equipment manufacturers. Private new construction put-in-place as a percent of total new construction put-in-place averaged 78 percent during 1986-90. Notably, however, private construction dropped from 79 percent of total new construction in 1989 to 76 percent in 1990. Most Federally-funded construction is done by private construction firms under contract with Federal agencies.[12] Thus, the Federal Government is not a major purchaser of construction equipment. For example, the Construction Industry Manufacturers Association 1988 Survey of Economic Contributions shows that the sales volume of U.S. military purchases was just 1.5 percent of total worldwide sales for participating companies.

While the level of construction in the United States in current dollars has increased steadily during 1986-90, in real terms the level has decreased, showing a 5-year decline from a 1986 high (table 3). In addition, the value of new construction as a percentage of gross national product has declined steadily during 1986-90, from 9.6 percent in 1986 to 8.2 percent in 1990.[13] Downturns in the construction market make it difficult for contractors to borrow funds to purchase equipment. Such downturns also decrease equipment values. One analyst reports that over the past year, values have dropped some 20 percent on most equipment.[14]

Regular fleet replacement and parts required for repair and maintenance also influence demand. Average service life of construction equipment varies from 5 to 20 years or more. Wheeled excavators, backhoes, and wheel loaders need to be replaced comparatively often, while loader graders are typically operational for up to 18 years.[15]

In general, the demand for mining equipment is influenced by the amount of mining activity in both the United States and overseas. Factors of demand for mining equipment can be more complex than those for construction equipment; however, due to the nature of

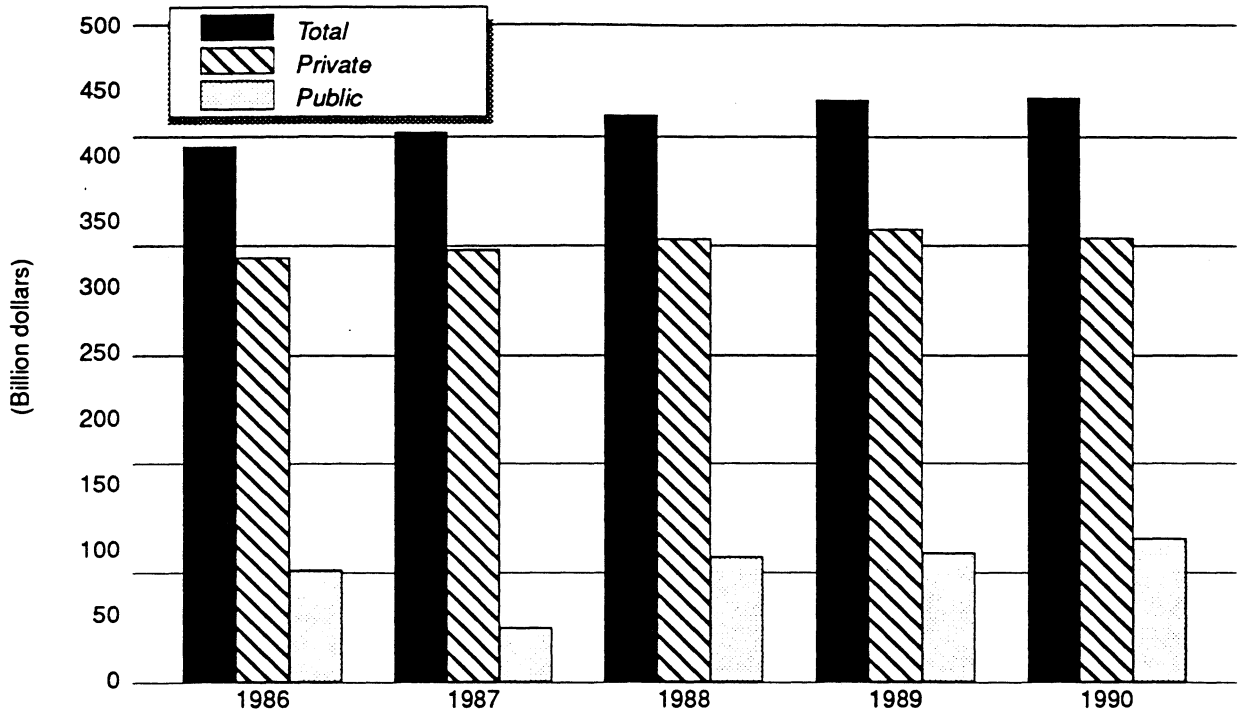
[12] *Construction Review*, U.S. Department of Commerce, May/June 1990.

[13] Estimated by staff of the U.S. International Trade Commission, based on official statistics of the U.S. Department of Commerce and *Economic Indicators*, Council of Economic Advisers, June 1991.

[14] "As Financing Dries Up, Bond Producers Get Wary," *Highway and Heavy Construction*, July 1991.

[15] Data provided by Equipment Manufacturers Institute.

Figure 1
Value of new construction in the United States, 1986-90



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

Table 3
New construction put-in-place in the United States, in millions of current dollars and constant (1987) dollars, 1986-90

Dollars	*1986*	*1987*[1]	*1988*	*1989*	*1990*
Current	407,693	419,264	432,223	443,721	446,434
Constant	421,367	419,250	415,004	409,775	402,770

[1] Data for 1987 differ slightly due to statisticians method of weighting monthly data.
Source: U.S. Department of Commerce, International Trade Administration, *Construction Review,* May-June 1991.

the various mineral, metal, and energy industries that employ this equipment. Coal mining operations are the largest end users of mining equipment in the United States. Principal metals mined with underground mining equipment are zinc, lead, tungsten, molybdenum, silver, iron ore, copper, and gold. The amount of mining activity in the United States is subject to a myriad of influencing factors, including Federal, State, and local regulations controlling land use, pollution emissions, and land reclamation; commodity prices and inventory levels; supply levels of basic metals and strategic materials; the need for building and construction materials mined in quarries; and production of durable goods and investment in capital equipment. Environmental and other trends affecting the demand of mining equipment include conservation and recycling, which has decreased the demand for such products as lead and aluminum, and the continued substitution of plastics and other synthetic materials for metals.

Coal mining is a relatively reliable market for mining equipment because of long-term contracts between mines and electric utilities. Coal remains relatively inexpensive relative to oil and natural gas for electric utilities, even though the price has increased in recent years. Thus, due to price and availability factors, utilities will most likely increase their consumption of coal in the future. Many analysts predict that the recent adoption of Clean Air legislation will serve to strengthen even further the market for coal and coal mining machinery, should low-sulfur, or "clean" coal be determined a viable energy source in terms of cost. Low-sulfur coal, however, is more expensive in terms of cost and transportation, and more of it is needed to produce the same amount of energy.

Because mines currently place great emphasis on extending the operating life of their equipment to reduce costs, repair and replacement parts generate about half the total demand in this industry.[16] In terms of oil and natural gas drilling equipment, demand is determined by the need for equipment replacement and various conditions affecting oil and natural gas demand, such as U.S. and world reserves, commodity and related prices, and related world events.

FOREIGN INDUSTRY PROFILE

The construction equipment industry is mature, and has entered an era of full-scale internationalization, in which companies' survival will depend heavily on their success in overseas sales and production. The drive for export promotion and expanding market share overseas has prompted major construction and mining equipment firms in many countries to seek arrangements with foreign firms, such as joint ventures, technical exchange agreements, and supply and distribution agreements. Moreover, major manufacturers the world over generally have established dealers and/or manufacturing subsidiaries in each major market. Fierce competition among the principal manufacturing countries — the United States, Japan, and certain countries of Western Europe — has led to international cooperation coupled with competition between three major international groupings: Hitachi-Deere-Fiat; Komatsu-Dresser; and Mitsubishi-Caterpillar.

Aside from North American producers, major foreign industry competition comes from Japan and Western Europe. In terms of global market share, the top four companies in 1989 were Caterpillar, Komatsu, J.I. Case, and Hitachi.[17] The leading manufacturers in certain product segments as indicated by 1989 global market share are as follows: crawler tractors — Caterpillar, Komatsu, Deere, and Case; crawler loaders — Caterpillar, Komatsu, Deere, and Case; hydraulic crawler excavators — Komatsu, Hitachi, Caterpillar, and Kobelco Construction Machinery, Inc. (wholly-owned by Japan's Kobe Steel, Ltd.); hydraulic wheeled excavators — Liebherr (Germany), Case/Poclain (joint venture between Case and Poclain of France), and Caterpillar.[18]

Komatsu is Japan's largest construction equipment manufacturer, with over 180 subsidiaries and affiliates worldwide. Komatsu is the second-largest producer of construction equipment worldwide, at one-third the size of Caterpillar of the United States. Komatsu serves the North and South American markets solely through the Komatsu Dresser joint-venture operation. Industry analysts report that Komatsu has been increasing its share of the U.S. market recently, particularly in crawler tractors, hydraulic excavators, and wheel loaders.[19] Komatsu's export ratio is around 40 percent.[20]

Another important Japanese manufacturer of construction equipment is Hitachi Construction Machinery Co., Ltd, with an export ratio of 34 percent. Hitachi's main export market is Europe; however, it formed a U.S.-based 50-50 joint-venture company with Deere and Company in June 1988. Hitachi supplies the U.S. market through this joint venture as well as through imports from its overseas operations. Hitachi also has had a joint venture with Fiatallis of Italy, known as Fiat-Hitachi Excavators, S.p.A., since 1986. In the United States, Hitachi concentrates efforts in the hydraulic excavator market. Mitsubishi Heavy Industries of Japan, whose export ratio is 25 percent, is teamed up with Caterpillar to form the Japanese-based 50-50 joint venture called Shin-Caterpillar Mitsubishi, Ltd.

It is believed that Komatsu, the top producer in Japan, accounts for at least 50 percent of the Japanese domestic market, followed by Shin-Caterpillar Mitsubishi Ltd. In 1989, the Far East market was dominated by Komatsu, followed by Hitachi, Caterpillar, and Kobelco. Hydraulic excavators are the predominant subsection of the construction equipment market in Japan, and the top four excavator manufacturers account for nearly the entire domestic market.

Industry experts reported in 1989 that the top four market share slots in Western Europe were claimed by Caterpillar, JCB (United Kingdom), Case, and Liebherr.[21] Other important European manufacturers include Fiatallis and VME (Belgium). In many cases, European construction equipment manufacturers concentrate their marketing efforts domestically and within the European Community, which claims a large proportion of the average export ratio of 60 percent. This may be attributed to market size and proximity and transportation factors.

JCB is a British-based construction equipment manufacturer that participates in the tractor/loader/backhoe market in the United States. Industry analysts report that since 1989, JCB has lost more than half its U.S. market share, owing largely to the increasing cost of importing products tied to the high value of the pound relative to the dollar.[22]

Fiatallis, the construction equipment arm of FiatGeotech — in turn part of the automaker Fiat S.p.A. of Italy — had an estimated North American market share in heavy construction equipment of 3 to 4 percent in 1989. FiatGeotech joined forces with Ford New-Holland in 1990. This operation will likely

[16] "General Industrial Machinery," *U.S. Industrial Outlook 1989*, U.S. Department of Commerce, p. 22–3.
[17] Manfredi and Associates.
[18] Ibid.
[19] *Machinery Outlook*, Manfredi and Associates, vol. 91.06, June 1991.
[20] All export ratios for Japanese manufacturers obtained from *Japan Company Handbook*, summer 1991.
[21] Manfredi and Associates.
[22] *Machinery Outlook*, Manfredi and Associates, vol. 91.06, June 1991.

concentrate more of its efforts in the area of agricultural equipment, because its share of the North American agricultural equipment market is more significant.[23]

VME Group, headquartered in Belgium, is a major international manufacturer of construction equipment, with the brand names Volvo BM, Michigan, and Euclid. VME was formed in 1985 when Clark Equipment Co. (U.S.) and AB Volvo of Sweden joined their construction equipment subsidiaries. It claims to be one of the largest producers of wheel loaders in the world, and also produces wheel dozers and excavator-loaders. Nearly 50 percent of VME's sales is in wheel loaders.

Liebherr of Germany primarily produces excavators, bulldozers, crawler loaders, and wheel loaders. Liebherr's export sales ratio is approximately 50 percent, and an estimated 80 percent of sales is within Western Europe.

Other major foreign manufacturers of construction equipment that register with some share of the principal U.S. construction equipment markets include Akerman (Switzerland), Case/Poclain, Champion (Canada), Daewoo (Korea), Hanomag (Germany), Hyundai (Korea), Furukawa (Japan), Kato (Japan), Kawasaki (Japan), Kubota (Japan), Mannesman Demag (Germany), MDI/Yutani (Japan), and Samsung (Japan).[24]

Foreign producers important in markets other than the United States include Faun (Germany), Hymac (United Kingdom), Ishikawajima Harima Heavy Industries Co. (Japan), Japan Steel Works (Japan), Orenstein and Koppel (Germany), Poclain (France), and Sumitomo (Japan).

Major U.S. producers of mining equipment name Anderson Strathclyde (UK), Eickhoff (Germany), Mitsui (Japan), and Sagem (France) as the major foreign competitors in longwall shearing equipment; Voest-Alpine (Austria), Anderson Strathclyde, Dosco (UK), Purat (France), and Eickhoff as the major foreign competitors in continuous miners; Atlas Copco (Sweden), Tamrock (Finland), and Furukawa in drilling equipment; and Komatsu, Furukawa, and Atlas Copco in surface mining equipment. Eimco Jarvis Clark Ltd. of Canada is also an important producer of underground mining equipment, and is part of the Eimco Group, owned by Tamrock. European producers are a strong presence in the mining equipment industry, particularly in longwall mining equipment.

Factors of competition among global producers of construction and mining equipment are numerous. No countries possess a technological advantage in the construction and mining equipment industries. These industries are mature and entirely global in nature, with new technologies spreading rapidly throughout the world. In a survey of major contractors in the United States, past performance, price, parts availability, long-term need, after-sales support, immediate need, and availability of specified machine were the primary purchase factors considered, in that order. Major mining concerns listed past performance, price, after-sales support, parts availability, and long-term need as their equipment purchase factors in rank order.[25] Foreign producers are improving the quality of their products at a rapid rate, and U.S. manufacturers report that foreign producers are also learning to develop their products increasingly well, more accurately meeting the customers' needs.

Competitive financing is a critical competitive factor in global sales of construction and mining equipment. This is particularly true for mining equipment, for which many of the largest customers are developing countries. U.S. firms often claim to be at a disadvantage in the global market because they are unable to offer competitive financing packages. Mining industry representatives report that many other countries have tied-aid loan programs designed to develop underground mining in developing countries. As the consulting and equipment is paid for through these tied funds, U.S. manufacturers are effectively excluded.

Manufacturers of construction and mining equipment must be very competitive through low production and inventory costs. They must be able to absorb increased costs from suppliers, rather than pass these costs on to the consumer, particularly when the currency is highly valued. Relatively higher labor and steel costs in the United States contribute to increasing imports from foreign competitors and U.S.-based firms' overseas subsidiaries. This has been a substantial factor in U.S. firms' decisions to move production abroad to major trading partners. Figure 2 provides a comparative view of labor and steel costs faced by manufacturers in some of the major producing countries.

Since U.S.-manufacturered construction and mining equipment and foreign-produced equipment are technologically similar, the value of the U.S. dollar can strongly influence U.S. export and import volume. A depreciated dollar on world currency markets can result in more expensive imports and boost U.S. exports by making them relatively less expensive. Exports, in fact, have increased, making up for slow domestic sales. A decreased value for the dollar also allows U.S. manufacturers to raise its dollar prices in times ofdepressed revenues, which can contribute to inflation in the industry. However, a weak dollar also increases

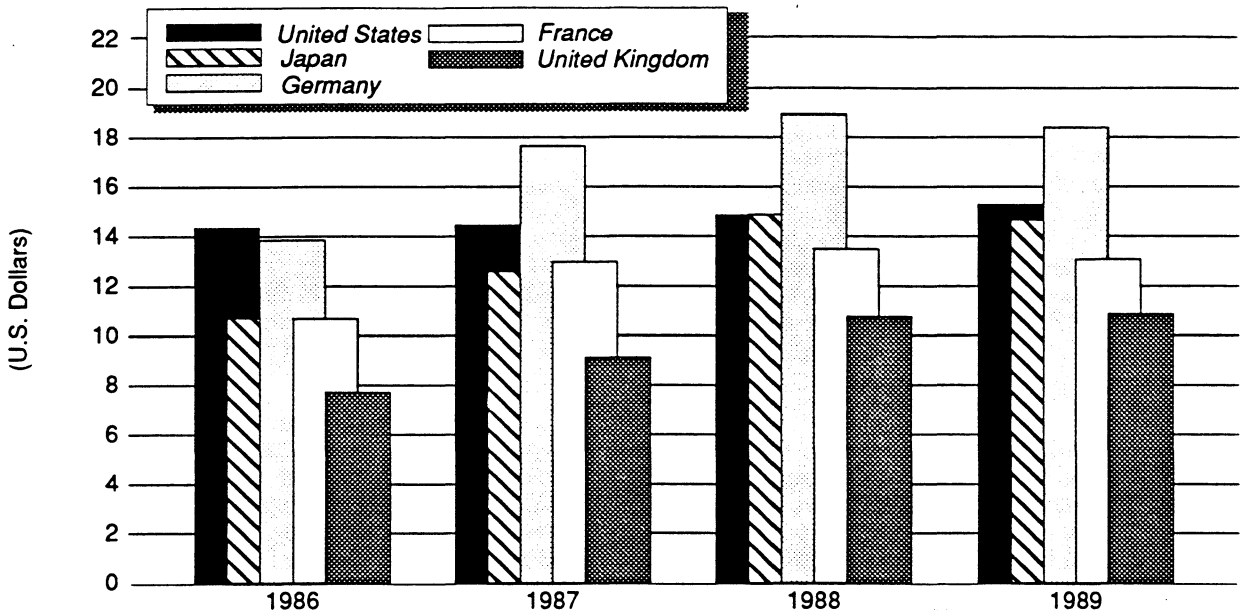
[23] *Machinery Outlook*, Manfredi and Associates, vol. 90.07, July 1990.

[24] Principal markets referred to here include crawler loaders, crawler tractors, hydraulic excavators, tractor/loader/backhoes, motor graders, and wheel loaders. USITC staff estimates based on *Machinery Outlook*, Manfredi and Associates, vol. 91.06, June 1991, and interviews with industry representatives.

[25] Surveys appear in *Construction Equipment*, Mar. 1990 and Sept. 1990.

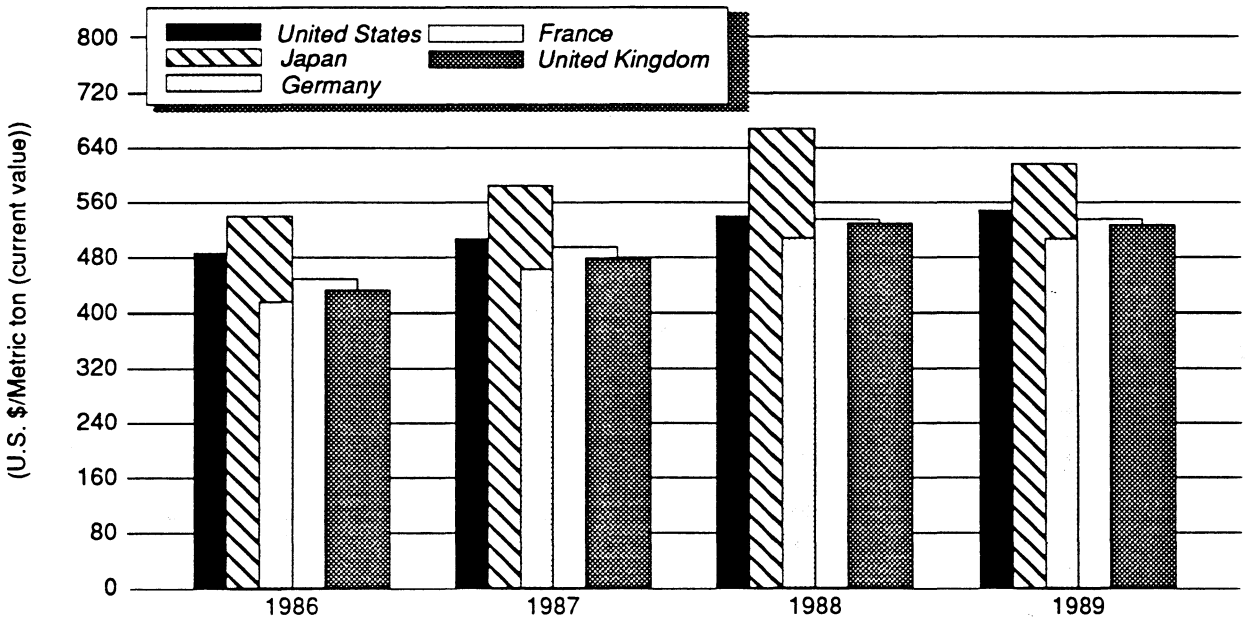
Figure 2
Comparative costs of inputs: Wages and steel, 1986-90

Production Workers Hourly Compensation
(includes all machinery of SIC 35)



Source: Bureau of Labor Statistics

Steel: Domestic Price Realizations



Source: PaineWebber, Price/Cost Monitor #13

costs for U.S. firms who source parts or produce certain lines overseas and import them to round out their product lines.

Currency fluctuations have been an impetus to firms to establish local production facilities in primary markets. As shown in table 4 below, the dollar has been weak over the 5-year period examined in this report, particularly against the yen and the deutsche mark. U.S. exports increased nearly 60 percent from 1986 to 1990, while imports increased by only 6 percent. In particular, exports to Japan increased 160 percent from 1986 to 1990, while imports from Japan fluctuated during the period, with a final 1986-90 increase of just 12 percent. The high value of the yen, particularly in 1986-88, curbed Japanese equipment exports. The low value of the dollar in 1988 helped to boost U.S. exports of construction and mining equipment by 30 percent.

U.S. TRADE MEASURES

General column 1 rates of duty for imports of construction and mining equipment range from a low of zero (for self-propelled peat excavators only) to a high of 5.7 percent ad valorem for offshore oil and natural gas drilling and production platforms, and parts thereof. The majority of products that fall in the category of construction and mining equipment fall in the 2.0- to 2.5-percent ad valorem tariff range. However, imports of construction and mining equipment generally entered the United States duty free during 1986-1990 under the following provisions: TSUS 807.00 and 806.30; HTS 9802.00.60 and 9802.00.80; Generalized System of Preferences; U.S.-Israel Free-Trade Agreement; and the U.S.-Canada Free-Trade Agreement. All of the products in the construction and mining equipment category are included in the United States-Canada Free-Trade Agreement, and are currently subject to gradual duty reductions. As of January 1, 1991, the duty rates on construction and mining equipment imported from Canada ranged from 0.8 to 3.9 percent ad valorem. U.S. duties on most construction and mining equipment imported from Canada will be phased out by 1993; the remaining tariffs will be eliminated by 1998. Refer to appendix A for an explanation of tariff and trade agreement terms. Table 5 presents individual tariff rates for products covered in this summary, and table 6 shows the value of dutiable and duty-free imports of construction and mining equipment during 1986-90.

There are no known nontariff measures to trade in construction and mining equipment practiced by the United States.

FOREIGN TRADE MEASURES

Tariff Measures

Construction and mining equipment exports to Japan currently enter duty free, with a 3-percent consumption tax paid at customs by the importer. European Community duty rates for construction and mining equipment run from 3.5 percent to 4.4 percent. Rates of duty in Canada for construction and mining equipment of U.S. origin run from free to 6.4 percent. The U.S.-Canada Free-Trade Agreement is providing for a gradual elimination of all duties. The Government of Mexico has recently been making strides in tariff reduction for construction equipment. Current tariff rates for construction and mining equipment are around 15 to 20 percent. Australia, whose tariffs on construction machinery run as high as 30 percent on certain types of construction and mining equipment, undertook in 1988 to gradually reduce tariffs to a maximum of 10 percent.[26]

[26] *Machinery Outlook*, Manfredi and Associates, vol. 88.07–88.08, Apr. 25, 1988.

Table 4
Real effective exchange rate indexes[1], major world producers, 1986-90
(1985=100.0)

Country	*1986*	*1987*	*1988*	*1989*	*1990*
United States	76.9	67.9	64.3	68.2	64.2
Canada	91.5	93.5	99.9	105.3	103.2
Japan	123.1	123.6	131.6	124.8	108.9
Belgium	101.9	101.3	100.1	101.4	102.6
France	105.3	106.5	105.3	104.0	109.2
Germany	111.2	122.0	119.1	116.0	121.4
Italy	101.6	102.7	100.4	104.2	108.8
United Kingdom	93.1	90.8	96.6	93.4	94.8

[1] Based on relative value-added deflators. Value-added deflators represent the quotient of the current and constant price estimates of value added in the manufacturing sector, adjusted for changes in indirect taxes. Such indicators are best viewed as composite indicators of the cost (per unit of real value added) of all factors of production. Extrapolation beyond the most recent benchmark year is based on wholesale prices for manufactures adjusted to exclude the influence of changes in raw material prices.

Source: International Monetary Fund, *International Financial Statistics*, July 1991.

Table 5
Construction and mining equipment: Harmonized Tariff Schedule subheading; description; U.S. col. 1 rate of duty as of Jan. 1, 1991; U.S. exports, 1990; and U.S. imports, 1990

HTS subheading	*Brief description*	*Col. 1 rate of duty as of Jan. 1, 1991*		*U.S. exports 1990*	*U.S. imports 1990*
		General	*Special*[1]		
				Million dollars	
8429.11.00	Self-propelled bulldozers and angledozers, for track laying	2.5	Free (A*,E,IL) 1.0% (CA)	132.3	47.6
8429.19.00	Self-propelled bulldozers and angledozers other than track laying	2.5	Free (A,E,IL) 1.0% (CA)	19.2	17.4
8429.20.00	Self-propelled graders and levelers	2.5	Free (A*,E,IL) 1.0% (CA)	161.6	28.2
8429.30.00	Self-propelled scrapers	2.5	Free (A*,E,IL) 1.0% (CA)	83.8	16.8
8429.40.00	Self-propelled tamping machines and road rollers	2.5	Free (A,E,IL) 1.0% (CA)	76.2	88.0
8429.51.10	Self-propelled front-end shovel loaders, wheel-type	2.0	Free (A,E,IL) 0.8% (CA)	533.7	430.9
8429.51.50	Self-propelled front-end shovel loaders, other than wheel-type	2.5	Free (A,E,IL) 1.0% (CA)	9.7	104.7
8429.52.10	Self-propelled backhoes, shovels, clamshells, and draglines with a 360 degree revolving superstructure	2.0	Free (A,E,IL) 0.8% (CA)	219.8	460.8
8429.52.50	Self-propelled machinery with a 360 degree revolving superstructure, other than backhoes, shovels, clamshells, and draglines	2.5	Free (A,E,IL) 1.0% (CA)	13.4	13.1
8429.59.10	Self-propelled backhoes, shovels, clamshells, and draglines not with a 360 degree revolving superstructure	2.0	Free (A,E,IL) 0.8% (CA)	116.9	158.7
8429.59.50	Self-propelled machinery not with a 360 degree revolving superstructure, other than backhoes, shovels, clamshells, and draglines	2.5	Free (A,E,IL) 1.0% (CA)	41.1	18.2
8430.10.00	Pile-drivers and pile-extractors	2.5	Free (A,E,IL) 1.0% (CA)	14.1	5.9
8430.20.00	Snowplows and snowblowers	2.5	Free (A,E,IL) 1.7% (CA)	22.2	13.6
8430.31.00	Self-propelled coal or rock cutters and tunneling machinery	2.5	Free (A,E,IL) 1.0% (CA)	21.2	32.8
8430.39.00	Coal or rock cutters and tunneling machinery, not self-propelled	2.5	Free (A,E,IL) 1.0% (CA)	7.8	27.6
8430.41.00	Self-propelled boring or sinking machinery	2.5	Free (A,E,IL) 1.0% (CA)	61.9	14.2
8430.49.40	Offshore oil and natural gas drilling and production platforms	5.7	Free (E,IL) 3.9% (CA)	62.9	0.2
8430.49.80	Boring or sinking machinery, not self-propelled, nesi	2.5	Free (A,E,IL) 1.0% (CA)	117.0	11.4
8430.50.10	Self-propelled peat excavators	Free		20.0	0.1
8430.50.50	Self-propelled machinery for working earth, minerals, or ores, nesi	2.5	Free (A,E,IL) 1.0% (CA)	20.0	15.0
8430.61.00	Tamping or compacting machinery, not self-propelled	2.5	Free (A,E,IL) 1.0% (CA)	22.7	4.8
8430.62.00	Scrapers, not self-propelled	2.5	Free (A,E,IL) 1.0% (CA)	4.1	1.1
8430.69.00	Machinery for working earth, minerals, or ores, not self-propelled, nesi	2.5	Free (A,E,IL) 1.0% (CA)	21.8	12.5
8431.41.00	Buckets, shovels, grabs, and grips suitable for use solely or principally with the machinery of headings 8426, 8429, or 8430	2.5	Free (A,E,IL) 1.0% (CA)	431.2	80.7

Table 5—Continued
Construction and mining equipment: Harmonized Tariff Schedule subheading; description; U.S. col. 1 rate of duty as of Jan. 1, 1991; U.S. exports, 1990; and U.S. imports, 1990

HTS subheading	*Brief description*	*Col. 1 rate of duty as of Jan. 1, 1991*		*U.S. exports 1990*	*U.S. imports 1990*
		General	*Special*[1]	*Million dollars*	
8431.42.00	Bulldozer or angledozer blades suitable for use solely or principally with the machinery of headings 8426, 8429, or 8430	2.5	Free (A,E,IL) 1.0% (CA)	16.6	20.8
8431.43.40	Parts for offshore oil and natural gas drilling and production platforms	5.7	Free (E,IL) 3.9% (CA)	202.1	2.2
8431.49.90	Parts suitable for use solely or principally with the machinery of headings 8429 or 8430, nesi	2.5	Free (A*,E,IL) 1.0% (CA)	658.0	635.9

[1] Programs under which special tariff treatment may be provided, and the corresponding symbols for such programs as they are indicated in the "Special" subcolumn, are as follows: Generalized System of Preferences (A); Automotive Products Trade Act (B); Agreement on Trade in Civil Aircraft (C); United States-Canada Free-Trade Agreement (CA); Caribbean Basin Economic Recovery Act (E); and United States-Israel Free Trade Area (IL).

Source: U.S. exports and imports compiled from data of the U.S. Department of Commerce.

Table 6
Construction and mining equipment: Dutiable and duty-free imports entering the United States, 1986-90

(Million dollars)

U.S. Imports	*1986*	*1987*	*1988*	*1989*	*1990*
Dutiable	1,821	1,891	1,955	2,053	1,941
Duty-free	307	330	437	215	322
Total	2,128	2,221	2,392	2,268	2,263

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

Nontariff Measures

There generally is a free flow of construction and mining equipment, uninhibited by nontariff barriers. Licensing requirements previously practiced by Korea and Mexico, perceived by U.S. industry as barriers to trade, are no longer in effect. Caterpillar claims that, as a direct result of licensing requirement removal, its sales to Korea increased over 1,000 percent.[27]

There is, however, one nontariff barrier that U.S. industry sources have identified, known as "preshipment inspection". Preshipment inspection affects a variety of industries; it is not limited to construction and mining equipment. Preshipment inspection is not a nontariff barrier in itself, but its effects can be. Among these effects are delays at the point of shipment, and attempts to exact a lower price for the goods to be shipped. The incidence of preshipment inspection, once practiced extensively by developing countries, is rapidly declining. There is currently a draft agreement in the GATT designed to discipline preshipment inspection companies, and place more responsibility on the countries that hire these firms.

U.S. MARKET

Consumption

Apparent U.S. consumption, as noted in table 7, had increased steadily between 1986 and 1989, from approximately $8.7 billion in 1986 to approximately $9.7 billion in 1989. Consumption decreased some $1 billion in 1990, to nearly the exact level in 1986.

Imports have become a significant percentage of U.S. consumption, as the increasing internationalization of this industry, along with rising U.S. production costs, has led the major U.S. manufacturers to produce many models of equipment solely in their foreign subsidiaries or joint ventures overseas. According to industry sources, they must therefore import these models to round out their product lines.

[27] USITC staff interview with Caterpillar officials.

Komatsu and Caterpillar have shared the number one and two spots in U.S. market share of hydraulic excavators during 1986-90. Deere and Co. has also been an important supplier to this market segment in the United States, as has Hitachi, J.I. Case, Link-Belt (90-percent owned by Sumitomo Heavy Industries, Ltd. of Japan), and Kobelco. Industry analysts forecast that hydraulic excavators will increase their share of the product market in the United States by over 40 percent from 1989 to 1995.[28] This is likely due to their increasing versatility. In wheel loaders, Caterpillar is by far the market leader in the United States, followed by Deere, Komatsu, VME (based in Belgium), Case, Dresser, Kawasaki (based in Japan), and Fiatallis (based in Italy). The crawler tractor and crawler loader markets are dominated by Caterpillar, with close to 50 percent of the U.S. market, followed by Deere, Komatsu, Case, Dresser, and Fiatallis. Finally, Case represents the predominate share of the U.S. tractor/loader/backhoe market segment, followed by Deere, Caterpillar, Ford New-Holland, and JCB (based in the United Kingdom).[29] Figure 3 reflects U.S. market share percentages by product segment.

Shipments

Estimated shipments of construction and mining equipment are noted in table 7. Shipments increased from $8.5 billion in 1986 to $10.0 billion in 1989, before decreasing to $9.5 billion in 1990. Changes in the level of shipments of construction and mining equipment during 1986-90 had many causes, including the level of private and public sector construction, the prices and inventory levels of minerals and metals, and the demand for coal. Exports have been very important to the level of shipments throughout the period.

For construction equipment, shipments rose sporadically. Shipments were low in 1986, as most firms posted profits after several years of losses or marginal operation. Shipments remained low in 1987, but increased by over 10 percent in 1988, largely due to increased exports. Domestic construction activity increased as well. Shipments of construction equipment rose again in 1989 due to increased activity

[28] Manfredi and Associates.

[29] All market share information is for 1989 and was provided by Manfredi and Associates.

Table 7
Construction and mining equipment: U.S. shipments, exports of domestic merchandise, imports for consumption, and apparent U.S. consumption, 1986-90

Year	U.S. shipments[1]	U.S. exports	U.S. imports	Apparent U.S. consumption	Ratio of imports to consumption
	Million dollars				Percent
1986	8,500	1,974	2,128	8,654	24.6
1987	8,800	1,872	2,221	9,149	24.3
1988	9,700	2,425	2,392	9,667	24.7
1989	10,000	2,591	2,268	9,677	23.4
1990	9,500	3,111	2,263	8,652	26.2

[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.

in building and commercial construction, and public works. Housing starts were low, but exports were again strong.

Construction equipment shipments slowed somewhat in 1990 because of less residential and commercial construction. However, increased activity in the areas of public works, quarries, surface mining, and exports prevented a significant decrease in shipments.

Shipments of mining equipment were low in 1986 as well, due primarily to the abundant global supply of minerals and metals, which kept mines from operating at capacity and which slowed the opening of new mines and the expansion of existing mines. Shipments increased in 1987-89 due to high levels of industrial production and investment in capital equipment, which lowered inventories of minerals and metals and spurred mining activity. This activity continued to support shipments through 1990, along with increased activity in the coal mining sector.

Shipments of construction and mining equipment are expected to rise 2-3 percent annually over the next few years.[30] The outlook for construction equipment demand is closely linked to that for construction activity, which is cautiously optimistic. Construction activity in the United States is likely to be sustained by public works construction. Industry analysts see a slight improvement in residential construction, which often signifies a turnaround in the construction industry.[31] The outlook in terms of coal mining is favorable; the Department of Energy predicts that U.S. coal exports will increase by almost 150 percent by the end of the next decade.[32] In terms of petroleum and natural gas, industry analysts predicted in 1990 that the energy market was in the early stages of recovery, and that the sector has not invested in equipment in over a decade, thus providing a positive outlook for demand for petroleum and natural gas drilling equipment.[33]

Imports

Imports of construction and mining equipment, as noted in table 8, have fluctuated between 1986 and 1990. Over the 5-year period, imports increased steadily but moderately from 1986, peaking in 1988, then falling 5 percent in 1989 and 0.2 percent in 1990. Industry sources indicate that this fall is at least partly attributable to the depreciation of the dollar, particularly compared with the Japanese yen.

All the products included in the construction and mining equipment group are imported into the United States. However, the amounts and patterns of these imports varied greatly over the past 5 years, with imports of some products increasing while imports of other products decreased. As of 1990, the three largest categories of imports were certain parts of construction and mining equipment, at over $635 million; self-propelled backhoes, shovels, clamshells, and draglines with a 360-degree revolving superstructure at over $460 million; and self-propelled front-end shovel loaders, wheel-type, at over $430 million (figure 4). Imports of products classified in the aforementioned parts category increased significantly—nearly 180 percent—since 1986, when imports were valued at $34 million. Many of these imports are from affiliates or licensees of U.S. firms; parts imports are generally for incorporation into U.S.-assembled equipment.

The overwhelming majority of U.S. imports of construction and mining equipment come from Japan, followed by imports from Canada, Germany, France, and the United Kingdom (figure 5). Japan far and away is the leading source, exporting over $876 million worth of construction and mining equipment to the United States in 1990, and accounting for 6 percent of U.S. consumption. Imports from Japan outpaced those from the second-leading supplier, Canada, by nearly

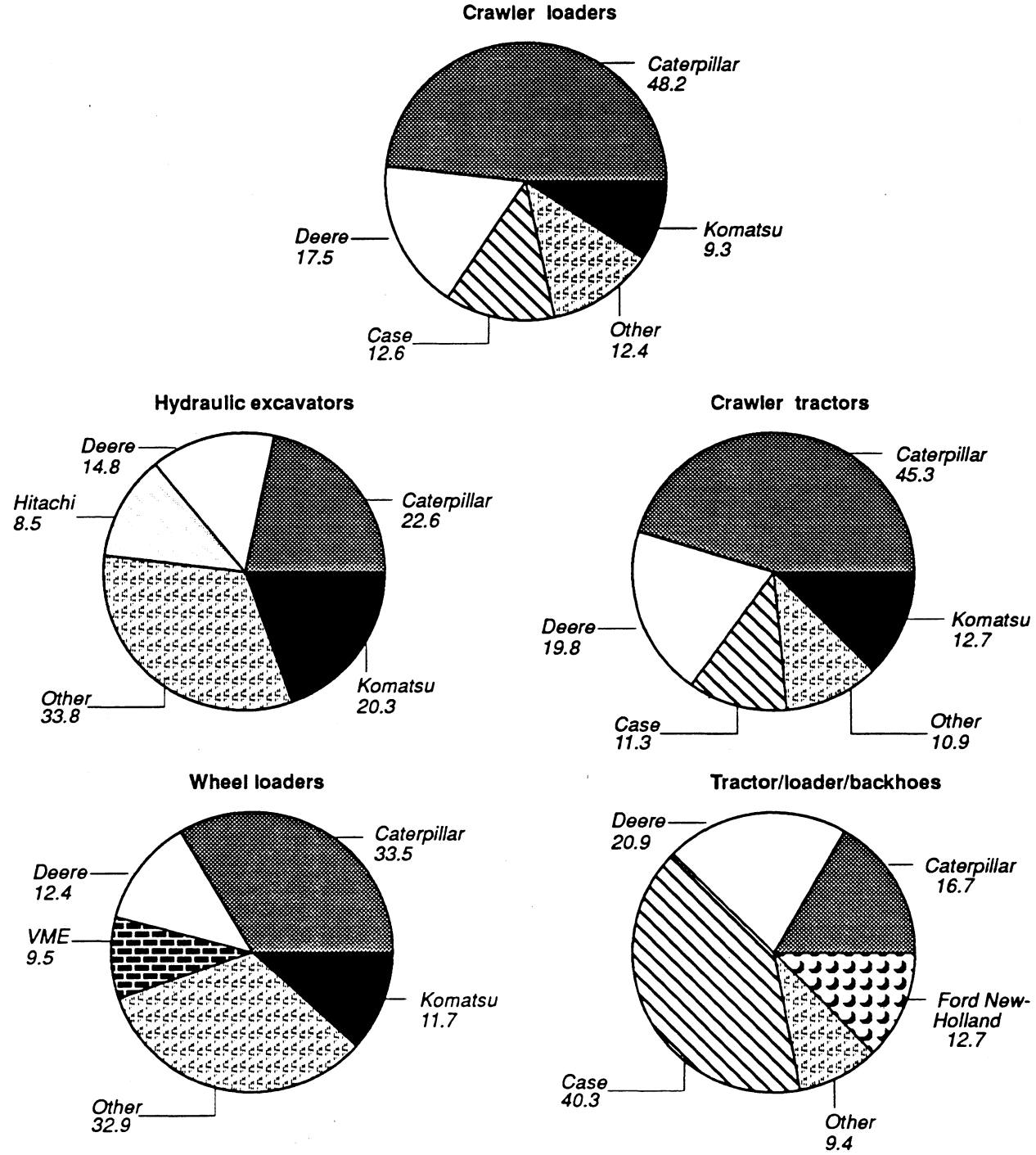
[30] *1991 U.S. Industrial Outlook*, U.S. Department of Commerce, pp. 20–3, 7.

[31] "Good News, With Reservations," *Engineering News Record*, Aug. 19, 1991.

[32] *Washington Trade Daily*, July 5, 1991.

[33] Paine Webber, Machine Tool Conference, 6th Biennial Investment Forum, Sept. 5–6, 1990.

Figure 3
U.S. market share, by selected product segment, 1989



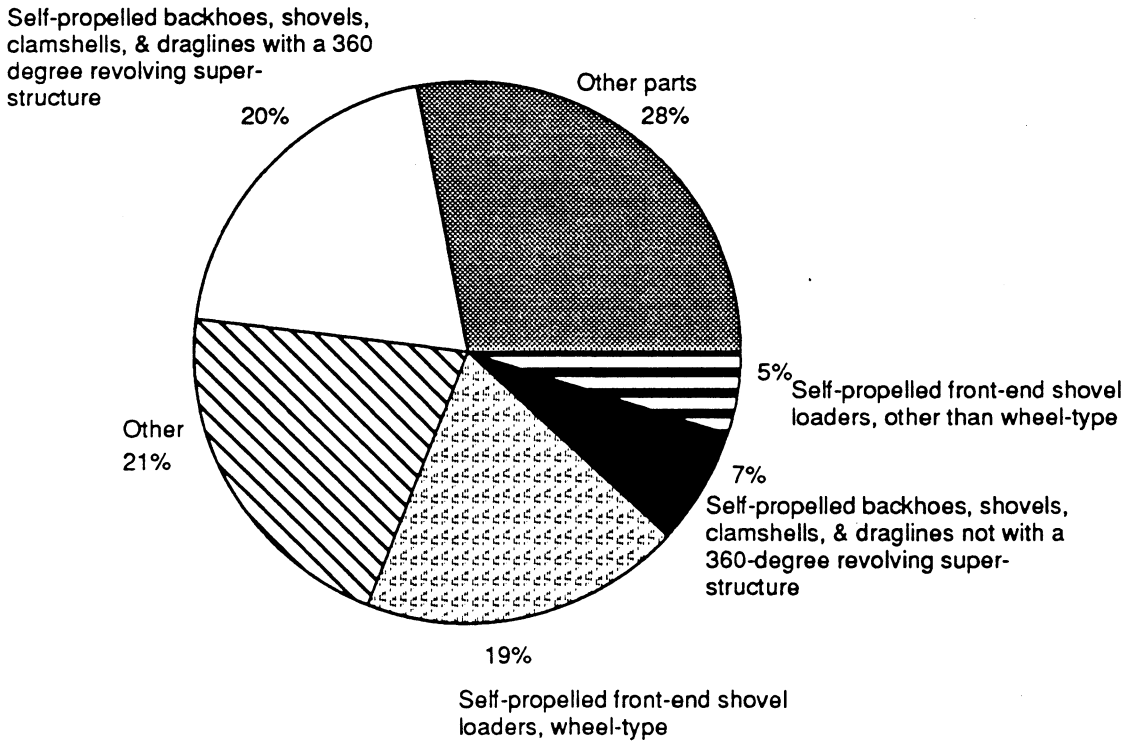
Source: Manfredi and Associates

Table 8
Construction and mining equipment: U.S. imports for consumption, by principal source, 1986-90
(1,000 dollars)

Source	*1986*	*1987*	*1988*	*1989*	*1990*
Japan	782,733	857,266	890,122	767,046	876,409
Canada	210,731	221,914	265,571	263,716	258,083
Germany	283,033	241,898	256,634	294,058	245,412
France	198,182	259,363	246,810	208,540	224,382
United Kingdom	247,775	254,415	247,535	219,930	186,169
Belgium & Lux	123,356	65,863	109,399	133,561	118,949
Italy	90,239	85,180	107,818	99,029	89,088
Brazil	35,534	57,318	59,136	93,946	76,152
Sweden	51,246	47,509	58,085	64,809	53,532
Mexico	14,692	28,823	52,156	41,878	50,948
All other	90,363	101,317	98,638	81,397	84,160
Total	2,127,884	2,220,865	2,391,905	2,267,909	2,263,284

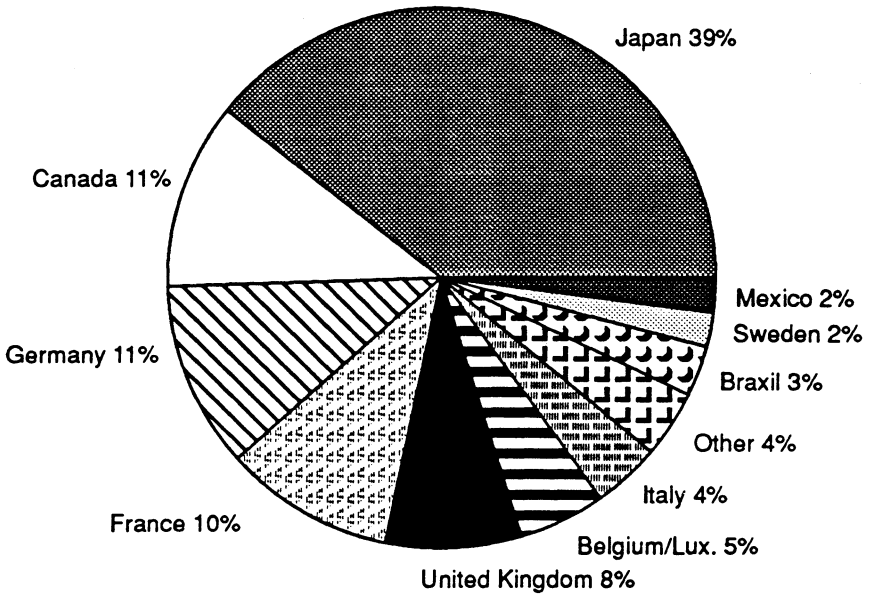
Source: Compiled from official statistics of the U.S. Department of Commerce.

Figure 4
U.S. imports, by major products, 1990



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

Figure 5
U.S. imports, from major sources, 1990
1990 total imports = $2,263 million



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

three-fold in 1990. Imports from Canada, Germany, France, and the United Kingdom were close in value, at $258 million, $245 million, $224 million, and $186 million, respectively, in 1990.

Generally, construction equipment is imported into the United States through a dealer; for example, an imported Hitachi excavator would be imported into the United States by a Hitachi dealer established in the United States. International traders and contractors are not, in most cases, involved in the trade of this equipment.

FOREIGN MARKETS

Foreign Market Profile

The Far East is the largest regional market for construction and mining equipment. In 1989, the Far East accounted for 45 percent of the world market for construction equipment, followed by Western Europe at 27 percent, and North America with 21 percent, for a total of 93 percent of the world market. By 1995, industry analysts estimate that the Far East will increase its global market share to 48 percent, largely because of increasing construction activity in this region, followed by Western Europe increasing its share to 28 percent, and North America, which is predicted to decrease its share to 17 percent.[34]

[34] Manfredi and Associates.

Canada has by far been the most important foreign market for U.S. construction and mining equipment between 1986 and 1990. While Canada is the United States' largest export market and its number two source of imports for construction and mining equipment, U.S. exports to Canada of this equipment are over three times greater than U.S. imports of this equipment from Canada. Canada is an important site for subsidiaries of U.S. firms. Moreover, industry sources cite recent increased development of Canadian natural resources as a contributing factor to the almost doubling of U.S. exports to Canada. Imports of construction equipment accounted for nearly 94 percent of the Canadian market in 1988, and almost 68 percent of Canadian imports of construction equipment come from the United States. Moreover, the Canadian construction equipment market is estimated to have grown almost 40 percent in size from 1986 to 1988.[35] Canada is also among the world's mining leaders, with mined products accounting for 25 percent of the total value of Canadian exports.

Belgium is the number two importer of U.S. construction and mining equipment, but imports just 25 percent of the value of Canada's total imports of U.S. construction and mining equipment in 1990. Belgium is an important foreign market for parts; this

[35] Information provided by Industry, Science and Technology Canada, Industrial Equipment Directorate.

may be explained by the existence of U.S subsidiaries in Belgium.

Australia is the number three foreign market for U.S. construction and mining equipment. The fact that Australia is one of the world's principal producers of minerals and metals contributes to Australia's prominence as a major U.S. foreign market. Australia is virtually self-sufficient in most mineral commodities.[36]

Mexico has become an important foreign market for U.S. construction and mining equipment. Exports to Mexico, while not significant in 1986, soared in 1990, reflecting a recent trend triggered by reforms of the Government of Mexico in the areas of import licensing and tariffs. Moreover, the recent toll road construction program, along with other planned infrastructure projects, has dramatically increased the demand for construction equipment in Mexico. In the realm of mining, recent government policy decisions have spurred significant growth in the Mexican mining sector. Among these changes are the liberalization of Mexico's mining regulations, the elimination of a mining tax, and the privatization of large tracts of national mining reserve land. These changes, coupled with the fact that Mexico is one of the world's major mineral producers, have made the Mexican mining industry more attractive to foreign and domestic mining operations.

Japan is also an important foreign market in terms of construction equipment. Were it not for the strength of the domestic industry, U.S. manufacturers would likely account for a much larger percentage of the Japanese market. Exports to Japan accounted for 4 percent of total U.S. exports in 1990. U.S. exports of construction and mining equipment to Japan have increased at a somewhat sporadic rate. The years 1988 and 1989 saw the largest increases; these were also years when the yen was particularly strong. The *Japan Economic Almanac* reports that "with the expansion of civil engineering work and building construction in Japan, heightened by the recent boom in urban redevelopment projects, the demand for nuts and bolts construction machinery...has reached new heights."[37] Japan is one of the world's leading construction markets.

The value of the world's five largest construction markets, as measured by Credit Suisse, Research Group is shown in table 9. These markets are all included in the top 10 export markets for U.S. construction equipment. It is noteworthy that, while U.S. contractors are largely successful in the global construction market, the correlation between this this success and the export of U.S. construction equipment is weak, due to constraints

Table 9
Residential and non-residential construction, major world markets, 1988-89

Country	*1988*	*1989*
	(Million of dollars)	
United States	324,249	330,232
Japan	316,622	298,855
Germany	62,355	68,877
France	32,737	35,226
United Kingdom	33,492	30,567

Source: *Japan's Construction Industry: Update,* Credit Suisse, Research Department, Tokyo, Japan, December 19, 1990.

placed on U.S. contractors operating overseas, such as price and availability.

Other foreign markets for mining equipment include India, the Netherlands, United Kingdom, China, Soviet Union, and South Korea. Coal production reached record quantities for China, India, and Australia in 1990.

Among the top 10 export markets for U.S. construction and mining equipment, the fastest growing markets over the period 1986 to 1990 have been Korea, Mexico, and Singapore, with U.S. export increases of 389 percent, 212 percent, and 145 percent, respectively. All three of these countries have recently embarked on major construction and/or mining projects. Korea's construction market is so active that the Government of Korea recently was forced to take measures to slow construction because materials shortages were beginning to cause faulty and dangerous construction.[38] At the beginning of 1991, the Government of Korea announced plans for $5 billion in infrastructure projects. The Government of Mexico has recently loosened import restrictions and instituted a toll road program that has offered many business opportunities for U.S. construction equipment manufacturers. Moreover, mine privatization should also continue to provide market opportunities for U.S. mining equipment manufacturers. Singapore as well has been experiencing a good deal of construction activity, as have Taiwan and Hong Kong, in order to facilitate continued economic growth. As a region, Asia has become one of the world's fastest growing markets for international construction firms. In addition, industry experts are predicting a mining surge for Southeast Asia that will create a $5 billion market for mining equipment, supplies, and related services over the next 10 years. This is due to activity in expanding mine operations and developing new projects to tap into mineral reserves that are yet to be fully exploited in the region.[39]

Potential markets for construction and mining equipment include the Soviet Union and Eastern

[36] "Australia and Oceania Minerals Yearbook – 1988," *1988 Mineral Yearbook, Volume III, Area Reports: International,* U.S Department of the Interior, Bureau of Mines.

[37] *Japan Economic Almanac*, 1990, p. 135.

[38] "South Korea Curbs Construction; Materials in Short Supply," *Journal of Commerce,* July 10, 1991.

[39] "Mining Surge is Expected in Southeast Asia," *American Metal Market,* Feb. 5, 1991.

Europe. Both the Soviet Union and Eastern Europe, due to recent changes in their political and economic outlooks, are expected to embark on major construction projects. Major examples are the Housing Space 2000 project and the farm and market access road and food storage projects in the Soviet Union. They will also continue to expand mining operations, and oil and gas pipeline systems. The Soviet Union has shown a strong interest in U.S. construction equipment, and has indicated a desire to foster joint ventures and other forms of direct investment by U.S. manufacturers. Industry experts indicate that annual production of construction equipment in the Soviet Union is exceeded by annual demand, and that this situation is likely to continue for at least 5 years.[40] Moreover, the Department of Commerce has identified construction equipment as one of the best prospects for U.S. exporters interested in the Soviet market.[41]

Like the Soviet Union and Eastern Europe, China and India also are projected to be large markets for coal mining equipment in coming years. Global coal trade, as predicted by the U.S. Department of Energy, will increase nearly 85 percent by the end of the next decade.[42] Additionally, as the use of electricity worldwide increases, so will the demand for coal.

Another potential market for U.S. exports of construction and mining equipment is the Middle East, particularly with the resolution of the Gulf crisis and the immense amount of reconstruction that will be undertaken over the next 5 years. Although reconstruction estimates have been downscaled recently, from upwards of $50 billion to up to $30 billion, the region is still a large potential market for construction and mining equipment.

[40] *Machinery Outlook*, Manfredi and Associates, vol. 90.06, June 1990.
[41] *Eurosphere*, KPMG Peat Marwick, Aug.–Sept. 1991.
[42] *Washington Trade Daily*, July 5, 1991.

Industry sources are increasingly optimistic about the economic integration of the European Community and its effects on the U.S. construction and mining equipment industry. One major construction equipment manufacturer notes that the economic unification is expected to bring some advantages, such as the standardization of technical regulations, that will simplify production, reduce costs, and expedite the transportation of products as borders are opened.[43] During the summer 1991, U.S. and EC officials arrived at an agreement that will allow the National Institute of Standards and Technology to become a "notified body" that will assure that U.S. entities will successfully perform conformity assessments required in EC Directives, such as the Machinery Safety Directive. Notified bodies will undoubtedly play a key role in determining which products have access to the EC market, which has been a concern of U.S. industry. Moreover, the U.S. and EC standards organizations have pledged to work together to develop mutually acceptable international standards that are expected to supercede national standards in the United States.[44]

U.S. Exports

U.S. exports of construction and mining equipment increased by 58 percent, from $2.0 billion in 1986 to $3.1 billion in 1990 (table 10). All of the products in the construction and mining equipment category are exported. The three products with the highest volume of exports are certain parts for construction and mining equipment, at $658 million in 1990; self-propelled front-end shovel loaders, wheel-type, at $534 million in 1990; and buckets, shovels, grabs and grips for construction and mining equipment, at $431 million in

[43] Deere and Company, Annual Report, 1990.
[44] "U.S.–EC Agree on American Role in Conformity Assessment," *Washington Tariff and Trade Letter*, June 24, 1991.

Table 10
Construction and mining equipment: U.S. exports of domestic merchandise, by principal markets, 1986-90

(1,000 dollars)

Market	*1986*	*1987*	*1988*	*1989*	*1990*
Canada	419,569	503,779	626,020	611,915	834,676
Belgium & Lux	89,504	90,938	163,582	197,515	205,479
Australia	109,901	87,808	119,462	179,970	199,134
Mexico	56,405	57,011	81,081	87,164	175,746
Japan	48,849	42,375	71,081	118,241	126,833
United Kingdom	66,705	66,184	89,982	71,977	98,525
Singapore	39,840	38,184	60,010	89,074	97,516
France	57,011	74,137	99,251	95,989	96,172
South Korea	17,947	24,136	25,912	57,062	87,780
Germany	65,354	50,902	65,772	71,390	83,255
All other	1,002,883	836,720	1,023,221	1,010,569	1,106,056
Total	1,973,968	1,872,174	2,425,324	2,590,866	3,111,172

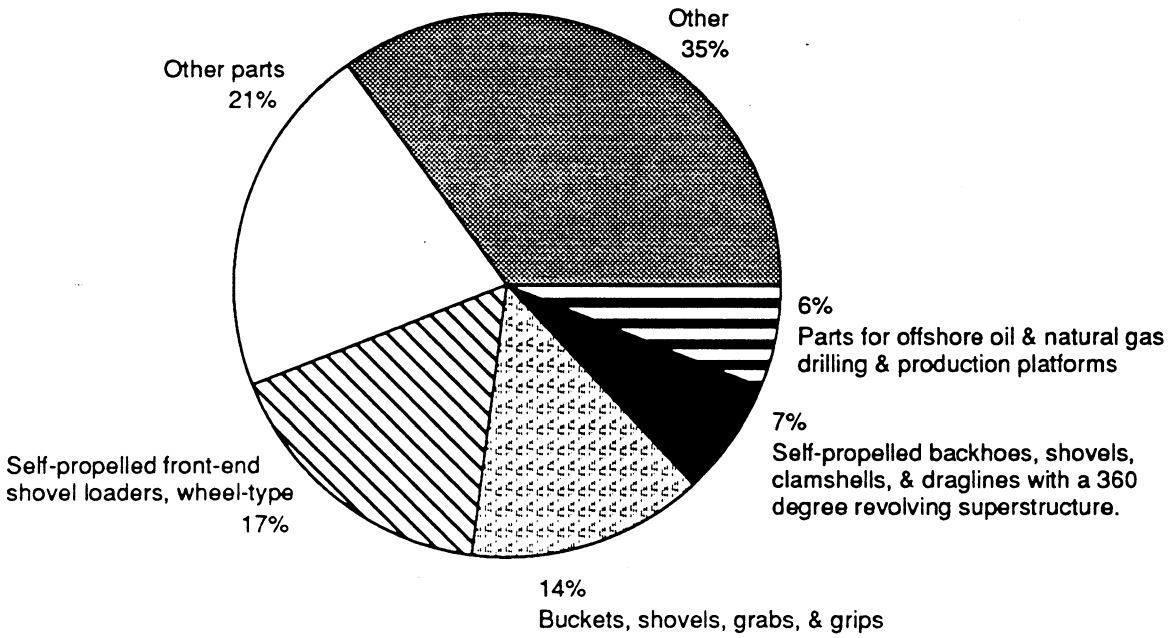
Source: Compiled from official statistics of the U.S. Department of Commerce.

1990 (figure 6). The export of this latter category of parts has increased 270 percent from 1986 to 1990. Parts have historically been the largest export category, owing to the fact that overseas service centers for U.S. equipment must be stocked to properly service and honor warranties on equipment sold abroad. It is not uncommon for U.S. manufacturers to guarantee delivery of repair and replacement parts anywhere in the world within a strict time limit. Perhaps an increasingly important trend behind the large increase in parts exports is the heightened overseas presence of U.S. manufacturers, generating the need for parts and components for overseas manufacture and assembly operations.

Canada continued to provide the largest market, receiving 27 percent of total exports in 1990; U.S. exports to Canada increased by 36 percent, from $612 million in 1989 to $835 million in 1990. The top three U.S. construction and mining equipment exports to Canada in 1990 were certain parts for construction and mining equipment, at almost $254 million; self-propelled front-end shovel loaders, wheel-type, at over $150 million; and self-propelled bulldozers and angledozers, for track laying, at almost $95 million. Canada received 39 percent of total U.S. exports of the first, 28 percent of the second, and 72 percent of total U.S. exports of the third product listed above.

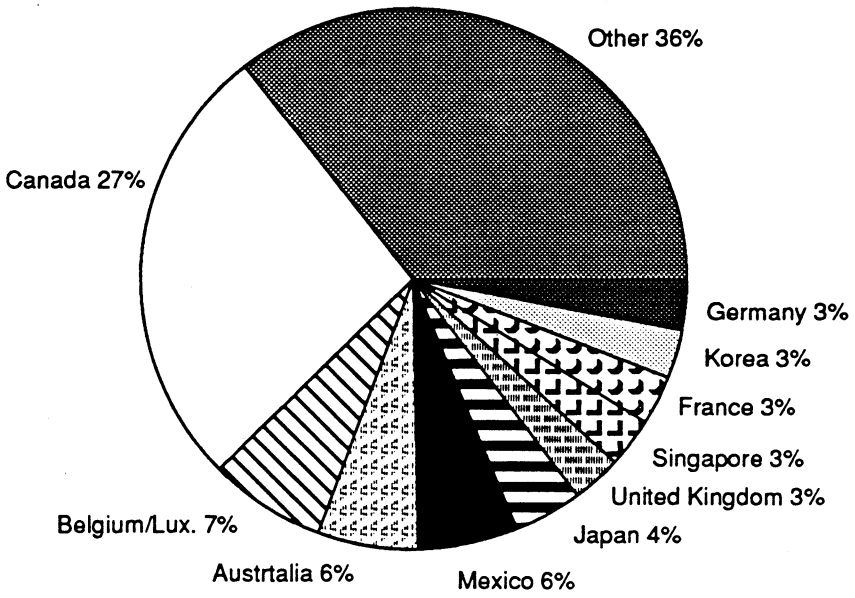
Belgium and Australia continued to be the second- and third-largest export markets for U.S. construction and mining machinery, respectively. Ninety-three percent of total 1990 Belgian imports of these U.S. products was accounted for by three categories: self-propelled front-end shovel loaders, wheel-type; buckets, shovels, grabs and grips suitable for use solely or principally with construction and mining equipment; and certain parts for construction and mining equipment. Moreover, these second and third parts categories accounted for 62 percent of Belgium's total imports of U.S. construction and mining equipment in 1990. This may be explained by U.S. subsidiaries operating in Belgium that source parts for production from their U.S. facilities. The three categories of construction and mining equipment listed above in reference to Belgium accounted for 57 percent of total Australian imports of these products from the United States in 1990. Forty-one percent of total Australian imports of U.S. construction and mining equipment in 1990 was in the two parts categories (figure 7).

Figure 6
U.S. exports, by major products, 1990



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

Figure 7
U.S. exports, to major markets, 1990
1990 total exports = $3,111 million



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

The largest increases in exports of construction and mining equipment in 1990 were to Mexico, Korea, and the United Kingdom, with 102-percent, 54-percent, and 37-percent increases over 1989 exports, respectively.

Construction equipment is exported from the United States by U.S. manufacturers to dealers overseas. International traders are generally not involved in this trade.

U.S. TRADE BALANCE

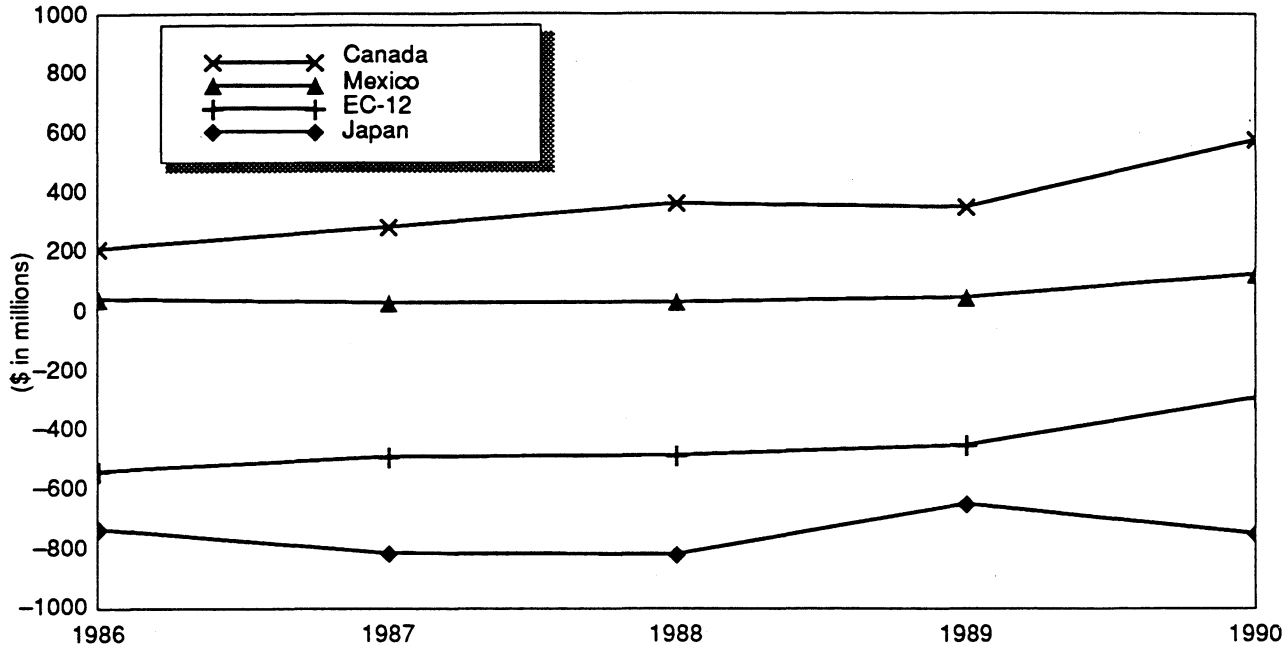
The United States has moved from a trade deficit of $154 million in 1986, to a trade surplus of $848 million in 1990 (table 11). While the United States has run a trade deficit with Japan between 1986 and 1990, it has maintained a surplus with its number two supplier, Canada, throughout the 5-year period. The U.S. trade surplus with Canada was 176-percent higher in 1990 than it was in 1986. Imports from the European Community have exceeded exports to that region throughout the 5-year period, and may be explained by U.S. manufacturers sourcing equipment from their European subsidiaries. The trade deficit with the European Community has decreased over the 5-year period, while the deficit with Japan has moved sporadically in both directions. Figure 8 provides U.S. bilateral trade balances with major trading partners, and figure 9 shows the 5-year trade progression leading from a trade deficit in 1986 to a trade surplus in 1990.

Table 11
Construction and mining equipment: U.S. exports of domestic merchandise, imports for consumption, and merchandise trade balance, by selected country and country group, 1986-90[1]

Item	1986	1987	1988	1989	1990
			Million dollars		
U.S. exports of domestic merchandise:					
Canada	420	504	626	612	835
Japan	49	42	71	118	127
Germany	65	51	66	71	82
Belgium	90	91	164	197	205
France	57	74	99	96	96
United Kingdom	67	66	90	72	99
Mexico	56	57	81	87	176
Australia	110	88	119	180	199
Brazil	53	46	51	82	63
Italy	17	26	24	21	20
All other	991	827	1,034	1,054	1,210
Total	1,974	1,872	2,425	2,591	3,111
EC-12	426	444	503	524	590
OPEC	180	140	221	128	198
ASEAN	69	61	110	146	221
CBERA	40	47	68	73	48
Eastern Europe	26	12	25	28	7
U.S. imports for consumption:					
Canada	211	222	266	264	258
Japan	783	857	890	767	876
Germany	283	242	257	294	245
Belgium	123	66	109	134	119
France	198	259	247	209	224
United Kingdom	248	254	248	220	186
Mexico	15	29	52	42	51
Australia	4	4	8	8	10
Brazil	36	57	59	94	76
Italy	90	85	108	99	89
All other	137	145	149	139	127
Total	2,128	2,221	2,392	2,268	2,263
EC-12	965	934	989	971	882
OPEC	3	3	(2)	(2)	(2)
ASEAN	6	7	3	1	1
CBERA	2	(2)	(2)	(2)	(2)
Eastern Europe	1	1	1	(2)	1
U.S. merchandise trade balance:					
Canada	209	282	360	348	577
Japan	-734	-815	-819	-649	-749
Germany	-218	-191	-191	-223	-163
Belgium	-33	25	55	63	86
France	-141	-185	-148	-113	-128
United Kingdom	-181	-188	-158	-148	-87
Mexico	41	28	29	45	125
Australia	106	84	111	172	189
Brazil	17	-11	-8	-12	-13
Italy	-73	-59	-84	-78	-69
All other	854	682	885	915	1,083
Total	-154	-349	33	323	848
EC-12	-539	-490	-486	-452	-292
OPEC	177	137	221	128	198
ASEAN	63	54	107	145	220
CBERA	38	47	68	73	48
Eastern Europe	25	11	24	28	6

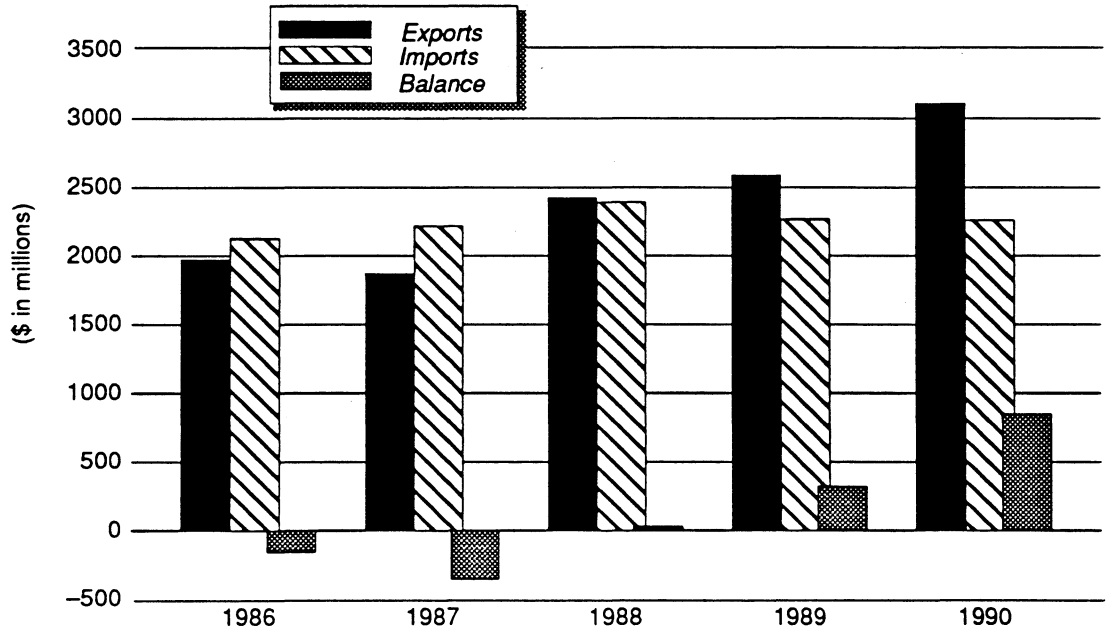
[1] Import values are based on customs value; export values are based on f.a.s. value, U.S. port of export. U.S. trade with East Germany is included in "Germany" but not "Eastern Europe."
[2] Less than $500,000.
Source: Compiled from official statistics of the U.S. Department of Commerce.

Figure 8
U.S. bilateral trade balances, 1986-90



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

Figure 9
U.S. exports, imports, and trade balances, 1986-90



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

APPENDIX A
EXPLANATION OF TARIFF AND TRADE AGREEMENT TERMS

TARIFF AND TRADE AGREEMENT TERMS

The ***Harmonized Tariff Schedule of the United States*** (HTS) replaced the Tariff Schedules of the United States (TSUS) effective January 1, 1989. Chapters 1 through 97 are based on the internationally adopted Harmonized Commodity Description and Coding System through the 6-digit level of product description, with additional U.S. product subdivisions at the 8-digit level. Chapters 98 and 99 contain special U.S. classification provisions and temporary rate provisions, respectively.

Rates of duty in the ***general*** subcolumn of HTS column 1 are most-favored-nation (MFN) rates; for the most part, they represent the final concession rate from the Tokyo Round of Multilateral Trade Negotiations. Column 1-general duty rates are applicable to imported goods from all countries except those enumerated in general note 3(b) to the HTS, whose products are dutied at the rates set forth in ***column 2***. Goods from the People's Republic of China, Czechoslovakia, Hungary, Poland, and Yugoslavia are among those eligible for MFN treatment. Among articles dutiable at column 1-general rates, particular products of enumerated countries may be eligible for reduced rates of duty or for duty-free entry under one or more preferential tariff programs. Such tariff treatment is set forth in the ***special*** subcolumn of HTS column 1.

The ***Generalized System of Preferences*** (GSP) affords nonreciprocal tariff preferences to developing countries to aid their economic development and to diversify and expand their production and exports. The U.S. GSP, enacted in title V of the Trade Act of 1974 and renewed in the Trade and Tariff Act of 1984, applies to merchandise imported on or after January 1, 1976, and before July 4, 1993. Indicated by the symbol "A" or "A*" in the special subcolumn of column 1, the GSP provides duty-free entry to eligible articles the product of and imported directly from designated beneficiary developing countries, as set forth in general note 3 (c)(ii) to the HTS.

The ***Caribbean Basin Economic Recovery Act*** (CBERA) affords nonreciprocal tariff preferences to developing countries in the Caribbean Basin area to aid their economic development and to diversify and expand their production and exports. The CBERA, enacted in title II of Public Law 98-67, implemented by Presidential Proclamation 5133 of November 30, 1983, and amended by the Customs and Trade Act of 1990, applies to merchandise entered, or withdrawn from warehouses for consumption, on or after January 1, 1984; this tariff preference program has no expiration date. Indicated by the symbol "E" or "E*" in the special subcolumn of column 1, the CBERA provides duty-free entry to eligible articles the product of and imported directly from designated countries, as set forth in general note 3 (c)(v) to the HTS.

Preferential rates of duty in the special subcolumn of column 1 followed by the symbol "IL" are applicable to products of Israel under the ***United States-Israel Free-Trade Area Implementation Act*** of 1985, as provided in general note 3 (c)(vi) of the HTS. When no rate of duty is provided for products of Israel in the special subcolumn for a particular provision, the rate of duty in the general subcolumn of column 1 applies.

Preferential rates of duty in the special duty rates subcolumn of column 1 followed by the symbol "CA" are applicable to eligible goods originating in the territory of Canada under the ***United States-Canada Free-Trade Agreement***, as provided in general note 3 (c)(vii) to the HTS.

Other special tariff treatment applies to particular ***products of insular possessions*** (general note 3 (a)(iv)), goods covered by the ***Automotive Products Trade Act*** (general note 3 (c)(iii)), and the ***Agreement on Trade in Civil Aircraft*** (general note 3 (c)(iv)), and ***articles imported from freely associated states*** (general note 3 (c)(viii)).

The ***General Agreement on Tariffs and Trade*** (GATT) (61 Stat. (pt. 5) A58; 8 UST (pt. 2) 1786) is the multilateral agreement setting forth basic principles governing international trade among its more than 90 signatories. The GATT's main obligations relate to most-favored-nation treatment, the maintenance of scheduled concession rates of duty, and national (nondiscriminatory) treatment for imported products. The GATT also provides the legal framework for customs valuation standards, "escape clause" (emergency) actions, antidumping and countervailing duties, and other measures. Results of GATT-sponsored multilateral tariff negotiations are set forth by way of separate schedules of concessions for each participating contracting party, with the U.S. schedule designated as schedule XX.

Officially knows as "The Arrangement Regarding International Trade in Textiles," the ***Multifiber Arrangement*** (MFA) provides a framework for

the negotiation of bilateral agreements between importing and producing countries, or for unilateral action by importing countries in the absence of an agreement. These bilateral agreements establish quantitative limits on imports of textiles and apparel, of cotton and other vegetable fibers, wool, manmade fibers, and silk blends, in order to prevent market disruption in the importing countries—restrictions that would otherwise be a departure from GATT provisions. The United States has bilateral agreements with more than 30 supplying countries, including the four largest suppliers: China, Hong Kong, the Republic of Korea, and Taiwan.

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