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U.S.-China Trade Growth and America's Transportation System

by Steven Beningo

The growth in U.S.- China trade over the last two decades has impacted the U.S. transportation system by increasing traffic at air cargo hubs and seaports. The highway and rail infrastructure that supports the movement of cargo to and from these facilities has also been affected. In particular, growing air trade with China in the Southwest and Great Lakes regions of the United States and the increase in water trade at west coast ports have put an even greater demand on the transportation infrastructure serving these areas.

The addition of work shifts at busy sea ports, the use of variable highway tolls to manage freight traffic, shifting trade flows among entry and exit points, and changing domestic trade routes can all be at least partly attributed to the marked increase in U.S.-China trade. Infrastructure changes will also affect the trade routes. For example, when completed several years from now, the widening of the Panama Canal will likely facilitate a shift in trade-related traffic from congested west coast ports to less crowded ports in the Southeast.

Trade Growth

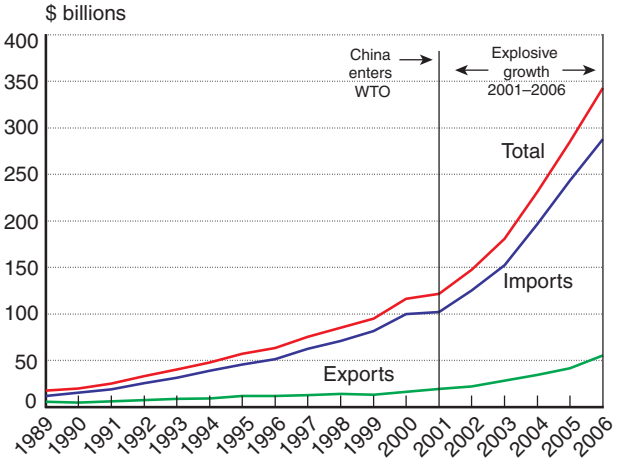
In 2006, China became America's second largest trading partner (after Canada), up from 10th largest in 1989. The two countries traded goods valued at $343 billion in 2006, compared to just $18 billion in 1989.[1] This compares with trade of $534 billion in 2006 between the United States and Canada, $332 billion in U.S trade with Mexico, and $208 billion in U.S. trade with Japan.

The value of U.S. imports from China increased by 2,300 percent, and U.S. exports to China increased by 851 percent. Figure 1 shows the growth in U.S.-China trade between 1989 and 2006, averaging 19 percent per year.

On December 11, 2001, China became a member of the World Trade Organization (WTO). As part of pre-membership negotiations, China committed to reduce barriers to the importation of products from other nations. In return, the United States and many other countries agreed to lower their limits on Chinese imports.[2] These actions led to a marked increase in U.S.-China trade between 2001 and 2006. Trade between the two countries increased by an average of 23 percent per year compared to an average of 14 percent per year for the previous 5-year period. (U.S. trade with other East Asian countries, including Japan and South Korea, grew 3.5 percent a year between 2001 and 2006.)

As seen in figure 1, the United States imports far more goods from China than it exports to China. In 2006, the United States imported $288 billion in merchandise from China while exporting $55 billion in goods. In 2006, the total value of U.S. imported goods from China nearly matched the $303 billion worth of goods imported from Canada that year. Mexico was a distant third in imports to the United States, at $198 billion, followed by Japan with $148 billion.

Figure 1: U.S.-China Trade, 1989–2006



KEY: WTO = World Trade Organization.

SOURCE: *FT 920 U.S. Merchandise Trade: Selected Highlights*, U.S. Census Bureau, Department of Commerce, Suitland, MD, 1990-2007.

[1] Only trade in goods is covered in this special report, trade in services is not covered. U.S.-China trade data do not include Hong Kong or Taiwan.

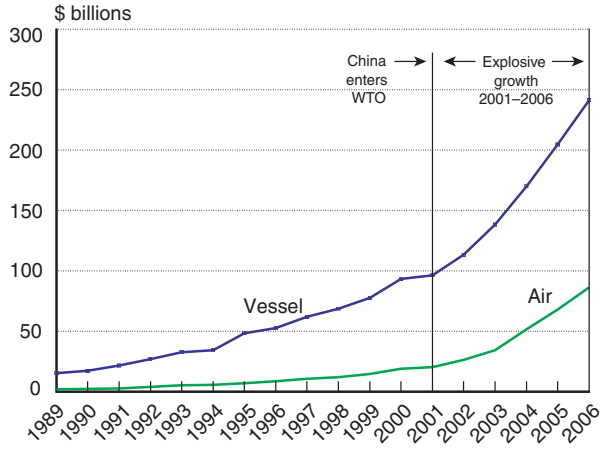
[2] Peter Carter, Graduate Student at the University of California at Los Angeles, *Goods Movement Impacts of China's WTO Accession on U.S. Textile Importation from Canada and Mexico*, paper submitted to the Transportation Research Board, 2007, p. 2.

Growth by Mode

Total U.S.-China trade by air increased from just under $2 billion in 1989 to over $86 billion in 2006 (figure 2). This is more than a 4,400 percent increase, averaging 25.2 percent annually for the period after accelerating to an annual average of 39 percent following China's acceptance by the WTO in 2001.[3] Imports by air increased at an average annual rate of 27 percent and exports by 21 percent. The proportion of total trade by air between the two countries increased from 11 to 25 percent.

U.S.-China trade by vessel increased from $15.4 billion in 1989 to $241 billion in 2006 – almost a 1,500 percent increase, averaging 17 percent annually. During this 17-year period, imports of products from China by vessel increased an average of 19 percent per year, and exports to China by vessel increased an average of 12 percent per year.

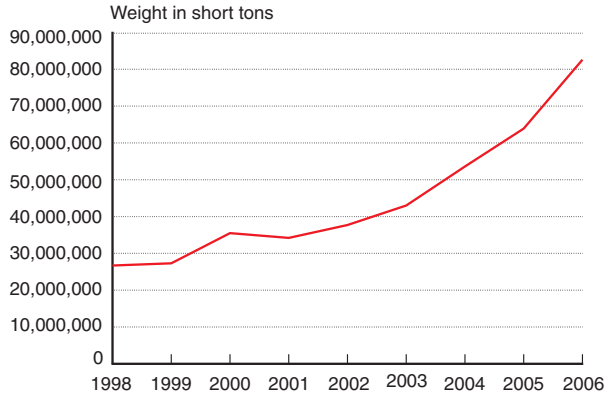
Figure 2: Value of U.S. Trade With China by Mode, 1989–2006



KEY: WTO = World Trade Organization.

SOURCE: *FT 920 U.S. Merchandise Trade: Selected Highlights*, U.S. Census Bureau, Department of Commerce, Suitland, MD, 1990-2007.

Figure 3: U.S. Imports from China by Vessel, Short Tons



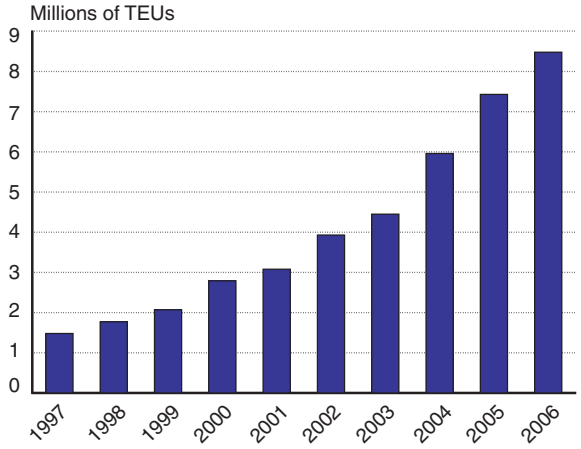
SOURCE: *U.S. Imports of Merchandise* DVDs, U.S. Census Bureau, Department of Commerce, Suitland, MD, 1999-2007.

[3] All annual average growth rates in this special report are geometric averages.

The weight data also show an acceleration of U.S. imports from China after 2001 (figure 3). While the weight of products imported to the United States by vessel from China increased at an average annual rate of 8.6 percent between 1998 and 2001, that rate accelerated to 19 percent over five years from 2001 to 2006. In 2006, the United States imported commodities with weight in excess of 1 billion short tons by vessels. In comparison, the United States imported 83 million short tons of commodities by vessel from China, accounting for 7 percent of total import weight by vessel.

The number of twenty-foot equivalent units (TEUs)[4] entering the United States from China increased from 1.5 million TEUs in 1998 to 8.5 million TEUs in 2006 (figure 4), with an annual average growth rate of 21.4 percent.

Figure 4: Millions of Containers (TEUs) Entering the United States from China by Vessel, 1997 - 2006



NOTE: TEU = Twenty-foot equivalent unit.

SOURCE: Gail Perkins, U.S. Maritime Administration, U.S. Department of Transportation, personal communication.

Growth in Water Trade by U.S. Region

Increased trade with China has greatly affected west coast ports and infrastructure as more than half of the trade between the United States and China by vessel enters or leaves the United States through ports located on or near the Pacific Ocean. Seven Pacific port districts[5] accounted for 55 percent of imports from China by vessel and 58 percent of exports to China by vessel in 2006. Figure 5 shows U.S. imports from China, by region, in 2006 compared to 1998.[6]

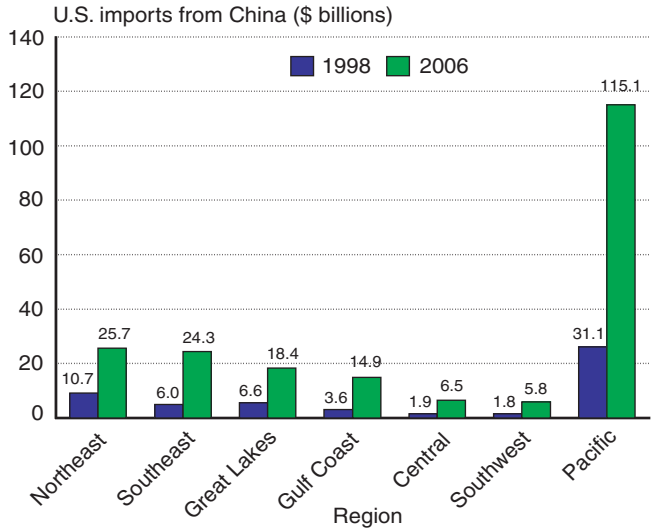
[4] A twenty-foot equivalent unit is a measure of containership capacity as determined by totaling the length of all containers and dividing by 20. For example, a 48-foot container equals 2.4 TEUs.

[5] For the purposes of this report, the Pacific port districts are considered to be Honolulu, Hawaii; San Diego, California; Los Angeles, California; San Francisco, California; Portland, Oregon; Seattle, Washington; and Anchorage, Alaska.

[6] For some graphs in this special report, 1998 is used as the base year because this is the earliest year for which BTS has enough detailed data to calculate the amount of imports and exports by port of entry/exit.

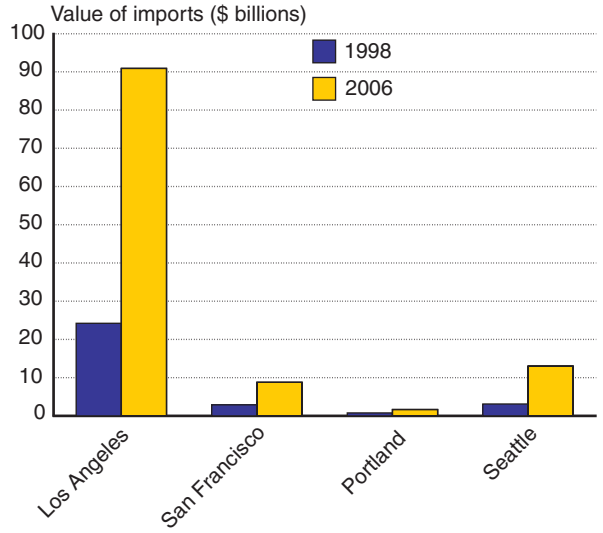
The value of Chinese imports entering the United States by vessel on the west coast increased from $31 billion in 1998 to $115 billion in 2006. Chinese imports valued at $91 billion passed through the Los Angeles port district in 2006, representing 79 percent of Chinese imports entering the United States via west coast ports (figure 6). The Los Angeles district includes both the Port of Los Angeles and the Port of Long Beach. Another $13 billion in waterborne Chinese imports passed through Seattle district ports. In 2006, imports from China accounted for 39 percent of all imports coming into the United States by vessel via west coast ports, compared to 23 percent in 1998.

Figure 5: Value of U.S. Imports from China by Vessel by Region, 1998 and 2006



SOURCE: *U.S. Imports of Merchandise DVDs*, U.S. Census Bureau, Department of Commerce, Suitland, MD, 1999-2007.

Figure 6: Value of U.S. Imports from China by Vessel at Selected Pacific Port Districts, 1998 and 2006



SOURCE: *U.S. Imports of Merchandise DVDs*, U.S. Census Bureau, Department of Commerce, Suitland, MD, 1999-2007.

Box A: Congestion Pricing

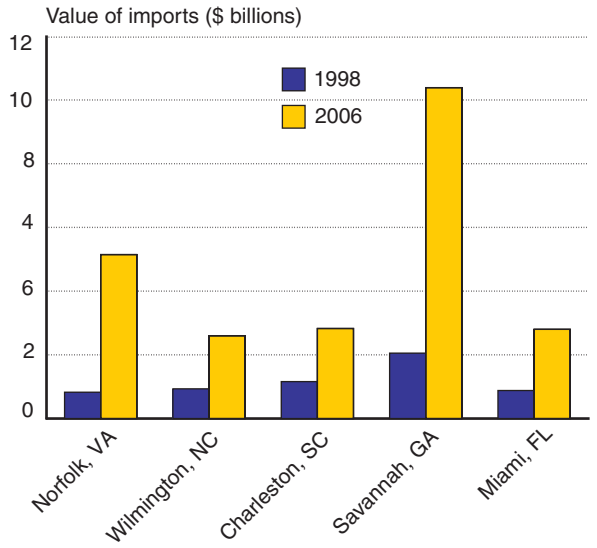
Congestion pricing comprises a group of market-based strategies that involve collecting a variable toll for highway use, with the primary intent of managing travel demand so as to reduce or eliminate congestion on a roadway facility, corridor, or network.

SOURCE: P. DeCorla-Souza, 2005, "Fair Highway Networks, A New Approach To Eliminate Congestion on Metropolitan Freeways," Public Works Management & Policy, 9(3):196-205.

Ports on the U.S. west coast have greatly expanded their operations to meet the demand resulting from increased Chinese imports. For example, the California ports of Los Angeles and Long Beach have added a second shift from 6 p.m. to 3 a.m. to provide more capacity to move goods through their ports. An organization named PierPASS, created by the marine terminal operators at the ports of Los Angeles and Long Beach, has implemented a program at the ports of Los Angeles and Long Beach that uses congestion pricing (see box A) as an incentive for shippers to move their goods at night and on Saturdays.[7] Off-peak movement of goods results in better use of the ports' capacities to accommodate the growing number of shipments arriving from China.

Anchorage, San Diego, and Seattle had the highest percentage growth in value among the west coast port districts, fueled largely by increasing U.S. demand for electronics and clothing from China.[8]

Figure 7: Value of U.S. Imports from China by Vessel at Selected Southeast Port Districts, 1998 and 2006



SOURCE: *U.S. Imports of Merchandise DVDs*, U.S. Census Bureau, Department of Commerce, Suitland, MD, 1999-2007.

[7] For more information on PierPASS, visit http://www.pierpass.org/.
[8] Anchorage: $22 million and 639 percent growth, San Diego: $251 million and 409 percent growth.

The sizable increase in U.S.-China trade has impacted U.S. ports outside the Pacific region as well. Increasing congestion at west coast ports is leading to a shift in U.S.-China trade routes, with more Chinese imports entering the United States at ports in the Southeast as trade routes through the Panama and Suez canals are becoming more competitive. The current widening of the Panama Canal is expected to allow the canal to offer transit to "post-Panamax" vessels, which are larger than the vessels that can currently navigate the canal. The expansion will double the capacity of the Panama Canal and provide additional opportunities for trade between China and ports in the southeastern United States.

Southeast port districts[9] accounted for 12 percent of imports from China by vessel in 2006, up from 8 percent in 1998, and accounted for 17 percent of exports to China by vessel, up from 12.7 percent in 1998. Among the Southeast port districts, the value of U.S. imports from China by vessel grew the most in the Norfolk, Savannah, and San Juan port districts. The Savannah port district reached $10 billion in Chinese imports via vessel in 2006, while another $5 billion passed through the Norfolk port district. Figure 7 shows the growth of U.S. imports from China from 1998 to 2006 at Southeast port districts.

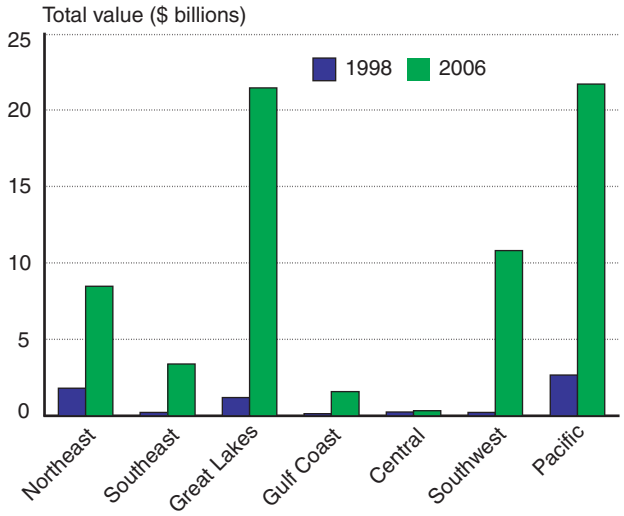
[9] For the purposes of this report, the Southeast port districts are defined as being Norfolk, Virginia; Wilmington, North Carolina; Charleston, South Carolina; Savannah, Georgia; Miami, Florida; San Juan, Puerto Rico; and Charlotte Amalie, Virgin Islands.

Growth by U.S. Airport Region

Air trade between the two nations (shipped by air couriers, e.g., United Parcel Service, Federal Express, and DHL) has also increased. As figure 8 shows, both the Great Lakes and Pacific regions received over $21 billion in Chinese imports to the United States by air in 2006. Between 1998 and 2006, the largest growth in imports of Chinese goods by air occurred in the Southwest and Great Lakes regions. This growth is attributed primarily to the rapid growth of freight shipments through two airports, Dallas/Fort Worth (a hub for several air freight companies) and Louisville in the Cleveland port district (home to a United Parcel Service hub). From 1998 to 2006, the Dallas/Fort Worth port district saw an increase in imports from China by air from under $250 million to nearly $11 billion. During the same period, the Cleveland port district's air imports from China increased from about $600 million to $10 billion. As a result of increasing China trade, freight carriers have expanded their operations at their hub airports, both within the United States and Asia.

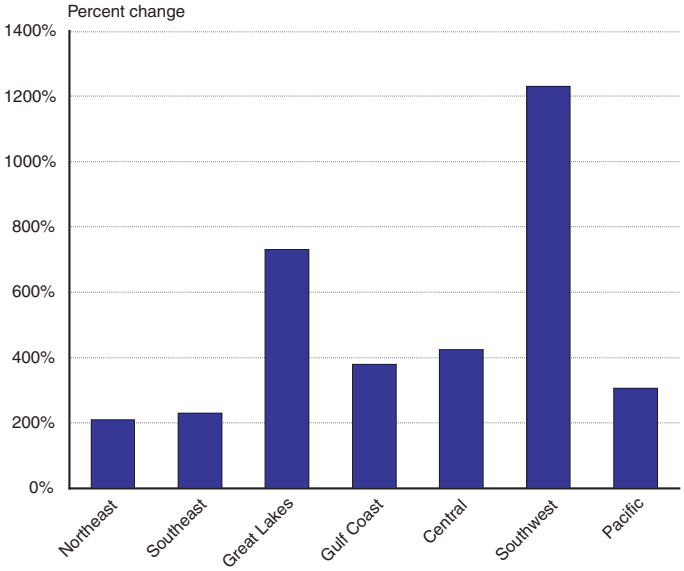
Although imports by air from China to the United States grew in all regions between 1998 and 2006, the share of imports arriving by air through Pacific and Northeast ports-of-entry declined as growth of air courier services in other regions of the United States continued. During the 8-year period, the share of the value of all China imports to the United States arriving at Pacific ports-of-entry by air declined from 41 to 32 percent, and the share of the value at Northeast ports-of-entry fell from 27 to 13 percent.

Figure 8: Total Value of Imports from China by Air by Port Region, 1998 and 2006



SOURCE: *U.S. Imports of Merchandise* DVDs, U.S. Census Bureau, Department of Commerce, Suitland, MD, 1999-2007.

Figure 9: Percent Increase in the Value of Electrical Machinery (HS 85) Imports from China via All Modes by Port Region, 1998 to 2006



SOURCE: *U.S. Imports of Merchandise DVDs*, U.S. Census Bureau, Department of Commerce, Suitland, MD, 1999-2007.

Due to the 27.9 percent per year growth in imports by air from China from 1998 to 2006 (figure 2), there was still a very large increase in the dollar value of goods arriving by air via Pacific and Northeast ports-of-entry during the 8-year period.

Commodity Trends

While electrical machinery was the top commodity by value traded between the United States and China in both 1998 and 2006, trade in articles of iron and steel and computers and other mechanical appliances grew faster. For all of the top 10 commodities, the United States imports far more goods from China than it exports to China. Table 1 shows the top 10 commodities traded between the United States and China in 2006, and the growth in that trade since 1998.

Electrical machinery accounted for $65 billion of imports and $10 billion of exports in 2006.[10] From 1998 to 2006, there was substantial growth in imports of Chinese electrical machinery into all regions of the United States (figure 9). The highest rate of growth in electrical machinery imports from China occurred at Southwest ports-of-entry, with an increase from $1 billion in 1998 to $11 billion in 2006. Most of this growth was the result of air shipments to the Dallas/Fort Worth port district, which grew from under $200 million to over $8 billion during the eight-year period.

[10] Electrical machinery includes such items as electric motors, transformers, magnets, batteries, vacuum cleaners, electric shavers, electrical lighting equipment, laser beams, microwave ovens, telephones, microphones, video recorders, smart cards, radar, radio equipment, computer monitors, televisions, television cameras, smoke detectors, filament lamps, and amplifiers.

Figure 10 shows the growth and relative regional share in U.S. electrical machinery imports via all modes from China by region from 1998 to 2006.

After electrical machinery, the next two commodities with the highest value of exports to China in 2006 were boilers and other mechanical appliances ($7.7 billion) and aircraft ($6.1 billion).

Table 1: Top 10 Commodities Traded Between the United States and China in 2006 Compared to 1998 Trade in Those Commodities ($ millions)

Commodity	1998 total trade	2006 total trade	Percent change
Electrical machinery	14,522	75,083	417%
Boilers and other mechanical appliances	10,335	69,970	577%
Toys, games and sports equipment	10,604	20,943	98%
Furniture and lamps	3,993	19,483	388%
Footwear	8,038	13,948	74%
Clothing, not knitted or crocheted	3,814	11,868	211%
Plastics	2,519	10,180	304%
Iron and steel	1,197	8,763	632%
Clothing, knitted or crocheted	1,862	8,020	331%
Assorted instruments	2,906	7,728	166%

SOURCE: *U.S. Exports of Merchandise and U.S. Imports of Merchandise* DVDs, U.S. Census Bureau, Department of Commerce, Suitland, MD, 1999-2007.

Box B: For the purposes of this report, the regions were considered to consist of the following port districts:

Northeast: Portland, Maine; St. Albans, Vermont; Boston, Massachusetts; Providence, Rhode Island; New York City, New York; Philadelphia, Pennsylvania; Baltimore, Maryland; and Washington, D.C.

Southeast: Norfolk, Virginia; Wilmington, North Carolina; Charleston, South Carolina; Savannah, Georgia; Miami, Florida; San Juan, Puerto Rico; and Charlotte Amalie, Virgin Islands

Great Lakes: Ogdensburg, New York; Buffalo, New York; Duluth, Minnesota; Milwaukee, Wisconsin; Detroit, Michigan; Chicago, Illinois; and Cleveland, Ohio

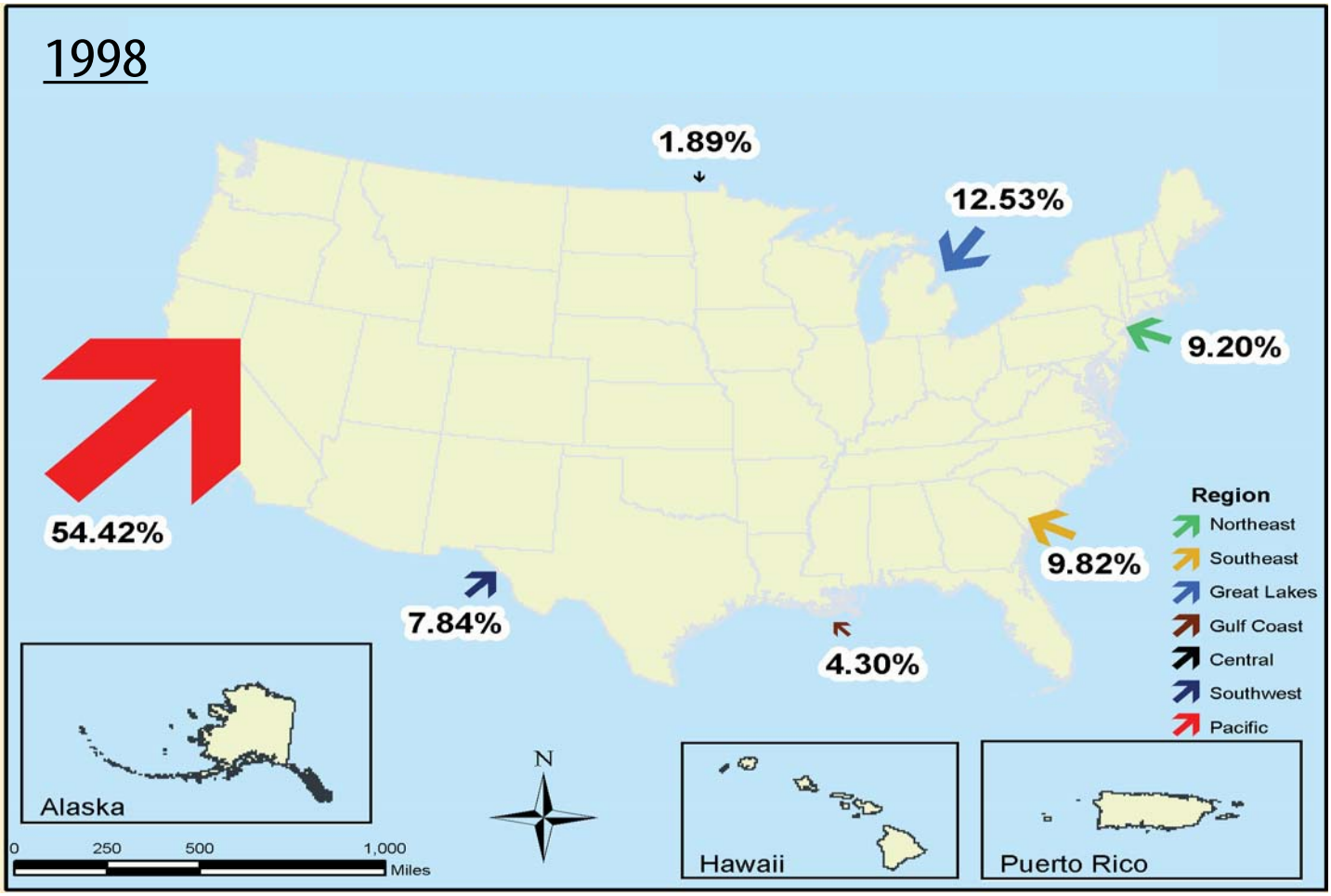
Gulf Coast: Tampa, Florida; Mobile, Alabama; New Orleans, Louisiana; Port Arthur, Texas; and Houston/Galveston, Texas

Southwest: Laredo, Texas; El Paso, Texas; Nogales, Arizona; and Dallas-Fort Worth, Texas

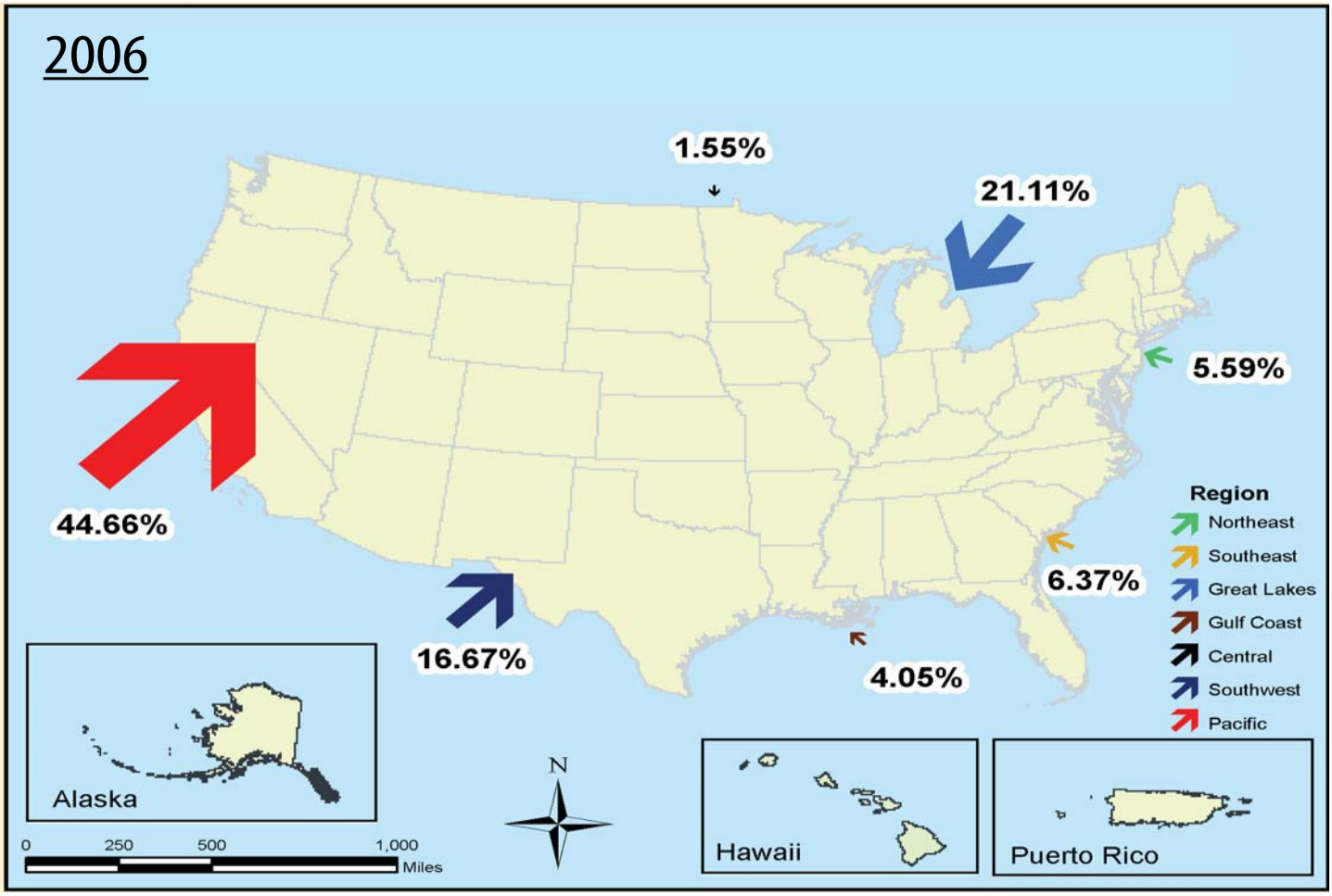
Pacific: Honolulu, Hawaii; San Diego, California; Los Angeles, California; San Francisco, California; Portland, Oregon; Seattle, Washington; and Anchorage, Alaska

Central: Great Falls, Montana; Pembina, North Dakota; Minneapolis, Minnesota; and St. Louis, Missouri

Figure 10: Percent of Total Value of Electrical Machinery (HS 85) Imported from China by Region via All Modes—1998 v. 2006



SOURCE: *U.S. Imports of Merchandise DVDs*, U.S. Census Bureau, Department of Commerce, Suitland, MD, 1999.



SOURCE: *U.S. Imports of Merchandise DVDs*, U.S. Census Bureau, Department of Commerce, Suitland, MD, 2007.

About this Report

This article was prepared by Steven Beningo, International Transportation Specialist, of the Bureau of Transportation Statistics (BTS). BTS is a component of DOT's Research and Innovative Technology Administration.

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