THE TRANSPORTATION OF IMPORTED CONTAINERIZED GOODS

Introduction

The supply chains for many consumer goods have become global and rely extensively on fast, reliable and flexible transportation as a key element in providing goods to customers when they want them. In order to match the supply of goods from around the world, with the real-time demands for consumer goods, the pull system supply chain relies heavily on information technology and fast and efficient transportation.[1]

We begin by discussing the international trade context in which containerized movement of imports occurs and, in particular, the foreign trade gateways that serve as a point of entry for imported goods. We then describe U.S. containerized import flows and identify key foreign trade gateways where these imports enter the country. Next, we turn to a discussion of the domestic transportation infrastructure which is a critical component in the various supply chains of these containerized imports. Finally, we discuss the economic impacts on the U.S. economy of disruptions to these supply chains. It should be noted that, because of the multiple sources used in this case study, the dates of the various data sources will differ somewhat. However, the figures are generally consistent across these multiple sources.

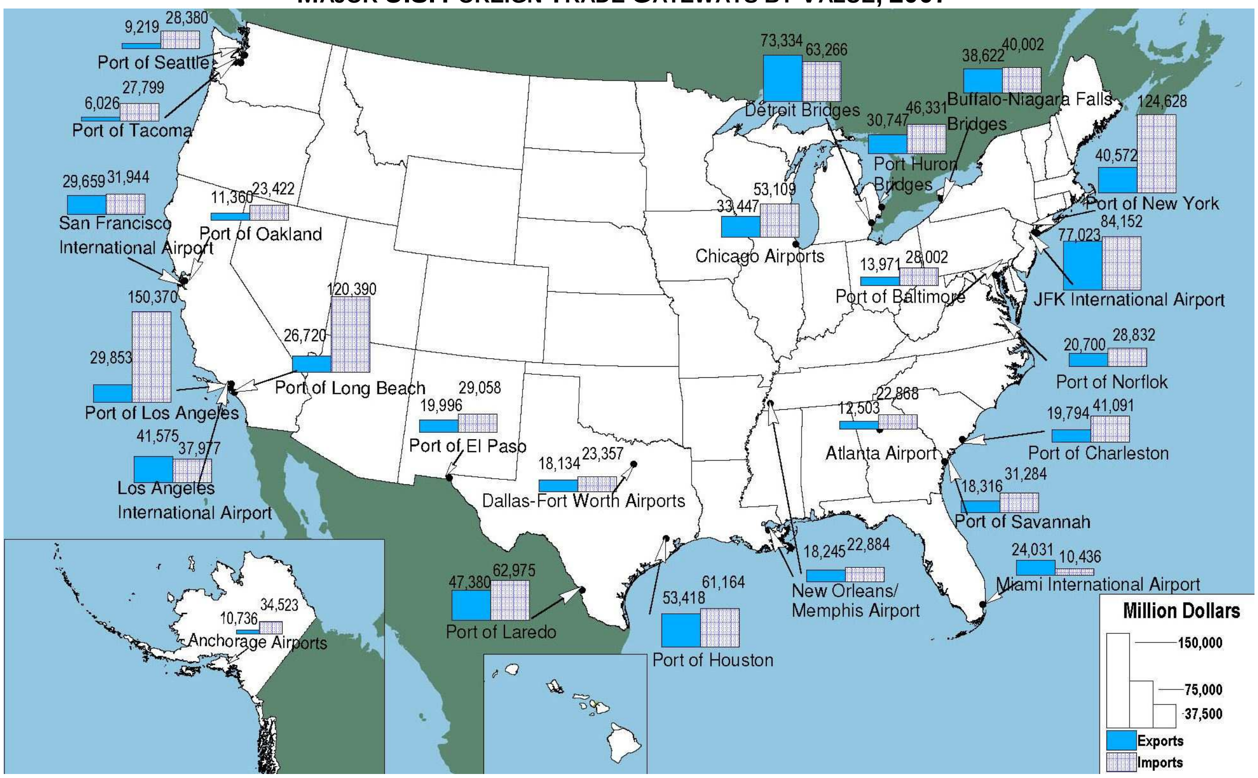
U.S. International Trade Gateways

The transportation of imported goods through domestic supply chains generally involves multiple modes of transportation, and begins at a point of entry into the country—i.e., foreign trade gateways. Based on the most recent available data (2007), of the goods imported into the U.S. ($1,953 billion), 52% (by value) came into the country via waterborne transportation, 21% came into the country by air transportation, 15% came into the country by truck transportation, and 5% came into the country by rail transportation.[2] Figure 1 shows major U.S. foreign trade gateways (top 25, by value) for 2007 and illustrates the various transportation modes—land, sea, air—by which imports make their way to this country. The top non-water gateways include: the air gateways of JFK International Airport, Los Angeles International Airport, and Chicago; and the land gateways of Detroit, MI, Laredo, TX and Port Huron, MI.[3] Once in the U.S., depending upon the final destination of the goods and the required timeliness of delivery, truck transportation may be used exclusively as the goods move to distribution centers and warehouses to retail establishments, or an intermodal rail/truck combination may be used. In fact, rail/truck

[1] "Supply Chains and Private Sector Dynamics," presentation by Paula Dowell to the Talking Freight Seminar, U.S. Federal Highway Administration, May 21, 2008, http://www.fhwa.dot.gov/freightplanning/may21transcript.htm
[2] .S. Department of Transportation, Bureau of Transportation Statistics, Research and Innovative Technology Administration, *Pocket Guide to Transportation 2009*, Table 5-5.
[3] [3] U.S. Department of Transportation, Bureau of Transportation Statistics, *America's Freight Transportation Gateways*, November 2009,

intermodal has become an increasing portion of railroads' business accounting for approximately 21% of U.S. railroad revenue.[4]

FIGURE 1
MAJOR U.S. FOREIGN TRADE GATEWAYS BY VALUE, 2007[5]



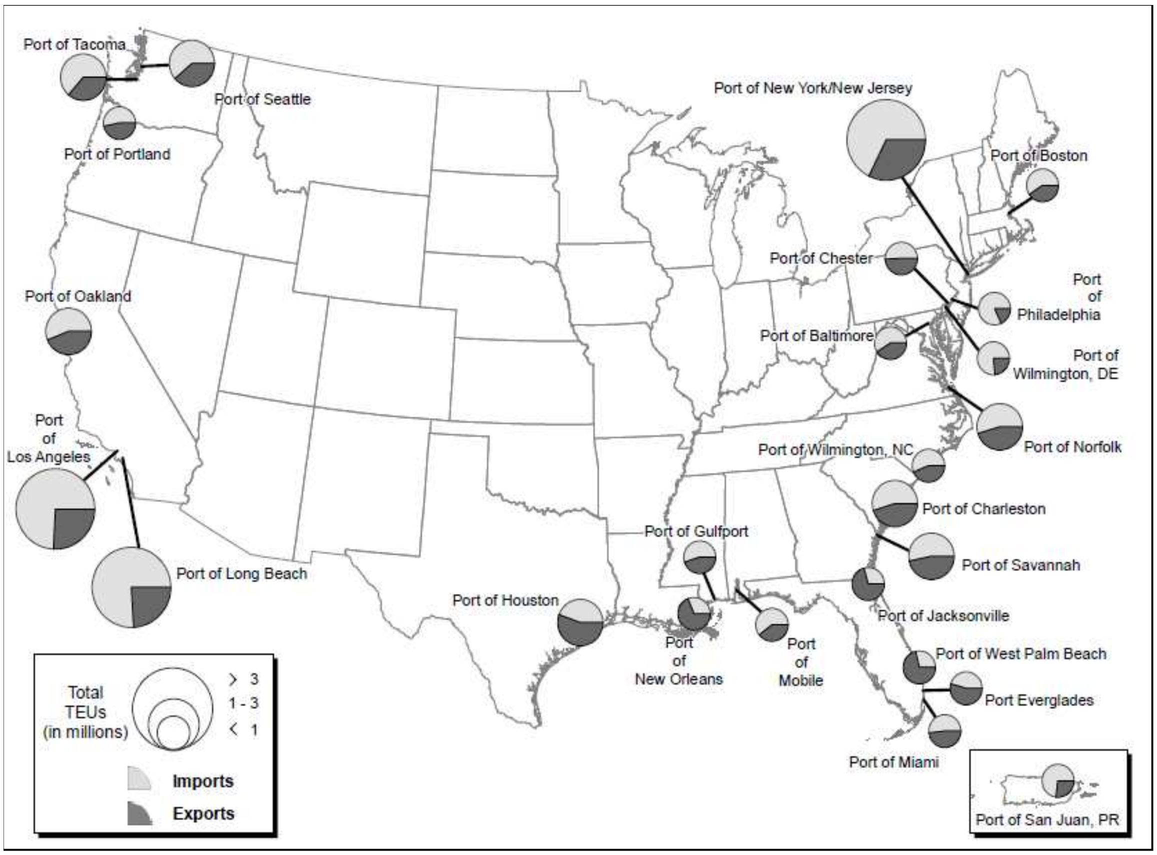
Containerized Imports

Of the goods coming into the U.S. by water mode, 59% ($423) billion came into the country in containers. The growing importance of containerized trade is evidenced by the increasing number of containers (of all sizes) entering the U.S., which almost doubled between 2000 and 2007 (from increasing from 6.0 million to 11.6 million).[6] Containerized imports include both finished goods and intermediate inputs, some of which are critical to U.S. manufacturers' "just-in-time" supply chains.[7] The port of Los Angeles accounted for 20.1% of 2008 container volume (measured in TEUs), followed by the ports of Long Beach (16.4%), New York/New

[4] Association of American Railroads, *Rail Intermodal Keeps America Moving*, AAR Policy and Economics Department, September 2009, p. 1.
[5] http://ops.fhwa.dot.gov/freight/freight_analysis/nat_freight_stats/images/hi_res_jpg/top25ftrgateval2007.jpg
[6] *America's Container Ports: Freight Hubs that Connect Our Nation to Global Markets*, U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, June 2009, Figure 15, p. 22.
[7] U.S. Congressional Budget Office, *The Economic Costs of Disruptions in Container Shipments*, March 29, 2006, p. 1.

Jersey (14.2%), Savannah, GA (7.5%), and Norfolk, VA (5.6%). The top three ports accounted for half of 2008 U.S. container volume.[8] Figure 2 shows the top container ports in the U.S.

FIGURE 2
TOP 25 CONTAINER PORTS FOR U.S. INTERNATIONAL MARITIME FREIGHT, 2008[9]



In 2007 almost three-fourths (72%) of U.S. container import TEUs were from 10 countries. Figure 3 shows that, by far, China (excluding Hong Kong) was the top container trading partner, with almost 50% of total TEUs entering the U.S. in 2007. The other top 5 2007 U.S. containerized cargo trading partners were Japan, Hong Kong, South Korea and Taiwan.[10]

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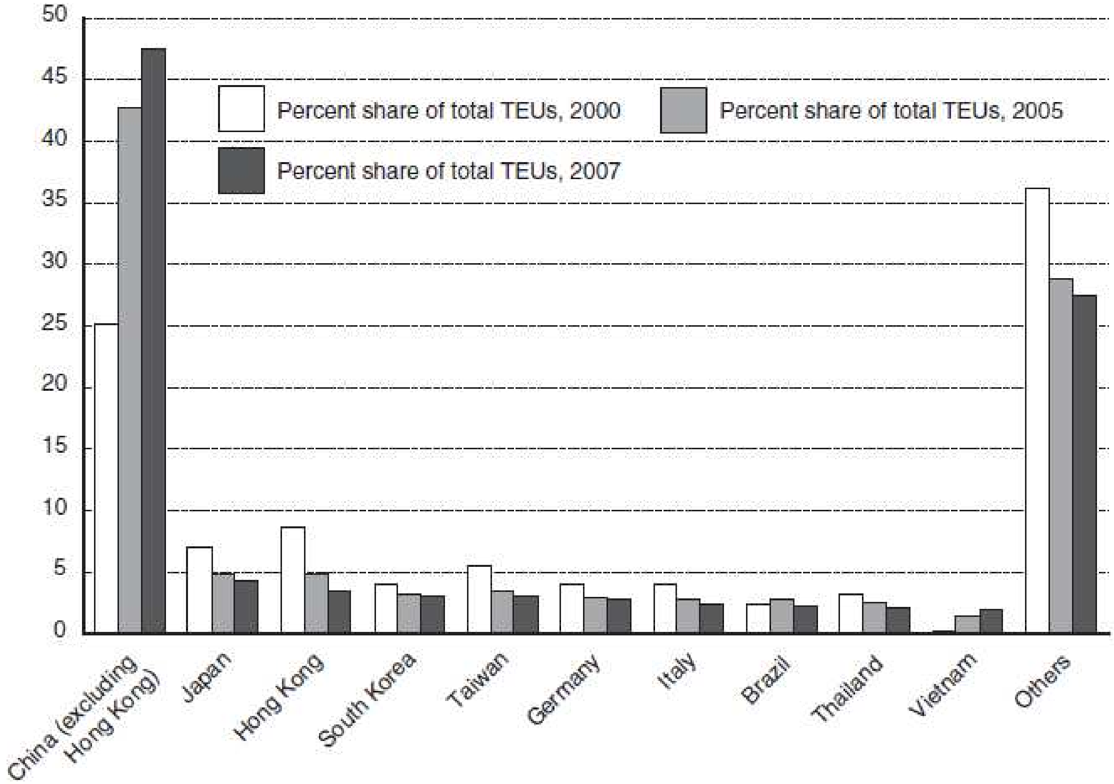
[8] *America's Container Ports: Freight Hubs that Connect Our Nation to Global Markets*, U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, June 2009, Table 1, p. 4. Volumes measured in TEUs. Percentages for these ports are slightly lower if measured by value.

[9] *America's Container Ports: Freight Hubs that Connect Our Nation to Global Markets*, U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, June 2009, Figure 8, p. 12.

[10] *America's Container Ports: Freight Hubs that Connect Our Nation to Global Markets*, U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, June 2009, p. 19.

FIGURE 3
TOP 10 TRADING PARTNERS FOR U.S. WATERBORNE CONTAINERIZED IMPORTS, 2000, 2005, AND 2007[11]



The top containerized commodities imported to the U.S. (by value) from a special study by the U.S. Congressional Budget Office are listed in Table 1. Although the data for this study are from 2004, Table 1 provides a qualitative assessment of the types of goods brought into the U.S. in containers. The table also indicates the percentage of each of the commodities that comes into the U.S. through the ports of Los Angeles and Long Beach. For a number of these commodities (many of which are consumer goods), at least 40% of the value of containerized imports come into the country through Los Angeles and Long Beach. The commodity categories for which Los Angeles/Long Beach account for the greatest proportions of U.S. containerized imports are Electric Machinery, Sound and Television Equipment, Parts; Leather Articles, Saddlery, Handbags; Footwear; Toys, Games, and Sports Equipment and Parts; Furniture, Bedding, Lamps; and Optic, Photographic, and Medical Instruments.

[11] *America's Container Ports: Freight Hubs that Connect Our Nation to Global Markets*, U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, June 2009, Figure 13, p. 20.

TABLE 1
TOP U.S. CONTAINERIZED IMPORTS BY VALUE[12]

		Los Angeles and Long Beach Ports		All U.S. Ports	
HS#	Category of Import	Value (Billions of dollars)	Percentage of Total Containerized Imports of That Commodity	Value (Billions of dollars)	Percentage of Total Containerized Imports Nationwide
84	Machinery, Boilers, Reactors, Parts	38.0	50.7	74.8	17.7
85	Electric Machinery, Sound and Television Equipment, Parts	31.7	64.1	49.4	11.7
87	Vehicles and Parts, Except Railway or Tramway	12.1	39.3	30.8	7.3
61	Apparel Articles and Accessories, Knit or Crochet	9.0	39.1	23.1	5.5
62	Apparel Articles and Accessories, Not Knit or Crochet	9.9	44.0	22.5	5.3
94	Furniture, Bedding, Lamps, Etc.	9.3	48.4	19.3	4.6
95	Toys, Games, and Sports Equipment and Parts	9.4	55.8	16.9	4.0
64	Footwear	7.8	56.0	13.9	3.3
39	Plastics and Articles Thereof	5.2	41.1	12.7	3.0
73	Articles of Iron or Steel	4.4	44.6	9.8	2.3
22	Beverages, Spirits, and Vinegar	0.9	10.0	8.7	2.1
40	Rubber and Articles Thereof	3.5	43.8	7.9	1.9
90	Optic, Photographic, and Medical Instruments	3.6	47.0	7.7	1.8
29	Organic Chemicals	1.3	19.1	6.6	1.6
63	Textile Articles, Needlecraft, Worn Textile Articles	2.6	40.6	6.4	1.5
44	Wood and Wood Articles	1.6	26.2	6.2	1.5
42	Leather Articles, Saddlery, Handbags	3.8	63.7	5.9	1.4
03	Fish, Crustaceans	2.1	39.6	5.3	1.3
30	Pharmaceutical Products	0.1	2.8	4.7	1.1
48	Paper and Paperboard	1.4	32.5	4.5	1.1
	Total, Top 20 Containerized Imports	**157.7**	**46.8**	**337.1**	**79.6**
All Containerized Imports		**182.3**	**43.0**	**423.4**	**100.0**

Source: Congressional Budget Office based on information from the U.S. Maritime Administration.
Note: HS = Harmonized Commodity Description and Coding System.

Containerized Imports and the U.S. Transportation Infrastructure

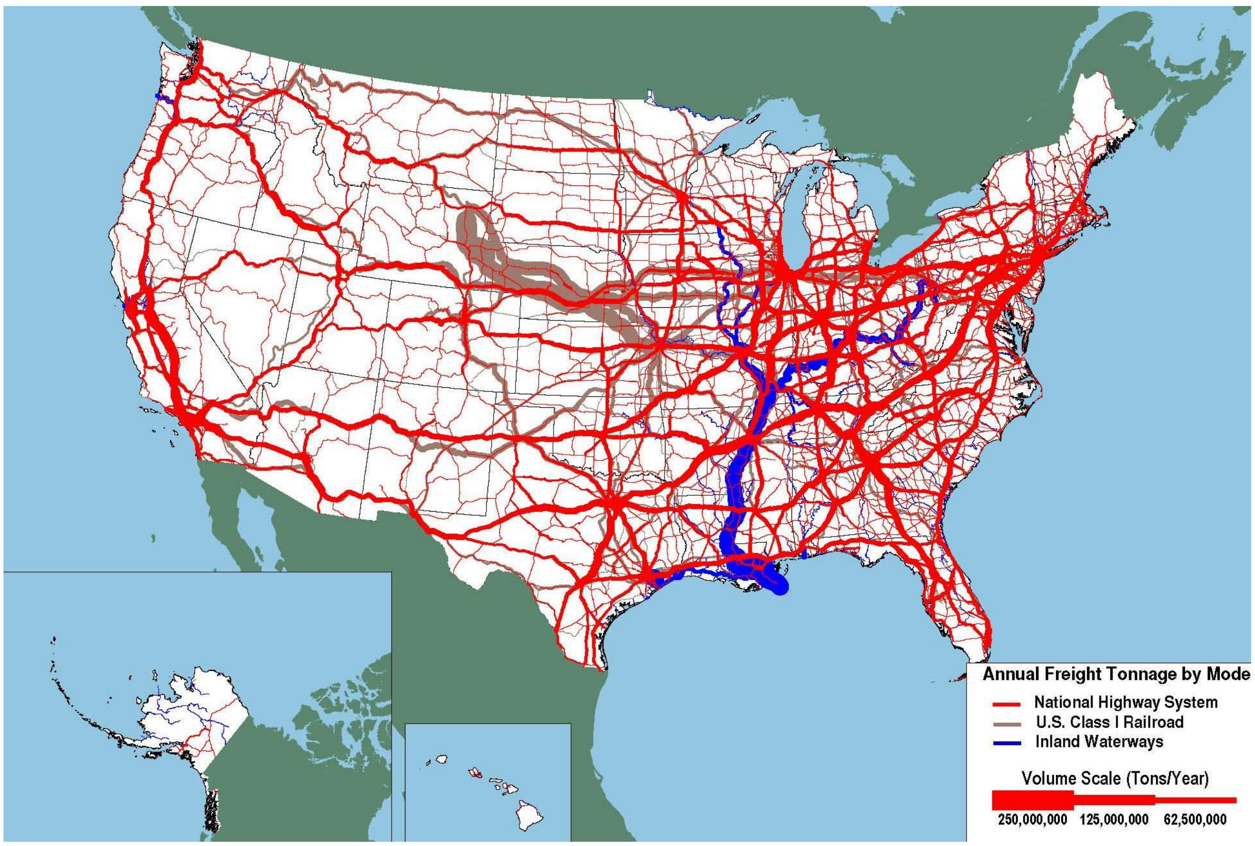
In general, containerized cargo moves through a network that links vessels, port terminals, and trucks and trains. The efficient flow of goods, thus, depends on the capacity at multiple points in the transportation chain, with restrictions in these flows occurring at "weakest links." With respect to ports, to receive container ships, a port must have a deep enough channel to accommodate large vessels and enough berths where ships can tie up. In addition, to manage containers, a port must have special equipment for loading and unloading containers, on-dock storage space and equipment for moving containers to local terminals (or storage and distribution

[12] U.S. Congressional Budget Office, *The Economic Costs of Disruptions in Container Shipments*, March 29, 2006, Table 3, p. 7.

centers farther inland), and sufficient intermodal connections for loading containers on trucks or rail cars. A key bottleneck in port areas often becomes dock space.[13]

Once containers leave port areas, waterborne containerized imports compete for capacity on the nation's transportation infrastructure with the transportation of exported goods to international freight gateways for transportation out of the country, the transportation of goods between domestic origins to domestic destinations, and non-freight uses of the infrastructure, such as passenger travel. Figure 4 shows that total tonnage of freight on U.S. highways, railroads and inland waterways in 2007. Figure 5 shows the tonnage of trailer-on-flatcar (TOFC) and container-on-flatcar (COFC) rail intermodal moves in 2008.

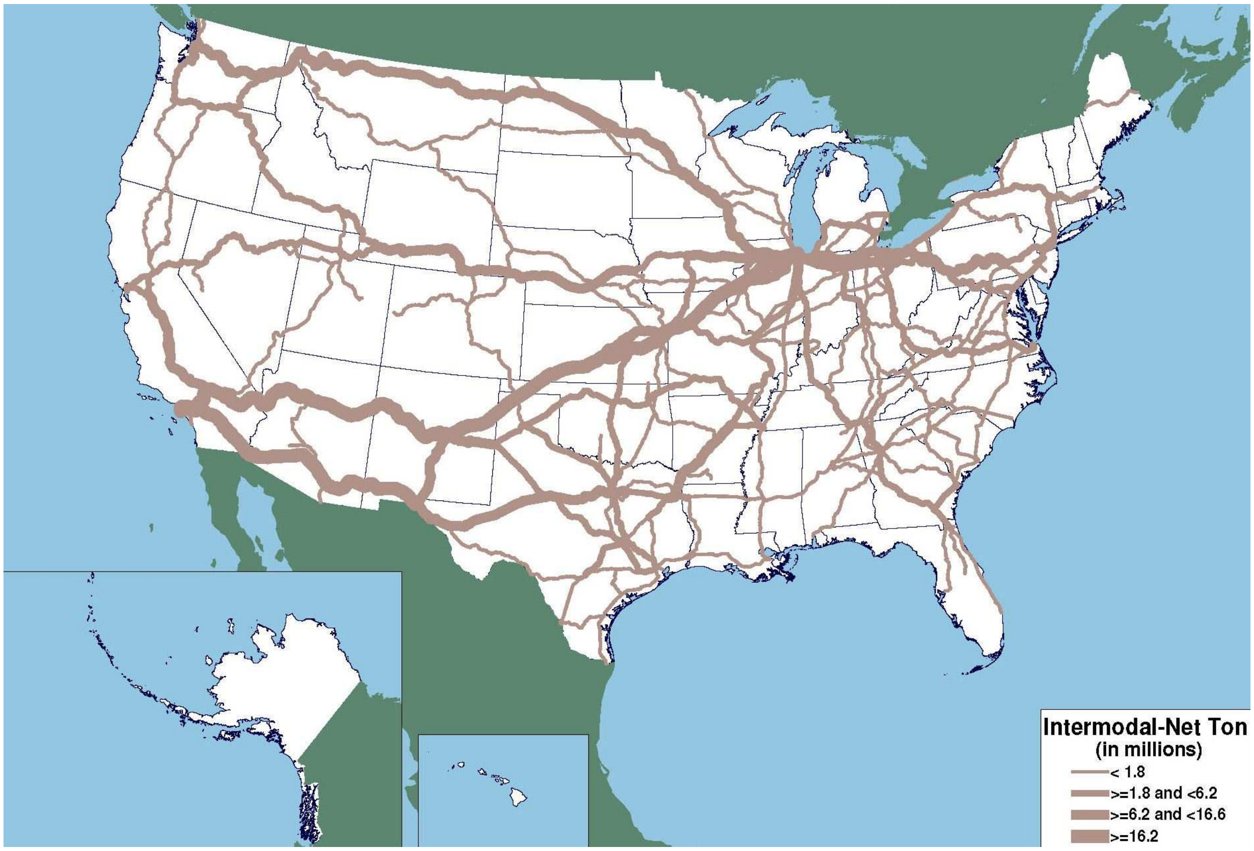
FIGURE 4
TONNAGE ON U.S. HIGHWAYS, RAILROADS AND INLAND WATERWAYS, 2007[14]



[13] U.S. Congressional Budget Office, *The Economic Costs of Disruptions in Container Shipments*, March 29, 2006, pp. 9-10

[14] http://ops.fhwa.dot.gov/freight/freight_analysis/nat_freight_stats/images/hi_res_jpg/tonhwyrrww2007.jpg

FIGURE 5
TONNAGE OF TRAILER-ON FLATCAR AND CONTAINER-ON-FLATCAR RAIL INTERMODAL MOVES, 2008[15]



Trends in business logistics demand higher levels of service from intermodal carriers as there has been a substitution of more frequent shipments for inventory, with carriers acting as rolling warehouses.[16] The role of speed and reliability of transportation as key components in manufacturing and retail supply chains places intense demands on the nation's transportation infrastructure.

A critical and first link between ports and the domestic transportation infrastructure is the landside access to seaports, which are also referred to as intermodal connectors. In general, landside access to seaports has not kept pace with the growth in container traffic. This is partly due to the efficiencies of containerization, which has significantly reduced the time to load or unload a ship, thus increasing port throughput. However, because there is often a lack of space

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[15] http://ops.fhwa.dot.gov/freight/freight_analysis/nat_freight_stats/images/hi_res_jpg/intermodalrail2008.jpg
[16] John F. Frittelli, *Intermodal Connectors: A Method for Improving Transportation Efficiency*, Congressional Research Service Report for Congress, May 7, 2003, p. 2.

for expansion of intermodal connectors, congestion of these connectors results or intensifies. The issue has been characterized as follows:

> Many cities grew around their ports, and thus many ports are now surrounded by dense urban environments. New rights-of-way for rail or truck traffic leaving port facilities are not available, restricting rail or road expansion.[17]

Some of these intermodal connectors are also in poor condition, contributing to the problem. National Highway System (NHS) freight connectors are public roads (often short, less than 2 miles long) that connect intermodal freight terminals with the National Highway System. A 2000 study found that NHS freight connectors to ports had twice the percentage of mileage with pavement deficiencies compared to non-Interstate NHS routes.[18]

Traffic bottlenecks on landside transportation networks serving ports may affect seaport performance and efficient movement of goods. Moreover, intermodal connectors that are in poor condition may reduce service reliability and predictability of the domestic transportation network. The intermodal system had been characterized as a network of conduits and pipes that is only as efficient as its "weakest link." Poor intermodal connectors can raise shipping costs, result in long lines of idling trucks that create congestion and use fuel.[19] In addition to being the top U.S. foreign trade gateways, Los Angeles and Long Beach also had greatest amount of traffic delay per traveler. The worst highway bottleneck in the country is the I-710/I-105 interchange in Los Angeles. I-710 is the major connector to the Port of Long Beach. Another critical and highly congestion connector is near the Port of New York and New Jersey around the George Washington Bridge. This is an extremely complex area, with multiple highways merging just prior to the Bridge and a major bottleneck on the eastern end. Overall, Los Angeles has the top five truck bottlenecks, Atlanta has four, and Chicago has three.[20] Figure 6 shows the critical link of the Los Angeles area freeway system in the freight transportation chain.

Consistent with the discussion of intermodal connectors above, a recent NCHRP report noted that the efficiency of U.S. freight transportation system is increasingly influenced by congestion along access routes to ports, airports, and other freight hubs. Such congestion increases the cost, reliability, and efficiency of the movement of goods throughout the transportation system,

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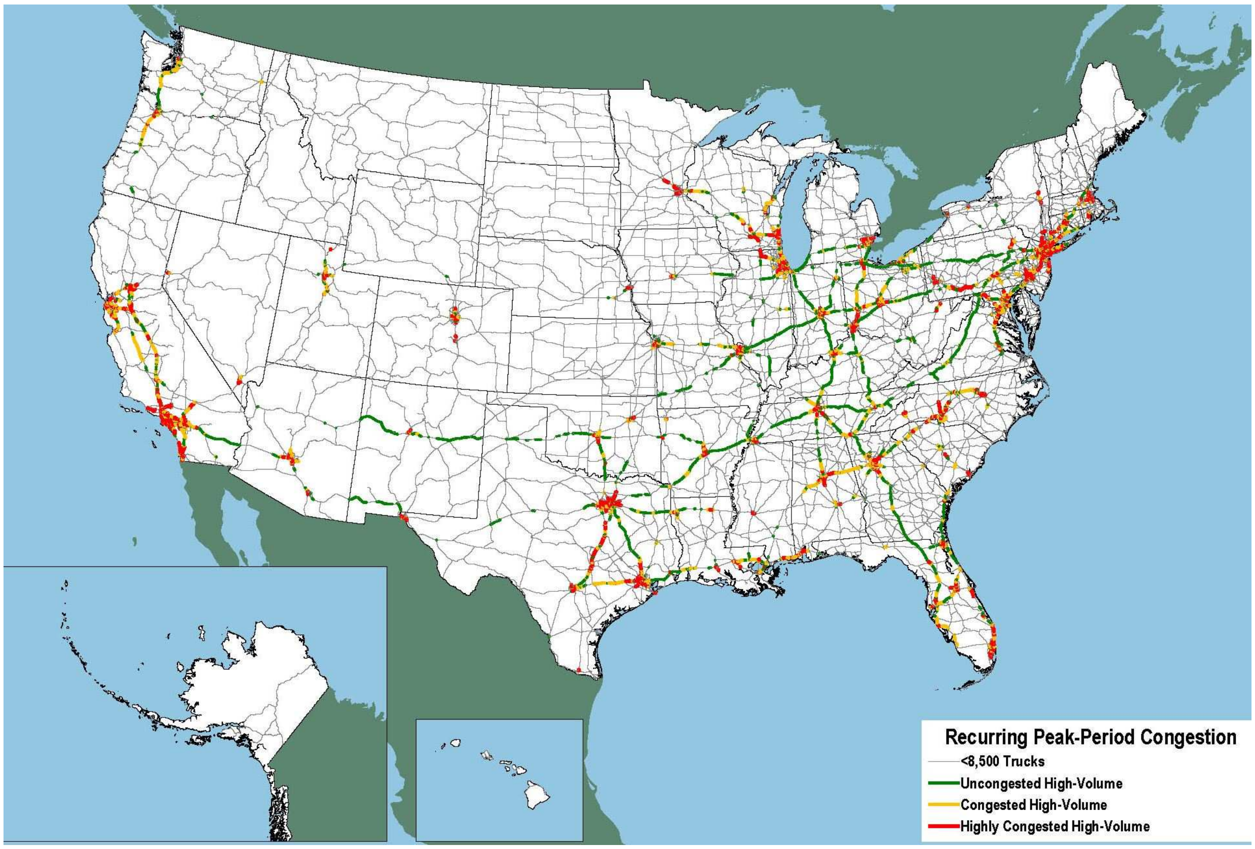
[17] *America's Container Ports: Freight Hubs that Connect Our Nation to Global Markets*, U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, June 2009, pp. 23-24.
[18] U.S. Department of Transportation, Federal Highway Administration, *NHS Intermodal Freight Connectors, A Report to Congress*, December 2000.
[19] John F. Frittelli, *Intermodal Connectors: A Method for Improving Transportation Efficiency*, Congressional Research Service Report for Congress, May 7, 2003, p. 2.
[20] Cambridge Systematics, *Estimated Cost of Freight Involved in Highway Bottlenecks*, U.S. Department of Transportation, Federal Highway Administration, Office of Transportation Policy Studies, November 12, 2008, pp. ES-14, ES-15.

revealing a need for flexible strategies and policy initiatives to address cargo access problems and requirements.[21]

FIGURE 6
PEAK PERIOD CONGESTION ON HIGH-VOLUME PORTIONS OF NATIONAL HIGHWAY SYSTEM[22]



The NCHRP report goes on to note that large cargo hubs are becoming more prevalent as carriers across all modes develop networks that concentrate the use of higher capacity ships, double-stack trains, jumbo cargo airplanes, and larger trucks or some combination of these on certain high-volume routes. Table 2, reproduced from this report, provides examples of various cargo hub types, the handling services provided, and the geographic scope served.

Although the increased use of higher capacity equipment allows carriers to streamline their service routes by focusing on a few hubs, this often results in greater freight traffic near these hubs. A recurring theme that was touched on above is that most existing cargo hubs are in and around metropolitan areas, near established areas of cities and near passenger airport terminals, where there is often heavy auto traffic and congestion, or near at-grade rail crossings. This tends

[21] *Financing and Improving Land Access to U.S. Intermodal Cargo Hubs*, NCHRP Report 497, Transportation Research Board, 2003, p. 1.
[22] http://ops.fhwa.dot.gov/freight/freight_analysis/nat_freight_stats/nhsconghvtrk2007.htm

to generate delays and safety and security concerns for nearby residents and businesses, particular as cargo hub traffic increases.[23] The NCHRP report states that intermodal connections at major hubs are a major source of delays but may well be where enhancements may have the greatest impact on improving transit times and reliability (compared with the smaller opportunities that may be possible in the long-haul segments of the cargo movements). However, such improvements often require the coordination of multiple public jurisdictions or private and public interests, which makes reaching a consensus on solutions difficult. In addition there may be a lack of local support because the benefits of such projects are widely dispersed beyond the immediate geographic region (e.g., improved function of supply chains that lower the price of goods to consumers in another part of the country), while the associated costs (e.g., heavy truck traffic) are localized and significant.[24]

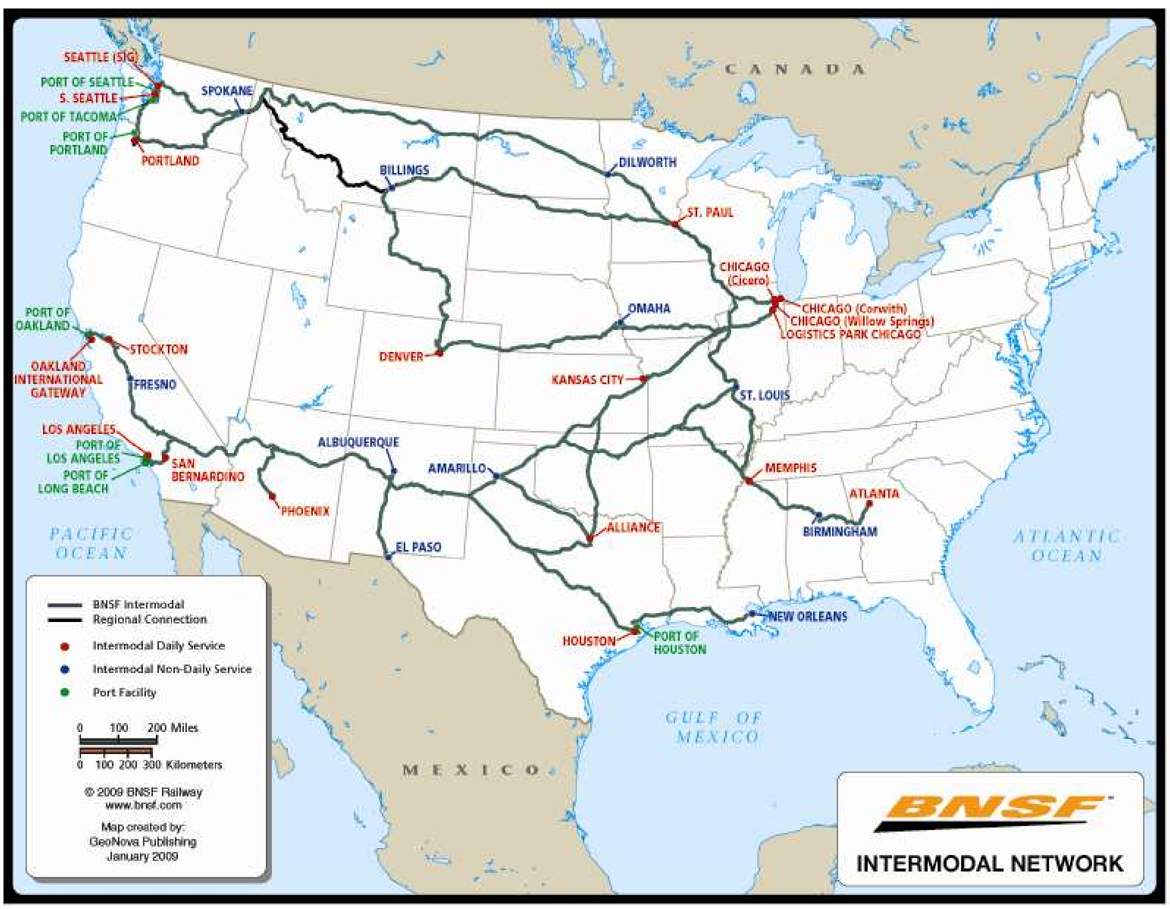
TABLE 2
TYPES OF CARGO HUBS[25]

Geographic Scope	Market Served	Examples	Cargo Hub Services	Carrier/ Terminal Control/Users
Domestic	Regional	• Regional hubs operated by FedEx that connect to its national hub at Memphis. • Intermodal rail yards, such as CSX yard in Philadelphia or NS yard in Atlanta	• Truck service connections to regional and national air cargo services • Truck and rail interface for regional rail services	• Single carrier (FedEx) • Single carrier (CSX and Norfolk Southern (NS))
	National	• UPS hub in Chicago • Rail hubs in Chicago and Kansas City • FedEx air cargo hub in Memphis and UPS air cargo hub in Louisville	• Truck and rail package consolidation hub • Truck and rail transfers to destinations nationally • Air package and cargo transfers to destinations	• UPS with BNSF rail • Individual rail carriers • Single carriers (FedEx and UPS)
International	Rail/Truck border crossings	• Border crossing rail yard and truck terminals at Laredo, Tx	• Border services to/from the US and Canada or Mexico	• Multiple or single carriers
	Air Cargo Gateway	• JFK, MIA, LAX cargo centers	• Domestic truck connections and air cargo connections between domestic and foreign markets	• Multiple carriers and connecting services
	Carrier Maritime Load Center	• Maersk/Sea Land Terminal in New Jersey	• Intermodal connections between domestic inland truck/rail services and international ocean vessels as well as transshipment to feeder vessels connecting to other regional ports	• Private single carrier (Maersk/Sea Land)
	New York/ New Jersey Maritime Terminals	• Multiple Terminal Complex	• Intermodal connections between domestic inland truck/rail services and international ocean vessels as well as transshipment to feeder vessels connecting to other regional ports	• Public and private terminals with multiple carriers and connecting services
	LA/LB Port Hub	• Multiple Terminal Complex	• Intermodal connections between domestic inland truck/rail services and international ocean vessels as well as transshipment to feeder vessels connecting to other regional ports	• Public and private terminals with multiple carriers and connecting services

[23] *Financing and Improving Land Access to U.S. Intermodal Cargo Hubs*, NCHRP Report 497, Transportation Research Board, 2003, pp. 5-6.
[24] *Financing and Improving Land Access to U.S. Intermodal Cargo Hubs*, NCHRP Report 497, Transportation Research Board, 2003, p. 6.
[25] *Financing and Improving Land Access to U.S. Intermodal Cargo Hubs*, NCHRP Report 497, Transportation Research Board, 2003, Table S-1, p. 5.

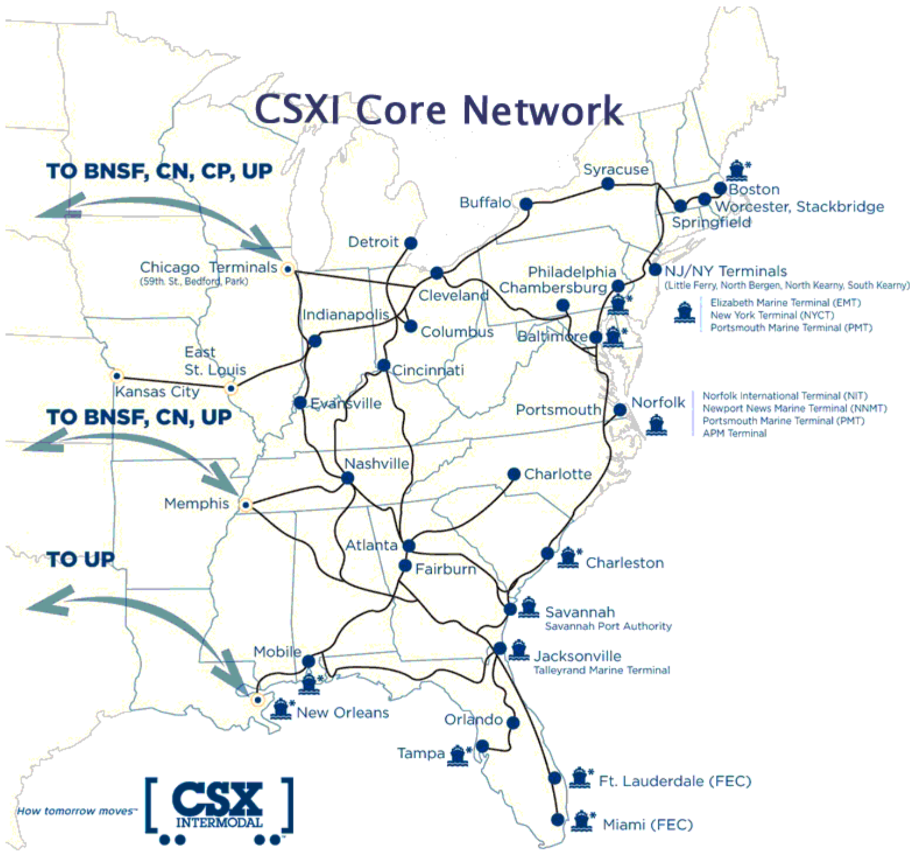
Examples of Western and Eastern rail intermodal networks are provided in Figure 7 (BNSF) and Figure 8 (CSX). Both of these maps show connections between major port areas on all costs (West, East, and Gulf) and inland intermodal cargo hubs. Of particular interest on the BNSF map, the Chicago area is the location of four intermodal terminals. This reflects the critical role of Chicago in the nation's transportation infrastructure. It should also be noted that Logistics Park Chicago is a recent brownfield development located in the Joliet area to avoid some of the congestion issues discussed above. Union Pacific also has large intermodal terminals in the Chicago area, including Rochelle (Global III) and a new terminal in Joliet (Joliet International Terminal), focused on international traffic (scheduled to open in June 2010). The CSX map also notes major points of interchange between Eastern and Western railroads, including Chicago, Memphis, and New Orleans.

FIGURE 7
BNSF INTERMODAL NETWORK[26]



[26] http://www.bnsf.com/markets/intermodal/maps.html.

FIGURE 8
CSX INTERMODAL NETWORK[27]



Economic Consequences of Supply Chain Disruptions

Most supply chains represent a fine balance of economic decisions that influence the flow of goods from origin to destination. Disruptions to any of the various links in these supply chains will likely result in economic consequences of one type or another. Such consequences include inventory impacts, availability of final goods for consumers, increases in transportation prices, and/or increases in the prices of final goods.

As an illustration of supply chain disruptions for containerized imports, a report by the U.S. Congressional Budget Office (CBO) assesses the potential costs to the U.S. economy of disruptions of container traffic at the ports of Los Angeles and Long Beach. As the discussion above highlights, these ports are primary gateways for containerized imports (largely consumer goods) from Asian points of origin. The report was done by the CBO at the request of the Permanent Subcommittee on Investigations of the Senate Committee on Homeland Security and

[27] http://www.csxi.com/?fuseaction=customers.map.

Governmental Affairs. The report analyzed two specific disruption scenarios: (1) an unexpected one-week halt to all container traffic through ports of Los Angeles and Long Beach ("one-week scenario"); and (2) an unexpected three-year halt to all container traffic through ports of Los Angeles and Long Beach ("three-year scenario").[28]

The report suggests that, although specific supply chains or bottlenecks are not analyzed, most of the estimated losses would be due to the losses of final sales of finished goods. This is because most of the containerized imports arriving through Los Angeles and Long Beach are finished goods, and because affected manufacturers would have the most sophisticated logistics chain and be in the best position to recover from such disruptions. The estimated economic impacts are for the U.S. economy as a whole and do not consider distributional effects. However, the net effects account for the diversion of traffic to alternative ports and, thus, represent losses to some and gains to others.[29]

Under the CBO's one-week scenario, the economic effects are temporary with the loss in U.S. GDP estimated to be between $65 million and $150 million per day. However, because of the short duration of the disruption, businesses and consumers would not substantially alter their consumption or production behavior. The economy would quickly rebound from this temporary disruption as normal shipping patterns are resumed, and GDP growth would return to its previous path.[30]

The CBO study asserts that disruption lasting more than a few days would have higher daily costs because measures taken by shippers and producers would become less effective, the longer that traffic was disrupted. However, as months went by, shippers, producers and consumers would adapt in ways that would reduce the daily economic cost of a disruption. For example, capacity of alternative ports would be expanded, and supply chains would be reconfigured (although possibly at a higher cost than before the disruption). Producers might also turn to more domestic sources of supply, and consumers might choose to purchase a different mix of goods[31]

Under the CBO's three-year scenario, real GDP would be reduced between 0.35% to 0.55% per year (or $45 billion to $70 billion), and reductions would persist at about 0.1% of GDP for about two years after the shutdown. Inflation would also be expected to increase by about two percentage points in the first year, and little changed or lower thereafter. Net employment would decline by about 1 million jobs during the shutdown.[32]

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[28] U.S. Congressional Budget Office, *The Economic Costs of Disruptions in Container Shipments*, March 29, 2006, p. 1. This scenario also includes an initial "precautionary stoppage" of container shipments at all U.S. ports.
[29] U.S. Congressional Budget Office, *The Economic Costs of Disruptions in Container Shipments*, March 29, 2006, pp. 2-3.
[30] U.S. Congressional Budget Office, *The Economic Costs of Disruptions in Container Shipments*, March 29, 2006, pp. 14-15.
[31] U.S. Congressional Budget Office, *The Economic Costs of Disruptions in Container Shipments*, March 29, 2006, p. 11.
[32] U.S. Congressional Budget Office, *The Economic Costs of Disruptions in Container Shipments*, March 29, 2006,

Although the three-year scenario may be somewhat extreme, it does illustrate that any significant disruption to important links in the containerized import supply chain (including disruptions at foreign points of origin) would have measurable and lasting effects on the U.S. economy. Such losses would not likely be recouped after completion of the disruption and significant adjustment costs would likely be incurred by consumers, producers, transportation providers, and other economic agents in the supply chain. Moreover, resulting changes in freight transportation patterns could materially alter traffic flows for particular transportation gateways, freight hubs, and corridors.

Another study that analyzed the economic costs of supply chain disruptions was performed by Winston and Shirley, who analyzed the impact of highway congestion on shippers' inventory costs. The authors note that firms engaged in shipping goods through transportation networks are exposed to congestion at the origin of their shipment, the locales that the shipment passes through enroute to its destination, and at the destination. Congestion raises shippers' costs because it ties up their inventory in transit. These costs are related to the timeliness of the goods being shipped and the consequences of additional transit times. For example, shippers of newspapers are likely to have a very high daily discount rate because the value of their commodity will depreciate substantially if its delivery is delayed by a day, while shippers of less perishable commodities will have lower discount rates. In addition, congestion forces a shipper to hold higher inventories, which increases inventory holding costs.[33]

Winston and Shirley employed three different methodologies to assess the range of congestion impacts on inventory costs. The estimated impacts on inventory costs from these methodologies are: (1) $4 billion due to congestion in state-level (intrastate) transportation, (2) $3 billion for congestion at origin and destination points, and (3) $7 billion for all sources of congestion.[34] In the authors' opinion, $7 billion is best estimate of the inventory costs incurred for all sources of delay of freight shipments due to highway congestion. In addition, the Texas Transportation Institute suggests annual congestion costs incurred by motorists are more than $50 billion.[35]

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p. 2, p. 18.

[33] Clifford Winston and Chad Shirley, *The Impact of Congestion on Shipper's Inventory Costs*, Final Report to the Federal Highway Administration, February 2004, p. 1.

[34] Clifford Winston and Chad Shirley, *The Impact of Congestion on Shipper's Inventory Costs*, Final Report to the Federal Highway Administration, February 2004, p. 2.

[35] Clifford Winston and Chad Shirley, *The Impact of Congestion on Shipper's Inventory Costs*, Final Report to the Federal Highway Administration, February 2004, p. 8.