The Economic Effects of Proposed Port Fees on Chinese-Made Ships

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Prepared By

Trade Partnership Worldwide, LLC

For

China Shipowners' Association

About the Authors

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Trade Partnership Worldwide, LLC, is an economic research firm dedicated to providing high-quality economic and trade policy research that assess the full impacts of U.S. and foreign trade policies and practices, proposed and actual, on the U.S. economy. It was formed in 2001 by Baughman, Francois and Dean Spinanger (now retired). Its sister firm, The Trade Partnership, was started by Baughman in 1991; the two firms merged in 2022.

About China Shipowners' Association

China Shipowners' Association is a trade organization composed of over 300 owners, operators and managers of merchant ships engaged in waterway transportation and other shipping related entities.

Executive Summary

On March 12, 2024, five unions filed a petition with the Office of the U.S. Trade Representative (USTR) charging that certain acts, policies and practices of China prevent the U.S. commercial shipbuilding industry from competing internationally. They ask that the United States assess a fee on every Chinese-made ship that calls at a U.S. port, and that the fees collected be used to subsidize the U.S. shipbuilding industry. Petitioners offer a "hypothetical" example of a port fee of $1 million applied to every Chinese vessel docking at a U.S. port. They allege that the money raised will help to make the U.S. industry competitive and would not "meaningfully" harm American consumers.

This study aims to fill an important void in the analysis offered by petitioners: quantification of the economy-wide effects of their proposed port fee. This analysis looks at not only the benefits to U.S. shipbuilders and their suppliers of the economic subsidy sought, but also the ripple effects of the added transportation costs across the rest of the U.S. economy. We find:

- Overall, the proposed port fee would have a net negative impact on the U.S. economy. GDP would decline by as much as 0.03%. Exports would drop by up to 2.1%, and imports would decline by up to 0.7%.

- The U.S. shipbuilding industry (manufacturers and workers) would benefit from the subsidy, but nearly every other sector of the economy (farmers, manufacturers and services providers, including their workers) would be harmed.

- U.S. agriculture exporters and workers would be particularly hard-hit, with exports of major agriculture products like wheat, rice, and oilseed dropping dramatically. U.S. exporters will lose competitiveness to exporters in Brazil, Canada, and Australia.

- Oil, gas and numerous manufacturing industries would also suffer declines in output and employment as a result of increased shipping costs.

- U.S. ports and related sectors would experience net negative impacts on both output and employment.

- As the impacts of the fee filter still further along supply chains, U.S. importers and retailers would feel the effects. Wholesale and retail trade, hospitality, and consumer services industries would all experience declines in output.

- Finally, the proposed port fee would have a negative impact on efforts to mitigate carbon dioxide emissions. Emissions nearly double after carriers adjust the mix of ports serviced to lower the impacts on them of the fee. This is because importers would need to use ground transportation to move goods diverted to Mexico and Canada back to their final U.S. destinations.

In short, the proposed port fee would subsidize the U.S. shipbuilding sector at great expense to wide swaths of the U.S. economy and work force, particularly agriculture.

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I. Introduction

On March 12, 2024, five unions filed a petition with the Office of the U.S. Trade Representative (USTR) charging that certain acts, policies and practices of China prevent the U.S. commercial shipbuilding industry from competing internationally.[1] They assert that "…the headwinds facing the industry since 2000 have been due primarily to unfair competition from China, which now dominates the global market for new commercial vessels."[2] They further assert that increased Chinese production of ships caused U.S. commercial ship production to drop,[3] causing some U.S. shipyards to go bankrupt, go idle or cease production,[4] and reduce their workforce.[5]

The petitioners ask for financial support to lower the costs of U.S.-built ships so they can compete with Chinese-made ships. "The commercial shipbuilding and repair industry in the United States can compete and grow if the massive market distortions that the Government of China has created are remedied," the petitioners claim.[6] To this end, they propose that, in the event the acts, policies and practices of China are not terminated, the United States assess a

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[1] The United Steel, Paper and Forestry, Rubber, Manufacturing, Energy, Allied Industrial and Service Workers International Union, AFL-CIO CLC (USW), the International Association of Machinists and Aerospace Workers (IAM), the International Brotherhood of Boilermakers, Iron Ship Builders, Blacksmiths, Forgers and Helpers, AFL-CIO/CLC (IBB), the International Brotherhood of Electrical Workers (IBEW), and the Maritime Trades Department, AFL-CIO (MTD), "China's Policies in the Maritime, Logistics, and Shipbuilding Sector," Petition for Relief under Section 301 of the Trade Act of 1974, As Amended, March 12, 2024, https://ustr.gov/sites/default/files/Section%20301%20Petition%20-%20Maritime%20Logisitics%20and%20Shipbuilding%20Sector.pdf, hereafter "Petition."

[2] *Ibid*., pp. 97-98. We use the verb "assert" here and later because in each instance, the claim by the petitioners is merely stated, and no economic analysis substantiating the causal link to the impact alleged is offered.

[3] *Ibid*., p. 98.

[4] *Ibid*., p. 101. Petition Exhibits about these closures fail to show a link to competition from Chinese-made ships as a contributing reason for the closures.

[5] *Ibid*., pp. 101-102. Notably, the employment data provided in the petition curiously ends in 2021, even though data are available into 2024. If these omitted data are included, the trend in employment shows a substantial improvement to the story told by petitioners. **In fact, employment levels at the end of the first half of 2024 exceed the annual averages for any year from 2001-2023.**

[6] *Ibid*, p. 7

fee on every Chinese-made ship that calls at a U.S. port, and that the fees collected be used to subsidize the U.S. shipbuilding industry through a U.S. Commercial Shipbuilding Revitalization Fund.[7] The petitioners assert that a fee that is high enough to "eliminate some of the unfair advantage that Chinese-built ships enjoy in international maritime trade, and also [is] sufficient to provide a robust funding stream for [the Fund] … would not meaningfully impact the cost to U.S. consumers of products delivered on Chinese built ships."[8]

Petitioners do not advise USTR how high the fee needs to be to raise the (unspecified) amount of money needed to make the U.S. industry competitive.[9] They offer a "hypothetical" example of a fee of $1 million applied to "over 10,000 incoming [presumably Chinese] vessels per year," which would raise in their estimation (unspecified) "billions of dollars" in revenue.[10]

On the basis of these allegations, USTR initiated a formal Section 301 investigation on April 17, requested comments from the public, and announced the Section 301 Committee would hold a public hearing May 29.[11] Twenty-three organizations or individuals[12] responded to USTR's request for comments on the investigation launched by the petition. Of those, most (18) specifically protested the port fee

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7 *Ibid*, p. 114 and 116-118.

8 *Ibid*., p. 115.

9 The Naval Institute has suggested that the U.S. shipbuilding industry requires as much as $50 billion over five years to "jumpstart" the industry. Major Jeffrey L. Seavy, "The United States Must Improve Its Shipbuilding Capacity," February 2024, Proceedings, Vol. 150/2/1,452, https://www.usni.org/magazines/proceedings/2024/february/united-states-must-improve-its-shipbuilding-capacity.

10 Petition, *op. cit*., p. 116.

11 Office of the U.S. Trade Representative, "USTR Initiates Section 301 Investigation of China's Targeting of the Maritime, Logistics, and Shipbuilding Sectors for Dominance," Press Release, April 17, 2024, https://ustr.gov/about-us/policy-offices/press-office/press-releases/2024/april/ustr-initiates-section-301-investigation-chinas-targeting-maritime-logistics-and-shipbuilding.

12 This count includes those who initially submitted comments by the first deadline for comments (May 22, 2024, not the second deadline for organizations that testified at the Section 301 Committee hearing to provide responses to questions asked at that hearing (June 5)).

remedy proposal and argued that it would be economically harmful.[13] Three specifically supported the imposition of a fee.

The purpose of this research is to quantify the full range of effects from the imposition of a fee on port calls by Chinese-made ships so that U.S. policy makers can better evaluate its net impacts.

The purpose of this research is to quantify those economic effects. We employ a model of the global economy that quantifies the full range of effects arising from the imposition of a fee on port calls by Chinese-made ships. The analysis captures all of the gains and losses so that U.S. policy makers can better evaluate the net impacts of petitioners' claims that a port fee will make them competitive at little cost to American consumers. Only armed with a thorough, comprehensive assessment of these economic effects can U.S. policy makers make the proper choice about whether or not it is in the overall U.S. economic interest to support the U.S. shipbuilding industry with the fee petitioners suggest. We begin with an overview of the shipbuilding and shipping services supply chain that would be impacted by the proposed fee, some recent events that demonstrate the sensitivity of that supply chain to disruption, and then an assessment of the potential impacts of the port fee on the U.S. economy broadly and the shipbuilding and shipping supply chain specifically.

[13] USTR Comments Portal, Public Docket: Request for Comments on the Section 301 Investigation of China's Acts, Policies, and Practices Targeting the Maritime, Logistics, and Shipbuilding Sectors for Dominance, https://comments.ustr.gov/s/docket?docketNumber=USTR-2024-0005.

II. Profiles of Components of the U.S. Commercial Shipbuilding Supply Chain

Ocean-going ships and shipping services are an often overlooked but key component of the smooth operation of every American farm, manufacturing facility, and household. According to the World Trade Organization, the United States was the second largest trading nation of goods, after China, in 2023.[14] Most of that U.S. trade is delivered by ship.[15] Many raw materials and consumer goods are transported on container ships; cars and other vehicles on "roll on, roll off" (Ro-Ro) ships. U.S. agricultural commodities travel by dry bulk ships, and oil is transported on bulk ships called tankers.[16]

The delivery of goods via commercial ships to customers in the United States (imports) or abroad (exports) is a complex and multi-sector effort.

The delivery of goods via commercial ships to customers in the United States (imports) or abroad (exports) is a complex and multi-sector effort. The supply chain includes the U.S. shipbuilding and repair industry, U.S. and foreign raw material and equipment suppliers, foreign commercial shipbuilders, commercial shipping services (carriers), ports and other transportation service providers (trucks and rail), U.S. exporters, and U.S. importers and retailers. To understand how a port fee assessed on Chinese-made ships docking at U.S. ports would affect all of the components of the U.S. commercial shipbuilding supply chain, it is useful first to profile each briefly.

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[14] Exports plus imports. World Trade Organization, https://stats.wto.org/.

[15] According to the U.S. Department of Transportation, in 2022 (the most recent year available), 61.3% of the volume (measured in short tons) or 44.6% of the total value of U.S. goods trade (exports plus imports) was delivered by water. U.S. Department of Transportation, "U.S.-International Freight Trade by Transportation Mode," https://www.bts.gov/browse-statistical-products-and-data/freight-facts-and-figures/us-international-freight-trade.

[16] See Clarksons for a description of the various types of commercial vessels (https://www.clarksons.com/glossary/types-of-cargo-ships-clarksons-ultimate-guide/_) and the various sizes of bulk ships (https://www.clarksons.com/glossary/a-guide-to-bulk-vessel-sizes/).

A. U.S. Shipbuilding and Repair Industry

The U.S. shipbuilding and repair industry (NAICS 336611) is composed of shipyards with drydocks and fabrication equipment capable of building ships, repairing ships, or converting or modifying them, among other related activities. Examples of products manufactured include barges, cargo ships, drilling and production platforms, floating oil and gas platforms, passenger ships and submarines.

The industry has two market sectors: military and commercial, with the U.S. Navy the primary customer of the industry. The most recent Census data available (through 2016) show that sales to the Navy accounted for 74% of total shipbuilding sales and 76% of repair services revenues.[17] According to a 2001 national security assessment of the industry, ship construction and procurement methods in the two markets are quite different and generally incompatible,.[18] Commercial ships are typically less complex than military vessels to build and repair.[19]

Heavy Navy demand for warships has put significant constraints on capacity for commercial ship building. According to the Congressional Research Service (CRS), "industrial base capacity constraints for building Navy ships are present at both shipyards and supplier firms, and arise from limits on production facilities (i.e., numbers and ages of production spaces and equipment) and …workforce challenges." CRS notes significant delays in construction and delivery, even as the Navy is tasked to increase its battle force fleet from 296 battle force ships to 381 over the next 35 years.[20]

Growing demand for military production puts increased pressure on cost factors for commercial shipbuilding. Independent observers substantiate petitioners' claim that the U.S. shipbuilding industry is internationally uncompetitive and struggling to survive. As of 2023,

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[17] Shipbuildinghistory.com, "Revenues in U.S. Shipbuilding and Repair Since 1987" (most recent update: April 30, 2021), http://shipbuildinghistory.com/statistics/bocrevs.htm.

[18] U.S. Department of Commerce, Bureau of Export Administration, Office of Strategic Industries and Economic Security, Strategic Analysis Division, "National Security Assessment of the U.S. Shipbuilding and Repair Industry," May 2001, file:///Users/apple_owner/Desktop/PB2001108035.pdf, p. 10.

[19] *Ibid*., pp. 10-11.

[20] "Navy Force Structure and Shipbuilding Plans: Background and Issues for Congress," Congressional Research Service, May 2024, https://sgp.fas.org/crs/weapons/RL32665.pdf.

Table 1. Size of Leading Makers of Container and Bulk Ships, and United States, 2023

	Container (TEUs)		Bulk* (DWT)	
Country	**Ave.**	**Max.**	**Ave.**	**Max.**
China	5,729	15,536	59,960	210,950
Korea	8,335	16,652	61,895	181,258
Japan	8,997	14,052	56,185	209,854
Poland	2,552	4,444	46,844	48,077
Germany	1,994	5,936	Nil	Nil
Denmark	8,465	11,008	182,060	182,060
U.S.	2,296	3,620	Nil	Nil

*Panamax (capacity 65,000-80,000 DWT) can pass through the Panama Canal; Aframax (80,000 to 120,000 DWT) carry oil; Suezmax (160,000 DWT) carry oil and can pass through the Suez Canal; Handymax (35,000-50,000 DWT); Capesize (170,000 DWT); Chinamax (up to 400,000 DWT) (source: Clarksons).
Sources: Containers from Alphaliner Service Search; Bulk from Clarksons.

just five U.S. shipyards constructed large commercial cargo ships (28 tankers, 10 container ships, one Ro-Ro ship, and one dry bulk ship).[21] Recently, the industry has been prioritizing larger ships to take advantage of economies of scale: the more goods that can be transported per ton, the lower the per item cost of delivery. Yet, the average tonnage of U.S. commercial ships is substantially smaller than what is needed to reduce total average shipping costs.

The cost of U.S.-built ships remains very high compared to ships built abroad.[22] "None of the U.S.-flag international trading fleet is domestically built... No overseas purchase of large U.S.-built ships has occurred in decades because U.S.-built ships can be four or more times the world price. Differences in wage rates, particularly for welders, and currency exchange rate policy are factors leading to higher prices in the United States. The lack of [ship] exports prevents U.S. shipyards from achieving economies of scale."[23]

Other recent developments in the market and some longstanding problems have imposed and continue to inflate the costs of U.S.-made ships. The costs of steel and aluminum (both domestic and

[21] John Fritelli, "U.S. Commercial Shipbuilding in a Global Context," In Focus, Congressional Research Service, Nov. 15, 2023, https://crsreports.congress.gov/product/pdf/IF/IF12534, hereafter "CRS 2023".

[22] In 1992, a study by the U.S. International Trade Commission found that U.S. bid prices for commercial vessels averaged 97% more than comparable world bids for similar ships: *Shipbuilding Trade Reform Act of 1992: Likely Economic Effects of Enactment*, Rep. to the Committee on Ways and Means, Inv. No. 332-316, USITC Pub. No. 2495, June 1992, https://www.usitc.gov/publications/332/pub2495.pdf, p. xi.

[23] CRS 2023, *op. cit*.

foreign) are inflated by the imposition of Section 232 and 301 tariffs on imports, [24] as well as a host of antidumping and countervailing duties affecting (largely) steel imports. For example, 2023 prices for U.S.-made fabricated metal plate work were 48.7% higher than they were in 2018, when the Section 232 and 301 tariffs were imposed.[25]

Raw material and machinery cost increases are particularly challenging as shipyards tend to employ fixed price contracts.[26] These cost increases, coupled with raw material and equipment delivery delays, are making it difficult for U.S. shipbuilders to move forward with the orders they currently have.

Labor constraints also contribute to the high cost of U.S.-made ships and the ability of commercial shipbuilders to deliver ships in a timely manner.

Labor constraints also contribute to the high cost of U.S.-made ships and the ability of commercial shipbuilders to deliver ships in a timely manner. The average annual wage of production workers in the shipbuilding industry was 20.4% higher in 2023 than it was in 2018.[27] As a result, in 2023, U.S. commercial ship prices were 21.6% higher than in 2018.[28]

Shipbuilding and repair employment over the last decade has fluctuated and is currently on the rise – a much rosier picture (from

[24] See U.S. International Trade Commission, *Economic Impact of Section 232 and 301 Tariffs on U.S. Industries*, Inv. No. 332-591, Pub. No. 5405, March 2023, Table E.S.1, p. 22, https://www.usitc.gov/publications/332/pub5405.pdf.

[25] Derived from Bureau of Labor Statistics, "Producer Price Index" data for fabricated plate work (stacks and weldments), downloaded June 28, 2024.

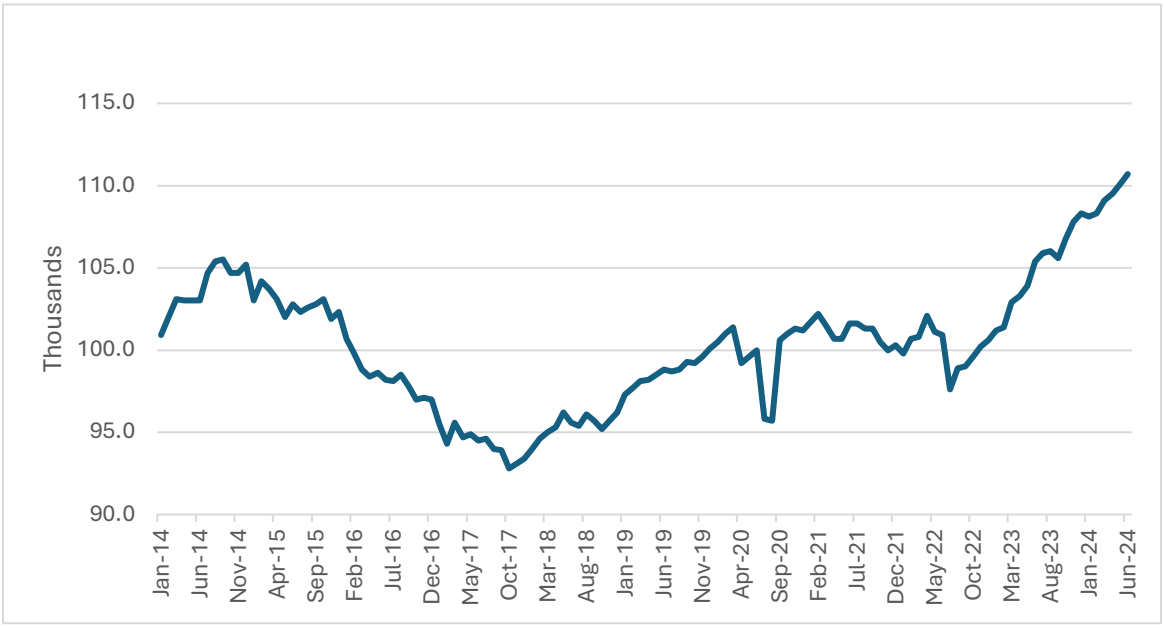
[26] Eric Haun, "2023 US Shipbuilding Report," *Marine News*, April 17, 2023, https://www.marinelink.com/news/us-shipbuilding-report-504422 (hereafter, Huan 1) and Eric Huan, "2022 US Shipbuilding Report," *Marine News*, March 11, 2022, https://www.marinelink.com/news/us-shipbuilding-report-494956 (hereafter, Huan 2).

[27] Derived from Bureau of Labor Statistics, Occupational Employment and Wage Statistics, May 2023 and May 2021, downloaded June 28, 2024.

[28] Derived from Bureau of Labor Statistics, "Producer Price Index" data for new, non-military ship construction, downloaded June 28, 2024.

the perspective of those seeking jobs) than the unions painted in their petition (see chart).[29]

Total Monthly Shipbuilding and Repair Employment, 2014-2024 (through June)
(NAICS 336611)



Source: Bureau of Labor Statistics. In 2023, 47% of these workers were production workers (the balance is primarily in services occupations related to shipbuilding and repair).

In fact, the situation today is one of worker shortages, which suggests that the upward trendline in the chart above could be even greater absent those shortages. *Marine News* reported "…many American shipyards and their partners throughout the shipbuilding supply chain are still finding it difficult to attract and retain the workers they need. If you're a skilled craftsperson looking for a job in shipbuilding, you're in luck, because there are plenty of openings at shipyards across the country. Job fairs and hiring events are becoming more commonplace…."[30] The 2001 national security review found severe labor shortage issues prevalent in the industry even 20 years ago. That report noted that labor turnover was high because the workload was uneven and harsh, and the industry must compete with other

[29] As previously noted, the petition does not report employment data past 2021 even though these data were available at the time it submitted the petition.

[30] Huan 1, *op. cit*..

manufacturers who can offer better working conditions. There were (and continue to be) shortages of machinists, welders, electricians and marine engineers.[31] Experienced older workers are retiring.

The potential impact of a port fee used to subsidize U.S. shipbuilding production would be to lower the cost of ships, thereby increasing demand for U.S.-made ships. It is unclear, however, if the labor constraints noted above will cap the degree to which U.S. shipbuilders could respond to an increase in demand: an inability to attract experienced workers cannot necessarily be offset by higher (subsidized) wages alone.

B. Raw Material and Equipment Suppliers

Industries that supply raw materials, equipment, and services (e.g., design and engineering services) are affected by the health of the U.S. shipbuilding industry. The U.S. shipbuilding industry purchases inputs from both goods and services sectors across the U.S. value chain. Leading manufactured goods supplier industries to U.S. shipbuilding include iron and steel, aluminum, machinery and equipment, and fabricated metal products. Also important are services, including engineering design and warehousing.

The imposition of a port fee that results in an increase in the production of U.S.-made ships would benefit industries that supply the industry with goods and services.

While most of these inputs are sourced domestically, estimates from the Organization for Economic Cooperation and Development suggest that in 2015 about 14% of the total value of U.S. shipbuilding production was composed of imported inputs.[32]

The imposition of a port fee that results in an increase in the production of U.S.-made ships would benefit industries that supply the industry with goods and services. As output increases in these sectors, so too would employment. The port fee would increase the costs of imported raw materials used to produce U.S. ships.

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[31] Commerce Department, *op. cit.,* p. x.

[32] Karin Gourdon and Christian Steidl, "Global value chains and the shipbuilding industry,", OECD Science, Technology and Industry Working Papers 2019/08, Figure 8, p. 19, https://www.oecd-ilibrary.org/docserver/7e94709a-en.pdf?expires=1719422851&id=id&accname=guest&checksum=4E2133DB2E0DF614ECB01F8898D9B60C.

C. Foreign Commercial Shipbuilders

China, Korea and Japan account for most of the 2019-2023 average gross tonnage of ships built per year, followed by 11 other countries, and then the United States.[33] Table 1 above demonstrates the wide range in the average and maximum sizes of ships made by each country, relative to U.S. vessel manufacturers. Yet, "…even the most successful shipbuilding firms in Korea and Japan often operate at a loss. According to an annual market review, ship sale prices seldom

Table 2. China's Share of Global Completions of Ocean Vessels by Selected Ship Types, 2010-2019

Type	World		China			
	Compensated Gross Tonnage	Gross Tonnage	Compensated Gross Tonnage	Share of World Total	Gross Tonnage	Share of World Total
	(000s)		(000s)		(000s)	
Bulk Carrier	142,538	331,787	75,519	53.00%	175,147	52.80%
Tanker	86,828	175,667	26,168	30.10%	52,098	29.70%
Fully Cellular Carriers (FCC)	66,930	136,613	20,214	30.20%	35,490	26.00%
Offshore Service	20,899	12,296	8,583	41.10%	4,929	40.10%
Gas Carrier	33,577	43,458	3,465	10.30%	3,975	9.10%
Pure Car Carriers (PCC)	8,724	15,587	1,850	21.20%	3,150	20.20%
Cruise	10,252	9,743	20	0.20%	8	0.10%
Passenger/Ferry	8,050	4,361	2,395	29.80%	1,471	33.70%
Roll-on/roll-off	3,580	5,443	595	16.60%	1,071	19.70%
Dredger	2,572	1,635	1,232	47.90%	766	46.90%
Others	33,011	26,549	12,023	36.40%	11,455	43.10%
Total	416,961	763,139	152,064	36.47%	289,560	37.94%

Notes: This table includes all seagoing vessels from 100 Gross Tonnage. Compensated Gross Tonnage is an indicator of the amount of work that is necessary to build a given ship and is calculated by multiplying the tonnage of a ship by a coefficient, which is determined according to type and size of a particular ship. The category "Bulk Carriers" includes "break bulk carriers", "general cargo," "dry bulk carriers", and "bulk/oil".
Source: Organization for Economic Cooperation and Development, calculations based on Clarksons Research Services Limited (2020), World Fleet Register, https://www.clarksons.net/wfr.

[33] U.N. Conference on Trade and Development, "Ships build by country of building, annual," https://unctadstat.unctad.org/datacentre/dataviewer/US.ShipBuilding and https://infogram.com/1pe2xex137m1nzcm2v9rlwydv3cledmjr5y?live.

exceed their building costs."[34] Foreign government subsidies often come to the rescue.

Because the proposed port fee would apply only to Chinese-made ships, we examined the makeup of that fleet in more detail. China's average share of total ship completions over the last decade varies considerably with the type of ship. Chinese bulk carriers are the most common; cruise ships the least common.

The imposition of a port fee on Chinese-made ships would likely result in increased demand by carriers servicing U.S. ports for ships made by other leading foreign suppliers.

The imposition of a port fee on Chinese-made ships would likely result in increased demand by carriers servicing U.S. ports (see "Commercial Shipping Services" below) for ships made by other leading foreign suppliers, especially if they continue to cost less than U.S.-made ships even with the port fee funding U.S. subsidies. U.S. shipbuilders will continue to face headwinds as long as foreign subsidies from other countries continue to undercut U.S. support.

D. Commercial Shipping Services

Ocean carriers purchase and operate commercial ships, providing waterborne transportation services for people (cruises) and importing goods into the United States or to those exporting goods from the United States (shippers). In addition to the transportation of goods, those services may also include logistics: the transportation of the goods after entry into the United States (warehousing, and truck or rail services to the next destination).

[34] CRS 2023.

Table 3. Top 10 Ocean Carriers, 2022

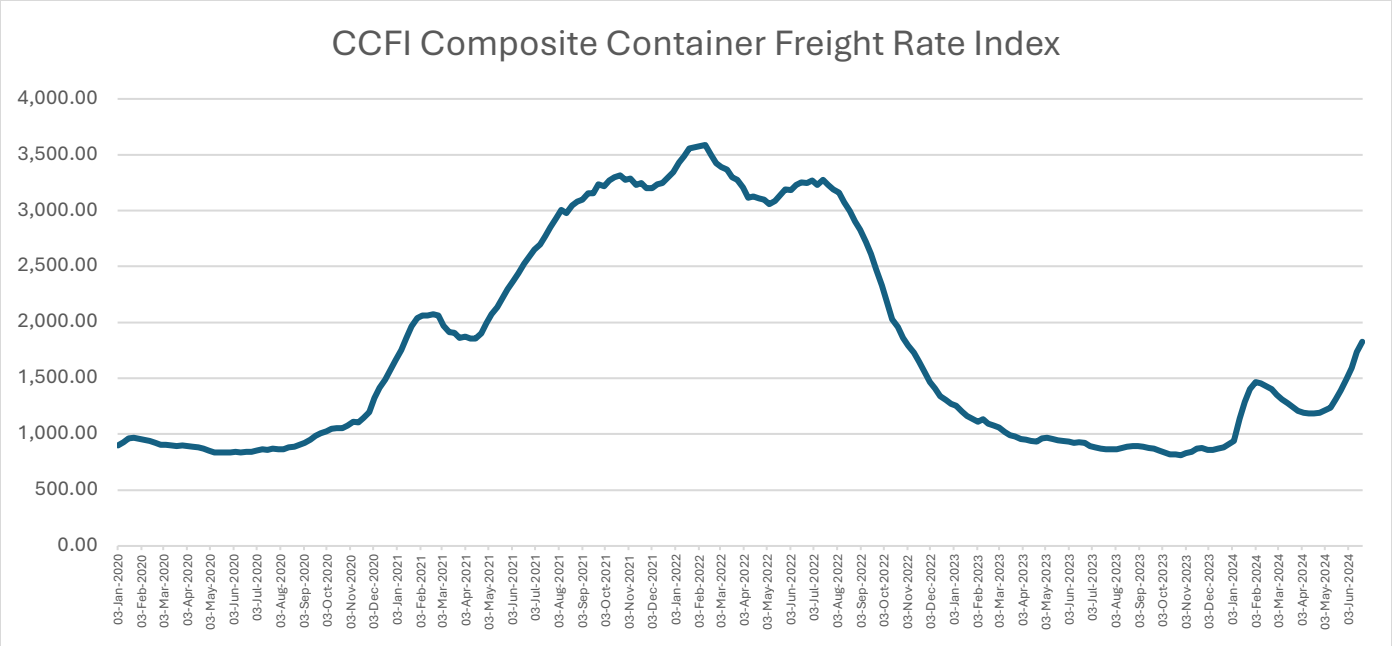
	Total TEUs	Ships	Ave. Size
Mediterranean Shipping Co. (MSC) (Switzerland)	4,337,384	662	6,551
Maersk (Denmark)	4,279,760	737	5,807
CMA CGM Group (France)	3,274,775	578	5,666
COSCO Group (China)	2,928,114	475	6,164
Hapag-Lloyd (Germany)	1,741,980	246	7,081
ONE (Ocean Network Express) (Japan)	1,526,937	209	7,306
Evergreen Line (Taiwan)	1,504,564	200	7,523
HMM Co. Ltd. (Korea)	820,520	76	10,796
Yang Ming Marine Transport Corp. (Taiwan)	666,164	93	7,163
Zim (Israel)	451,855	125	3,615

Source: American Journal of Transportation, https://www.ajot.com/premium/ajot-2022-top-50-ocean-carriers

Carriers typically negotiate fixed one- to two-year contracts governing the terms, conditions and prices of shipping goods with their larger customers (shippers of exports or imports, e.g., major retailers, agricultural exporters). These contracts usually include volume commitments (shippers agree to ship a certain volume of goods over the course of the contract term) and commitments from the carriers for timely delivery of products. For the retail sector, for example, contracts typically run from May 1 to April 30, with the contract negotiation period occurring two months prior.

Smaller shippers may collectively participate in contracts negotiated by shipper associations. Or a small shipper may contract with a non-vessel operating common carrier (NVOCC), which buys space from carriers and then sells it to shippers. Purchasing shipping services on the spot market is never preferred as those rates can be volatile (see chart below).

Some of the larger carriers have considerable market power and can typically pass on new or unexpected cost increases to their customers. They may try to do this before the expiration of the contract, or certainly when it is time to renegotiate the contract. The sudden imposition of a port fee would likely be fully passed on to carriers' customers as an additional charge, certainly in the next contract negotiating process.



Source: Shanghai Shipping Exchange.

E. U.S. Port Services and Related Sectors

Terminal operators at the ports manage the landing, unloading and reloading of ships that dock in the United States. They also manage the storing of goods awaiting pickup and a truck and rail transportation stream to move goods out of their port area to nearby warehouses or onward to warehouses or customers across the country. Ports may be operated by governments (federal, state or local) or private entities. The United States has over 150 deep-draft ports (those that can handle ocean-going ships).[35]

Marine cargo handlers include individuals who load and unload ships at ports and harbors, and provide longshoreman services, marine cargo handling services, ship hold cleaning services, and stevedoring services. Tens of thousands of these workers are represented by unions (including the International Longshore and Warehouse Union representing workers on the West Coast and Hawaii, and the International Longshoremen's Association (ILA) representing workers on the East and Gulf Coasts).[36] These unions negotiate employment

[35] U.S. Environmental Protection Agency, "Port Primer: 3.1 Port Operations," https://www.epa.gov/community-port-collaboration/ports-primer-31-port-operations.

[36] Notably, neither of these unions have publicly endorsed the pending Section 301 petition.

contracts with organizations representing the management groups for terminal operators and carriers (the Pacific Maritime Association (PMA) on the West Coast, and the United States Maritime Alliance (USMX) representing the East and Gulf Coast ports). PMA members employed more than 16,400 registered longshore workers at 29 West Coast ports.[37] East and Gulf Coast dockworkers represented by the ILA total 45,000.[38]

Table 4. Number of Commercial Ship Calls at U.S. Ports, 2023

Liquid bulk cargo ships	22,585
Liquid petroleum gas ships	3,035
Liquid natural gas ships	1,601
Dry bulk cargo ships	14,487
Dry breakbulk cargo ships	7,368
Role-on roll-off ships	6,068
Container ships	19,418
Passenger ships	193,375
All ships	267,937

Source: UNCTAD, https://unctadstat.unctad.org/datacentre/.

U.S. ports manage hundreds of thousands of port calls annually. Most are passenger (cruise) ships, followed by liquid bulk cargo ships (which carry wet bulk cargo such as crude or certain refined oil products, or other liquid cargo except for liquefied gas) and container ships.[39]

U.S. ports are increasingly challenged by the need to handle larger ships. U.S. and other country ports have responded by adjusting the ability of their key ports to service these increasingly huge vessels; the Panama and Suez Canals have completed major expansion projects. Many have spent millions, even billions of dollars, to dredge their ports to permit access to these larger ships and to install cranes and other infrastructure on land capable of loading and unloading them. Yet just 10 U.S. ports can currently handle ships of 8,000 TEU or greater.[40] This means that carriers with smaller Chinese-made ships

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[37] Pacific Maritime Association, "Propelling West Coast Ports Forward," https://www.pmanet.org/west-coast-ports/.

[38] Paul Berger, "East Coast, Gulf Coast Dockworker Talks Are Starting Under Threat of a Strike," *The Wall Street Journal*, March 11, 2024, https://www.wsj.com/articles/east-coast-gulf-coast-dockworker-talks-are-starting-under-threat-of-a-strike-9787ef96.

[39] Very likely none of the passenger cruise ships were made in China. China built its first cruise ship for delivery in December 2023. "China's First Domestically Built Cruise Ship Delivered," *MarineLink,* July 8, 2024, https://www.marinelink.com/news/chinas-first-domestically-built-cruise-510297.

[40] Transport Geography, "Channel Depth at Major North American Container Ports," https://transportgeography.org/contents/chapter6/port-terminals/channel-depth-ports-north-america/.

cannot try to lower the average cost of the port fee by switching to larger Chinese ships when calling on or sailing from most U.S. ports. Nor can they substitute larger ships made in other countries to service ports that cannot manage their bulk. In both cases, continuing to use Chinese-built ships will increase the pressure for them to pass those higher costs on to their customers.

Some U.S. ports, notably those on the West Coast but also the East Coast, compete with ports in Canada and Mexico. If the cost of calling at a U.S. port is suddenly much higher from a port fee, carriers will feel pressure to divert U.S.-bound Chinese-made ships facing a port fee to a Mexican or Canadian port instead, forcing their customers to transport their goods by truck or rail from there to U.S. destinations.

A port fee that disrupts the in- and outflow of merchandise from and to ships at port would negatively impact U.S. ports and their related services sectors.

Intrinsic to port infrastructure are connecting rail and truck services as well as warehouse operators, who ensure that goods that are offloaded from ships or are pending loading for export are moving goods quickly and efficiently to their final destinations. A port fee that disrupts the in- and outflow of merchandise from and to ships at port (or diverted to other ports) would negatively impact these sectors.

F. U.S. Exporters

U.S. exports also depend heavily on a stable and affordable supply of ocean transportation vessels and services. Nine categories of exports, spanning the sectors of the U.S. economy, accounted for over 75% of total U.S. exports in 2023: transportation equipment, chemicals, oil and gas, nonelectrical machinery, petroleum and coal products, computer and electronic equipment, food and related products, agricultural products, and primary metal products.[41] U.S. agricultural exports are concentrated in four products: grains and feeds; oilseeds and products; animals (e.g. livestock and poultry), meats, and products; and horticultural products. Most of these exports are shipped on commercial vessels out of U.S. ports. For agriculture,

[41] U.S. Census Bureau, USATradeOnline, 2023 U.S. FAS exports, data download July 22, 2024.

based on volume, 55% of waterborne trade moves in bulk vessels; 45% in container vessels.[42]

According to an annual Journal of Commerce survey, the top 10 exporters of containerized products were Koch Industries, 212,660 TEUs, varied products), Dow (196,488 TEUs, chemicals), International Paper (177,998 TEUs, paper and packaging), ExxonMobil Chemical (136,323 TEUs, chemicals), DeLong (123,045 TEUs, animal feed and grain), International Forest Products (120,089 TEUs, packaging, paper products, pulp, forest products, recyclables), America Chung Nam (110,898 TEUs, paper and plastics recyclables), Winfibre (99,696 TEUs, paper and recyclables), Newport CH International (84,347 TEUs, paper, metals and plastics recyclables), and Shintech (79,718 TEUs, chemicals).[43]

The imposition of a port fee that is passed on to U.S. agricultural exporters or importers would have a negative impact on that trade, and exports more broadly.

U.S. agriculture is particularly sensitive to increases in shipping costs. The imposition of a port fee that is passed on to U.S. agricultural exporters or importers can thus be expected to have a negative impact on that trade, and exports more broadly.[44]

G. U.S. Importers and Retailers

U.S. importers (also referred to as consignees) are the entities that take title to goods imported on ocean carriers. They may be manufacturers, retailers, or wholesalers or other middlemen who

[42] U.S. Department of Agriculture, "U.S. Agricultural Port Profiles," https://agtransport.usda.gov/stories/s/U-S-Agricultural-Port-Profiles/7vku-v3nn/.

[43] Journal of Commerce, *op. cit.*

[44] See Md Deluair Hossen, Andrew Muhammad, Bart Kenner, James Kaufman, "Unraveling the impacts of freight rates on US containerized agricultural trade," *Journal of the Agricultural and Applied Economics Association*, February 5, 2024, https://onlinelibrary.wiley.com/doi/full/10.1002/jaa2.105; Michael K. Adjemian, Delmy L. Salin, and William W. Wilson, "Implications of Rising Ocean Freight Rates for Agri-food Product Markets, USDA Agricultural Marketing Services, 2023, https://agecon.uga.edu/content/dam/caes-subsite/ag-econ/documents/cvs/Ocean%20Transport%20Cost%20Shocks-Adjemian%20Salin%20and%20Wilson%202023.pdf and Jane Korinek and Patricia Sourdin, "Clarifying Trade Costs: Maritime Transport and its Effect on Agricultural Trade", *OECD Trade Policy Papers*, No. 92, OECD Publishing, Paris, September 28 2009 https://doi.org/10.1787/220157847513.

then sell the goods to manufacturers, wholesalers or retailers. In 2023, the 10 largest direct importers of containerized freight (by TEUs) were: Home Depot (475,000), Target (400,000), Dole Food (230,269), Lowe's (228,974), LG Group (210,368), Chiquita Brands International (179,033), Ashley Furniture (171,168), Samsung America (157,615), Dollar Tree (150,000), and Fresh Del Monte Produce (136,188).[45]

Importers and retaiers would be negatively impacted by a port fee if the carriers they use to bring in imported merchandise to the United States pass the fee cost along to them.

This segment of the supply chain, while not directly responsible for paying the proposed port fee, would be negatively impacted to the degree that the carriers they use to bring in imported merchandise to the United States attempt to pass the fee cost along to them, or their suppliers embed in prices of goods sold to importers and retailers the part of the fee the carriers passed on to them. Depending on the sensitivity of consumers to price increases, these importers would attempt to pass the cost increases on to their customers (e.g., shoppers at their stores). But in instances where that is not possible, they would be forced to absorb the price increase out of profits. Currently there is little room for retailers to absorb unexpected and large transportation cost increases. Retail industry profits are currently just 3.4%[46]

[45] Journal of Commerce, "Top 100 Importer/Exporter Rankings: Biggest shippers rise in down year," May 20, 2024. Walmart is traditionally the largest importer but the Journal could not verify Walmart's total for 2023 so did not include it in the 2023 ranking.

[46] Data for the first quarter 2024, for retailers with total assets of $50 million and over; Income after income taxes as a share of net sales from U.S. Census Bureau, Quarterly Financial Report, T84_0-2024Q1, https://www.census.gov/econ/qfr/hist_financial.html. Prior to the pandemic, during the first quarter of 2019, retail profitability was 3.9%.

III. Recent Market Dynamics

The shipbuilding supply chain is frequently disrupted by a range of *ad hoc* events that cause the cost of shipping goods to and from the United States to increase, even soar, with repercussions for the prices of goods sold in the United States to U.S. farmers, manufacturers and households. Shortages caused by ships that cannot service U.S. ports, or higher spot shipping rates, or diversion of ships from one port to another on a different U.S. coast, or threats of labor stoppages that could delay the loading or unloading of docked ships all impose higher costs on one or more parties in the shipbuilding supply chain. These recent experiences demonstrate the far reach through the supply chain of sudden large increases in U.S. shipping costs.

Over the last four years, events that have disrupted the shipping supply chain and raised transportation costs have included:

- **The pandemic**. Covid-19 shut-downs wholly disrupted global trade for months, creating a mismatch between the supply of and demand for goods at a point when demand for goods soared. Hundreds of ships anchored off ports unable to load or unload freight. Families across the country received a "crash course" in global supply chains as they tried to understand why retail stores no longer had toilet paper and other key products in abundant supply. Port congestion contributed to an escalation of inflation in 2021.[47] President Biden's Council of Economic Advisers noted: "In the transportation and logistics industry specifically, a series of supply chain disruptions and delays at ports during the pandemic led to historically high prices for imports to the United States during the pandemic. At their highest point, spot shipping prices for containers coming from China to U.S. West Coast ports skyrocketed to more than 1000 percent of 2019 levels."[48]

- **Houthi rebel attacks on commercial vessels traveling through the Red Sea and Gulf of Aden**. These attacks have caused many

[47] See for example Xiwen Bai, Jesus Fernandez-Villaverde, Yiliang Li & Francesco Zanetti, "The Causal Effects of Global Supply Chain Disruptions on Macroeconomic Outcomes: Evidence and Theory," National Bureau of Economic Research Working Paper 32098, February 2024, https://www.nber.org/digest/202404/supply-chain-disruptions-and-pandemic-era-inflation.

[48] Council of Economic Advisers, "Issue Brief: Supply Chain Resilience," November 30, 2023, https://www.whitehouse.gov/cea/written-materials/2023/11/30/issue-brief-supply-chain-resilience/.

carriers to divert ships around the Cape of Good Hope, which adds weeks to travel time to cargo from Asia destined for the East Coast of the United States. Rising costs of shipping (e.g., time and fuel) have found their way into higher freight rates, up 137% from October2023 to January 2024 for a 40-foot container from North Asia to the U.S. East Coast.[49] This in turn delays the return of empty containers back to Asia to pick up new cargo. The attacks, and therefore disruption to trade, are expected to continue.

- **A drought reducing water levels in the Panama Canal**. Canal authorities have had to restrict daily ship transit through the Canal. Maersk established a land bridge across Panama for some cargo. Others rerouted ships from Asia headed to the U.S. East Coast through the Suez Canal – until the Houthi rebel attacks made those routes too dangerous.

- **U.S. sanctions on COSCO Shipping Tanker (Dalian) Co. Ltd. (COSCO Dalian), Kunlun Shipping Company Ltd., and certain other entities and individuals for transporting Iranian oil and petroleum products contrary to U.S. sanctions**. Although the sanctions period was brief (from September 25, 2019 to January 31, 2020), it nevertheless caused significant fluctuations in freight rates for oil tankers on the Middle East-to-China route, with consequent disruptions to the supply chain. To avoid the sanctions, cargo owners sought out alternative oil tankers, causing a rapid contraction in tanker capacity and a resulting increase in freight rates – up 768% for Very Large Crude Carriers on the Middle East-to-China route from before the sanctions were imposed.

- **Port labor contract negotiations**. Every time a port labor contract is set to expire, shippers worry that any failure to complete negotiations between unions and port management will result in strike-related delays in loading and unloading cargo at the ports. Work stoppages and protracted negotiations with West Coast dockworkers and the Pacific Maritime Association over 14 months in 2022 and 2023 caused a "significant shift of cargo from the

[49] Spencer Kimball, "Red Sea crisis could jeopardize inflation fight as hipping costs spike globally," CNBC, Jan 11, 2024, https://www.cnbc.com/2024/01/11/red-sea-crisis-could-jeopardize-inflation-fight-as-shipping-costs-spike-globally.html and Lori Ann LaRocco, "Fears are rising ocean freight rates may surpass $20,000 with relief for global trade into 2025," CNBC, June 13, 2024, https://www.cnbc.com/2024/06/13/fears-rise-ocean-freight-rates-may-hit-20000-with-no-relief-in-sight.html. Alternate shipping routes are estimated to have added one to two weeks of transit time and $1 million in additional fuel costs for each voyage.

West Coast to the East Coast and Gulf Coast ports because of the challenges and uncertainty during the last West Coast Port labor negotiations…"[50] U.S. manufacturers and retailers are currently concerned about the breakdown in talks between the International Longshoremen's Association and the U.S. Maritime Alliance on negotiations for a contract affecting U.S. East and Gulf Coasts. The current agreement expires September 30. Already cargo once headed for the East Coast is being shifted back to the West coast as a precaution.[51]

It is into this already-unstable environment that the impacts of a new port fee need to be considered.

As the United States prepares for the 2024 pre-holiday shipping season and (for retailers) already-fixed contracts with carriers, continuing sources of instability (Red Sea and Panama Canal disruptions, labor contract negotiations on the East Coast) plus new sources of instability (a current shipping container shortage,[52] and perhaps a new port fee) are boosting shipping costs, and downstream customers are alarmed.

It is into this already-unstable environment that the impacts of a new port fee need to be considered. June begins the period when retailers and other importers start to import their back-to-school and holiday merchandise.

In short, the imposition of a port fee on Chinese-made ships could cause similar supply chain effects:

- An imbalance in available container ships as carriers seek to substitute non-Chinese ships for Chinese-ships on their U.S. routes;

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[50] "NAM, Allies to Biden: Intervene in Port Talks Now," Press Release, June 28, 2024, https://nam.org/nam-allies-to-biden-intervene-in-port-talks-now-31482/.

[51] Lori Ann LaRocco, "Strikes at East Coast, Gulf orts are a big labor risk this year, and trade diversions have already started," CNBC, Mar. 7, 2024, updated Apr. 6, 2024, https://www.cnbc.com/2024/03/07/countdown-clock-for-strike-at-east-coast-gulf-ports-has-begun.html.

[52] Lori Ann LaRocco, "Sudden container crunch sends ocean freight rates soaring, setting off global trade alarm bells," CNBC, May 23, 2024, updated May 31, 2024, https://www.cnbc.com/2024/05/23/a-sudden-container-crunch-is-sending-ocean-freight-rates-soaring.html.

- Further imbalance in available ships for exports as carriers redirect some trade to non-U.S. ports; and
- Pass-through of the fee to U.S. consumers (defined as those purchasing the imported products, including farmers, manufacturers, wholesalers, retailers and households), fueling inflation.

To evaluate the merits of the proposed port fee, policy makers should consider its full economic consequences as demonstrated by a rigorous economic quantification of those impacts. The next section of this report details many of the estimated economic effects of a port fee.

IV. Estimated Economic Effects of Proposed Port Fee on U.S. Shipbuilding Supply Chain

This section describes briefly the model we used to comprehensively estimate the impacts of the proposed port fee assessed on carriers under two scenarios: (1) carriers do not have time to adjust to the fee by diverting some cargo to Canadian or Mexican ports or by substituting other foreign-made ships for Chinese ships in their fleets, and (2) carriers make those adjustments over time. We report the estimated impacts along the shipbuilding supply chain described in Section II given basic data required for the analysis and economic assumptions about the U.S. labor market.

A. Model Summary

A comprehensive assessment of the potential impacts of a port fee on the U.S. economy must use a methodological approach that captures the full range of the many ways in which those impacts are experienced by farmers, manufacturers, services providers, workers and consumers. This study uses such an approach, which is detailed in the Appendix.

We estimate the direct and indirect effects of two port fee scenarios on trade, U.S. output and jobs.

Briefly, we estimate the direct and indirect effects of two port fee scenarios on trade, U.S. output and jobs. The model captures the direct effects changes plus all of the related up- and downstream impacts, including spending increases or decreases as company sales and worker incomes change.[53] It reflects the differences in price, quantity and quality between imported goods and U.S.-produced goods. It also captures the jobs directly and indirectly related to the process of importing or exporting goods and services (e.g., jobs associated with transporting imports from the ports to warehouses, jobs at the warehouses, or retail jobs that sell

[53] For example, as one sector expands, it spends more on raw materials and other inputs, which creates new business and jobs in those sectors. The expanding sectors hire more workers at higher wages and those workers spend more money at restaurants or on vacations, which in turn supports added business and employment in those sectors. The reverse is also true: contracting sectors buy fewer inputs and lay off workers, who cut spending at restaurants and on vacations until they can find new employment. Thus, a fee on shipping services will affect spending and employment in seemingly unrelated industries, such as entertainment, health care and education.

the traded goods if they are finished consumer products). Finally, our methodology considers the positive *and* negative effects of trade on jobs, and results reported are therefore "net" job impacts.

B. Scenarios

We explore two scenarios. The first is the application of a $1 million port fee to every port call made by a Chinese-made ship, without any compensating changes made by carriers to the composition of their fleets or the U.S. ports serviced. In other words, in this scenario, carriers continue to use Chinese-made ships to make U.S. port calls, and the amount of the fee collected is not abated by transferring U.S.-bound cargo or foreign-bound U.S. exports to ports in Canada or Mexico, or onto ships made in other countries. It is the scenario most likely in the first (if not the second) year of the imposition of the fee, before carriers have had time to make adjustments to mitigate some of the cost of the fee on their customers. We mapped trade against the port calls by type of ship, where possible (e.g., average number of port calls of bulk ships for oil and agricultural commodities; calls for container ships applied to trade that can be shipped in containers, etc.) Given that overall, the average number of port calls is just under 25,000, the first scenario measures the impacts of subsidizing the U.S. shipbuilding industry with a total subsidy value raised of about $25 billion a year.

The second scenario explores the impacts of a $1 million fee if some carriers make adjustments in their fleet or ports serviced to attempt to lower the costs to them of the fee. It is not possible to know at this time the precise degree to which carriers will make those adjustments. For the purposes of this analysis, we assume that 30% of carriers' U.S. port calls are transferred to ports in Canada or Mexico, and carriers continuing to service U.S ports do so with 30% fewer Chinese-made ships, replacing them with ships made in other countries. Under this scenario, likely to dominate the trade after two years, the potential number of port calls made by Chinese ships drops to just under 9,500 (9,449), raising about $10 billion a year from a $1 million per call fee.

C. Data and Market Assumptions

Official government or even private sector data reporting the number of Chinese-made ships calling at U.S. ports does not exist, and therefore must be estimated to evaluate the impacts of a $1 million port fee on each port call of a Chinese-made ship. We applied China's

share of global ships by type (Table 2 above, from the OECD) to the average over six years of total U.S. port call data (all ships, all countries (from UNCTAD previously in Table 4), as detailed in Table 5. This yields a total estimate of 24,936 port calls by Chinese-made ships to which we apply a $1 million fee per visit, or a total subsidy of $24.9 million (scenario 1).

Table 5. Estimation of China's Share of Total U.S. Commercial Ship Port Calls

Ship Type	Average 2018-23	2018	2019	2020	2021	2022	2023	China share	China port calls
All ships	268,534	284,429	290,748	246,863	260,187	261,039	267,937	9.31%	24,936
Passenger ships	194,920	209,015	215,173	176,727	187,300	187,928	193,375	0.00%	0
Liquid bulk carriers	21,793	22,011	22,413	20,269	21,298	22,184	22,585	29.70%	6,708
Container ships	19,424	19,817	20,820	20,037	18,816	17,638	19,418	26.00%	5,049
Dry breakbulk carriers	7,486	8,016	7,610	6,654	7,327	7,938	7,368	52.80%	3,890
Dry bulk carriers	15,026	15,710	15,048	14,117	15,391	15,405	14,487	52.80%	7,649
Roll-on/roll-off ships	6,431	7,603	6,972	5,874	6,203	5,865	6,068	20.07%	1,218
Liquefied petroleum gas carriers	2,423	1,787	2,019	2,326	2,596	2,776	3,035	9.10%	276
Liquefied natural gas carriers	1,031	470	693	859	1,256	1,305	1,601	9.10%	146
Total	268,534	284,429	290,748	246,863	260,187	261,039	267,937	9.31%	24,936

Sources: Derived from UNCTAD and OECD data. . See Table 2 and discussion for share basis.

We assume that the U.S. economy is operating at full employment. This means that the impact of the fee will be felt in changes to U.S. wages rather than in net gains or losses in total U.S. employment. There is very little employment "slack" currently in the United States so changes in supply and demand resulting from the fee will be felt by existing workers moving around to new jobs in other sectors in response to higher wage offerings, rather than people currently unemployed moving into the labor force or those employed losing their jobs.

The base year for our analysis is 2023. Change estimates provided are off of values for each economic variable in 2023.

D. Results

Output, export and import results are detailed below in Table 6. Employment results are detailed in Table 7.

Overall, the imposition of a port fee on Chinese-made ships calling on U.S. ports would have a net negative impact on the U.S. economy. Under scenario 1, for each year the port fee is in effect, U.S. GDP would decline by 0.03%. Total U.S. exports would contract by 2.1%, and imports would drop by 0.5%. Inefficiencies in economic production would increase carbon emissions by 2.2%. (Because we assume the economy is at full employment, overall there would be no net increase or decrease in U.S. jobs as a result of the imposition of the fee; instead, workers would move from jobs in sectors made less competitive by the fee and paying lower wages to jobs in sectors made more competitive, paying higher wages.)

Under scenario 2, U.S. GDP would decline annually by 0.01%. U.S. exports contract by 1.3%, and imports by 0.7%. The fee would have a greater negative impact on climate under this scenario because the truck and rail transportation needed to move goods from ports in Canada and Mexico would now need to be factored in. U.S. CO_2 emissions increase by 4.7%.

1. U.S. Shipbuilders and Repair Industry

Subsidizing the U.S. shipbuilding industry with a $1 million port fee would benefit the industry substantially. As noted above, under scenario 1, the fee would raise about $25 billion annually for the petitioners' Fund. In scenario 2, the amount raised would be somewhat smaller, $10 billion annually.

While the shipbuilding industry would gain output and employment, overall the imposition of the fee on Chinese-made ships calling on U.S. ports would have a net negative impact on the U.S. economy.

With no compensating changes by carriers to reduce the impacts of the fee, output of the "transportation equipment" sector (which includes shipbuilding), would increase by 50%, and exports would nearly double. (The sector also includes trucks, rail cars and other types of ships and boats in addition to ocean-going commercial ships. It is these latter types of vessels that likely seek increases in exports. The decline in imports is most likely declines in truck and rail cars, also included in this sector, as there are virtually no current imports of foreign ships.) Employment of production workers is estimated to increase by 50% (as noted above, there may be a question about whether this increased demand for production workers can be

supplied given the current shortage of specialized labor required to build commercial ships).

The results are similar, but smaller, for the imposition of a fee after carriers attempt to mitigate some of its costs by reducing the number of U.S. port calls made by ships produced in China. Output of the Transportation equipment sector is estimated to increase by 18.5%, and exports by 31.2% (again, most likely of other non-ocean-going ships and other transportation equipment). Employment of production workers would increase by 18.3%.

2. Raw Material and Equipment Suppliers

While some raw material and other manufacturing or services sectors that supply the U.S. shipbuilding industry would likely see increases in related output, overall these sectors would see net declines in output in both scenarios. For example, output and exports of the Ferrous metals, Metals nec, and Metal products sectors all decline in scenario 1, and most decline as well in scenario 2 (the small exception is a small increase in output of Ferrous metals). Other important supplier sectors would also be negatively impacted: computers, and electric and non-electric machinery and equipment. These declines are due to the negative feedback effects of the port fee on the U.S. economy more broadly.

As output and exports decline in these supplier industries, so too would employment. Most of the key supplier sectors shed jobs – at all skill levels under scenario 1, and at most skill levels even under scenario 2. Workers across the skill set would need to find jobs in other sectors as their wages fall in response to the declines in exports and output. There would be some small gains in a handful of supplier sectors under scenario 2, but not for factory workers.

3. U.S. Ports and Related Sectors

Business would decline at U.S. ports and related services sectors as a result of the imposition of the port fee. Under scenario 1, output in the "Transportation, nec" sector (which includes ports, and the trucking and rail transportation sectors) would be reduced by 0.13%;

Business would decline at U.S. ports and related services sectors as a result of the imposition of the port fee, negatively impacting workers.

output in the Warehousing and transport support services (including longshoremen) also declines, by 0.35%.

If carriers adjust their fleets and port calls to mitigate some of the cost of the fee (scenario 2), we estimate output in the "Transportation, nec" sector would be reduced by 0.06% and output in the Warehousing and transport support services (including longshoremen) would decline by 0.12%.

In both scenarios, port traffic would face higher transportation costs and, especially in scenario 2, there would be fewer options to move cargo, increased time to market and reduced shelf life for perishable goods – all reflected in the output decline estimates.

U.S. agricultural exports, and output and employment as a consequence, would contract significantly as a result of the higher shipping costs resulting from the port fee.

Nearly all categories of workers would lose jobs in both scenarios, most notably Equipment Operators (both scenarios). As noted above, thousands of workers in this sector are represented by unions that have not publicly endorsed the port fee.

4. U.S. Exporters

U.S. agricultural exports, and output as a consequence, would contract significantly as a result of the higher shipping costs resulting from the port fee. Large declines in exports (and output) would be borne by U.S. wheat, oilseed, and other grain farmers. U.S. agriculture exporters and workers would be particularly hard-hit, with exports of major agriculture products like wheat, rice, and oilseed dropping dramatically. U.S. exporters will lose competitiveness to exporters in Brazil, Canada, and Australia.

As noted earlier, U.S. agricultural exports are highly sensitive to cost increases,[54] and the fee increases the transportation cost of U.S.

[54] "On average, 10% higher shipping costs reduce U.S. agricultural export values by 0.58% and import values by 1.72%. For exports, we find a significant negative impact for several product categories." Md Deluair Hossen, Andrew Muhammad, Bart Kenner, James Kaufman, "Unraveling the impacts of freight rates on US containerized agricultural trade," Journal of the Agricultural and Applied Economics Association, February 5, 2024, https://onlinelibrary.wiley.com/doi/full/10.1002/jaa2.105. See also Michael K. Adjemian, Delmy L. Salin, and William W. Wilson, "Implications of Rising Ocean Freight Rates for Agri-food Product Markets, USDA Agricultural Marketing Services, 2023, https://agecon.uga.edu/content/dam/caes-subsite/ag-econ/documents/cvs/Ocean%20Transport%20Cost%20Shocks-Adjemian%20Salin%20and%20Wilson%202023.pdf

agriculture exports. In scenario 1, wheat export prices increase by 6.6%, rice by 5.2%, and other grains by 5.7%. As a consequence, U.S. exports decline: wheat, -29.4%; rice, -22.8%, and oilseeds, -16.9%. The hit to U.S. agricultural exports and output remains negative, even under the scenario where carriers adjust their fleets and port calls. Exports and output of farmers growing wheat, rice, oilseeds and other grains decline. Export prices also increase. Farm household income drops 8.9% in scenario 1, and 4.1% in scenario 2. Employment at farms growing wheat takes the heaviest toll (at all skill levels, in both scenarios, -17%); followed by rice (-7%) and oilseeds (-8%), all of which experience employment declines as wages fall with exports and output.

Several manufacturing sectors would experience declines in output , employment and due to the higher costs associated with supply chain disruptions.

Coal and oil exports and output decline under both scenarios. Both products are highly sensitive to shipping costs (see discussion above in Recent Developments, regarding the impacts of Houthi rebel attacks in the Red Sea). In scenario 1, coal exports decline by 8.8%; oil by 4.9%. U.S. coal output drops by 1.4%, and oil output declines by 0.2%. In scenario 2, coal exports decline by 2.4%; oil by 0.7%. U.S. coal output drops by 0.6%, and oil output declines by 0.1%. As a consequence, employment at all skill levels decline (in both scenarios), especially in coal country.

Within manufacturing, under both scenarios, other sectors that face declines in output and exports (most likely due to the higher costs associated with supply chain disruptions) include textiles and apparel, leather products, chemicals and pharmaceuticals, and computers and other consumer electronics. Factory worker employment in these sectors also declines.

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5. U.S. Importers and Retailers

Imports would decline for many products, contributing to declines in output for Trade (the wholesale and retail sectors) in scenario 1. Imports of most food and beverage products drop under both scenarios, as do imports of apparel and leather products. These declines would be due in part to the higher costs associated with importing as well as the declines in national income associated with the fee.

Increases of imports of other products are in part due to the transfer of sourcing to manufacturers in Canada and Mexico, or to the need to buy more lower cost imports in place of now-higher cost U.S. output. (U.S. companies forced to absorb some of the port fee from their suppliers may try to pass on the added cost to their customers, for example.) Additionally, as some sectors would be hurt directly more than others by higher shipping costs, this is reflected in the uneven pattern of output and trade effects across sectors. Those sectors hurt relatively less in direct terms by higher shipping costs benefit somewhat in labor markets in terms of relative competitiveness when compared to sectors hurt relatively more in direct terms.

Table 6. Estimated Economic Effects of $1 Million Per Port Call Fee

(Percent Change)

Scenario 1: No Changes to Port Calls or Fleet Composition			
Sector	Output	Exports	Imports
Wheat	-16.26	-29.39	-15.00
Rice	-6.33	-22.79	-24.95
Other grains	-1.79	-3.30	-11.21
Oil seeds	-8.02	-16.86	-23.51
Vegetables, fruit, nuts	0.97	-0.07	-2.53
Plant-based fibers	0.21	-0.57	-4.11
Crops nec	6.19	-27.63	-12.58
Livestock	0.09	0.35	-3.25
Animal products nec	0.10	0.02	-3.36
Beef	-0.09	-2.93	-1.04
Other meat products	-0.22	-2.53	-1.21
Vegetable oils and fats	0.42	-1.18	-6.74
Dairy products	-0.24	-3.84	0.46
Sugar	-0.12	-2.91	0.39
Food products nec	-0.22	-2.00	-0.32
Beverages and tobacco products	-0.22	-1.51	0.05
Forestry	-1.37	-1.61	-2.94

Scenario 1: No Changes to Port Calls or Fleet Composition, continued			
Sector	Output	Exports	Imports
Fishing	-0.09	-1.18	-0.74
Coal	-1.40	-8.79	-52.47
Oil	-0.24	-4.86	-4.20
Gas	-0.18	-0.86	-0.85
Minerals nec	0.23	-4.37	-9.54
Textiles	-2.10	-4.85	0.96
Wearing apparel	-3.66	-6.09	-0.27
Leather products	-3.69	-6.30	-0.22
Wood products	0.11	-4.53	2.07
Paper products, publishing industries	-0.84	-3.52	1.19
Petroleum, coal products	-0.68	-2.40	-2.42
Chemical products	-2.36	-5.92	-2.44
Basic pharmaceutical products	-2.67	-5.81	0.69
Rubber and plastic products	-1.04	-3.53	1.10
Mineral products nec	-0.81	-4.10	0.97
Ferrous metals	-0.52	-3.44	1.60
Metals nec	-3.84	-6.48	-0.64
Metal products	-0.35	-5.00	2.84
Computer, electronic and other equipment	-3.84	-6.69	1.09
Electrical equipment	-3.07	-5.29	0.81
Machinery and equipment	-2.18	-5.73	1.79
Motor vehicles and parts	-1.21	-2.89	0.70
Transport equipment nec (ships etc.)	50.21	91.79	-40.38
Manufactures nec	-1.43	-6.76	1.62
Utilities	0.02	-0.93	-0.42
Construction	0.66	-2.87	2.59
Trade	-0.01	-2.92	3.88
Accommodation, food and entertainment	-0.37	-2.28	1.53
Transport nec	-0.13	-1.66	1.70
Water transport	-0.42	-1.49	-0.27
Air transport	-0.76	-1.80	1.30
Warehousing and support	-0.35	-2.71	1.25
Communication	-0.18	-2.71	2.23
Finance, insurance, real	-0.21	-2.63	2.06
Business services nec	-0.04	-2.74	2.61
Consumer services	-0.05	-2.63	2.15
Public services	-0.05	-2.74	2.03
TOTAL	-2.06	-0.03	-0.47

Scenario 2: Port Calls or Fleet Composition Adjust			
Sector	Output	Exports	Imports
Wheat	-7.29	-13.17	-7.36
Rice	-3.05	-10.98	-11.74
Other grains	-0.77	-1.75	-5.25
Oil seeds	-3.55	-7.52	-11.83
Vegetables, fruit, nuts	0.57	-0.39	-1.44
Plant-based fibers	-0.10	-0.81	-4.41
Crops nec	2.64	-13.09	-5.63
Livestock	0.07	-0.31	-1.58
Animal products nec	0.03	-0.49	-1.97
Beef	0.00	-1.54	-1.30
Other meat products	-0.11	-1.32	-1.36
Vegetable oils and fats	0.09	-1.61	-3.72
Dairy products	-0.11	-2.18	-0.93
Sugar	0.00	-1.94	-0.63
Food products nec	-0.05	-1.23	-0.62
Beverages and tobacco products	-0.08	-0.88	-0.22
Forestry	-0.62	-2.10	-2.18
Fishing	-0.03	-0.59	-0.29
Coal	-0.57	-4.14	-28.09
Oil	-0.09	-2.40	-1.98
Gas	-0.13	-0.73	0.02
Minerals nec	0.09	-2.01	-4.21
Textiles	-0.49	-2.49	-0.30
Wearing apparel	-0.92	-2.74	-0.13
Leather products	-0.87	-2.90	-0.19
Wood products	0.12	-3.23	-0.35
Paper products, publishing industries	-0.36	-2.36	-0.33
Petroleum, coal products	-0.37	-1.40	-1.18
Chemical products	-1.01	-2.95	-1.44
Basic pharmaceutical products	-1.00	-2.31	0.16
Rubber and plastic products	-0.27	-1.85	-0.35
Mineral products nec	-0.04	-2.12	-0.69
Ferrous metals	0.03	-1.88	-0.10
Metals nec	-1.54	-2.90	-0.45
Metal products	-0.03	-2.32	0.24
Computer, electronic and other equipment	-1.47	-2.78	0.34
Electrical equipment	-1.13	-2.30	0.20
Machinery and equipment	-0.83	-2.66	0.35
Motor vehicles and parts	-0.45	-1.31	0.16
Transport equipment nec (ships etc.)	18.46	31.86	-18.48

Scenario 2: Port Calls or Fleet Composition Adjust, continued			
Sector	Output	Exports	Imports
Manufactures nec	-0.40	-2.86	0.25
Utilities	0.01	-0.23	-0.35
Construction	0.24	-1.08	0.97
Trade	0.00	-1.08	1.42
Accommodation, food and entertainment	-0.14	-0.83	0.54
Transport nec	-0.06	-0.63	0.68
Water transport	0.06	0.08	0.02
Air transport	-0.33	-0.72	0.53
Warehousing and support	-0.12	-0.84	0.48
Communication	-0.07	-1.00	0.82
Finance, insurance, real	-0.08	-0.95	0.76
Business services nec	-0.02	-1.01	0.96
Consumer services	-0.02	-0.93	0.78
Public services	-0.02	-1.02	0.75
TOTAL	-0.01	-1.28	-0.65

"nec" is "not elsewhere classified"

Table 7. Estimated Employment Effects of $1 Million Per Port Call Fee

(Percent Change)

Scenario 1: No Changes to Port Calls or Fleet Composition					
Sector	Factory Workers, Equipment Operators	Technicians, Skilled Workers	Professionals and Managers	Clerical Workers	Shopkeeping, Service Workers
Wheat	-17.59	-17.51	-17.52	-17.52	-17.51
Rice	-7.12	-6.97	-6.99	-6.99	-6.96
Other grains	-2.49	-2.39	-2.41	-2.41	-2.39
Oil seeds	-8.95	-8.86	-8.88	-8.88	-8.86
Vegetables, fruit, nuts	0.42	0.52	0.50	0.50	0.52
Plant-based fibers	-0.43	-0.34	-0.35	-0.35	-0.33
Crops nec	5.91	6.01	5.99	5.99	6.01
Livestock	-0.52	-0.42	-0.44	-0.44	-0.42
Animal products nec	-0.53	-0.43	-0.45	-0.44	-0.43
Beef	-0.34	0.09	0.02	0.02	0.11
Other meat products	-0.49	-0.07	-0.14	-0.13	-0.05
Vegetable oils and fats	0.10	0.52	0.45	0.46	0.54
Dairy products	-0.63	-0.39	-0.43	-0.43	-0.38
Sugar	-0.42	-0.18	-0.22	-0.22	-0.17
Food products nec	-0.49	-0.07	-0.13	-0.13	-0.04
Beverages and tobacco products	-0.54	-0.12	-0.19	-0.18	-0.10
Forestry	-1.64	-1.56	-1.58	-1.57	-1.56
Fishing	-0.26	-0.18	-0.19	-0.19	-0.18
Coal	-3.34	-3.27	-3.28	-3.28	-3.26
Oil	-0.59	-0.52	-0.53	-0.53	-0.51
Gas	-0.51	-0.43	-0.44	-0.44	-0.43
Minerals nec	0.25	0.33	0.32	0.32	0.33

Scenario 1: No Changes to Port Calls or Fleet Composition, continued					
Sector	Factory Workers, Equipment Operators	Technicians, Skilled Workers	Professionals and Managers	Clerical Workers	Shopkeeping, Service Workers
Textiles	-2.36	-1.89	-1.97	-1.96	-1.87
Wearing apparel	-3.86	-3.41	-3.48	-3.47	-3.38
Leather products	-3.94	-3.49	-3.56	-3.55	-3.46
Wood products	-0.17	0.31	0.23	0.24	0.33
Paper products, publishing industries	-1.13	-0.66	-0.74	-0.73	-0.64
Petroleum, coal products	-1.07	-0.60	-0.67	-0.67	-0.58
Chemical products	-2.71	-2.25	-2.32	-2.31	-2.22
Basic pharmaceutical products	-3.04	-2.58	-2.65	-2.64	-2.55
Rubber and plastic products	-1.33	-0.86	-0.93	-0.93	-0.84
Mineral products nec	-1.11	-0.64	-0.71	-0.71	-0.61
Ferrous metals	-0.85	-0.38	-0.45	-0.45	-0.35
Metals nec	-4.14	-3.69	-3.76	-3.76	-3.66
Metal products	-0.62	-0.15	-0.23	-0.22	-0.13
Computer, electronic and other equip.	-4.15	-3.69	-3.76	-3.76	-3.67
Electrical equipment	-3.35	-2.89	-2.96	-2.96	-2.87
Machinery and equipment	-2.47	-2.00	-2.07	-2.07	-1.98
Motor vehicles and parts	-1.53	-1.06	-1.13	-1.13	-1.04
Transport equipment nec (ships etc.)	49.76	50.47	50.36	50.37	50.51
Manufactures nec	-1.69	-1.22	-1.29	-1.29	-1.19
Utilities	-0.32	0.15	0.08	0.08	0.18
Construction	0.41	0.94	0.85	0.86	0.96
Trade	-0.52	0.11	0.01	0.02	0.15
Accommodation, food & entertainment	-0.94	-0.31	-0.40	-0.40	-0.27
Transport nec	-0.56	0.07	-0.03	-0.02	0.10
Water transport	-0.89	-0.27	-0.36	-0.36	-0.23
Air transport	-1.21	-0.58	-0.68	-0.68	-0.55
Warehousing and support	-0.75	-0.13	-0.22	-0.22	-0.09
Communication	-0.54	-0.06	-0.14	-0.13	-0.04
Finance, insurance, real	-0.63	-0.16	-0.23	-0.22	-0.13
Business services nec	-0.45	0.02	-0.05	-0.05	0.05
Consumer services	-0.46	0.01	-0.06	-0.06	0.04
Public services	-0.45	0.02	-0.05	-0.05	0.05
TOTAL	0	0	0	0	0
Scenario 2: Carriers Adjust Port Calls or Fleet Composition					
Wheat	-7.96	-7.92	-7.93	-7.92	-7.93
Rice	-3.42	-3.36	-3.37	-3.35	-3.35
Other grains	-1.09	-1.05	-1.05	-1.05	-1.05
Oil seeds	-3.99	-3.96	-3.96	-3.95	-3.95
Vegetables, fruit, nuts	0.33	0.37	0.37	0.37	0.37
Plant-based fibers	-0.40	-0.36	-0.37	-0.36	-0.36
Crops nec	2.52	2.56	2.55	2.56	2.56
Livestock	-0.20	-0.16	-0.17	-0.16	-0.16
Animal products nec	-0.25	-0.21	-0.21	-0.20	-0.20
Beef	-0.10	0.07	0.04	0.07	0.07
Other meat products	-0.22	-0.05	-0.08	-0.05	-0.05
Vegetable oils and fats	-0.04	0.13	0.11	0.14	0.14
Dairy products	-0.28	-0.19	-0.20	-0.18	-0.18
Sugar	-0.13	-0.03	-0.05	-0.03	-0.03
Food products nec	-0.16	0.01	-0.01	0.02	0.02
Beverages and tobacco products	-0.21	-0.04	-0.06	-0.03	-0.03

Scenario 2: Carriers Adjust Port Calls or Fleet Composition, continued					
Sector	Factory Workers, Equipment Operators	Technicians, Skilled Workers	Professionals and Managers	Clerical Workers	Shopkeeping, Service Workers
Forestry	-0.74	-0.71	-0.71	-0.71	-0.71
Fishing	-0.09	-0.06	-0.07	-0.06	-0.06
Coal	-1.41	-1.38	-1.38	-1.38	-1.38
Oil	-0.23	-0.20	-0.20	-0.20	-0.20
Gas	-0.35	-0.32	-0.33	-0.32	-0.32
Minerals nec	0.09	0.12	0.12	0.12	0.12
Textiles	-0.60	-0.41	-0.43	-0.40	-0.40
Wearing apparel	-1.01	-0.82	-0.85	-0.81	-0.81
Leather products	-0.98	-0.79	-0.82	-0.79	-0.79
Wood products	0.01	0.20	0.17	0.21	0.21
Paper products, publishing industries	-0.48	-0.29	-0.32	-0.28	-0.28
Petroleum, coal products	-0.53	-0.34	-0.37	-0.33	-0.33
Chemical products	-1.16	-0.97	-1.00	-0.96	-0.96
Basic pharmaceutical products	-1.15	-0.96	-0.99	-0.95	-0.95
Rubber and plastic products	-0.39	-0.20	-0.23	-0.19	-0.19
Mineral products nec	-0.17	0.02	0.00	0.03	0.03
Ferrous metals	-0.11	0.08	0.05	0.09	0.09
Metals nec	-1.67	-1.48	-1.51	-1.48	-1.48
Metal products	-0.14	0.05	0.02	0.06	0.06
Computer, electronic and other equip.	-1.59	-1.41	-1.43	-1.40	-1.40
Electrical equipment	-1.25	-1.06	-1.09	-1.06	-1.06
Machinery and equipment	-0.95	-0.76	-0.79	-0.75	-0.75
Motor vehicles and parts	-0.58	-0.39	-0.42	-0.38	-0.38
Transport equipment nec (ships etc.)	18.32	18.54	18.51	18.55	18.55
Manufactures nec	-0.51	-0.32	-0.35	-0.31	-0.31
Utilities	-0.13	0.06	0.03	0.07	0.07
Construction	0.14	0.35	0.32	0.36	0.36
Trade	-0.21	0.04	0.00	0.05	0.05
Accommodation, food & entertainment	-0.36	-0.11	-0.15	-0.10	-0.10
Transport nec	-0.23	0.02	-0.01	0.03	0.03
Water transport	-0.14	0.12	0.08	0.13	0.13
Air transport	-0.51	-0.26	-0.30	-0.25	-0.25
Warehousing and support	-0.29	-0.03	-0.07	-0.02	-0.02
Communication	-0.21	-0.02	-0.05	-0.02	-0.02
Finance, insurance, real	-0.25	-0.06	-0.09	-0.05	-0.05
Business services nec	-0.18	0.01	-0.02	0.02	0.02
Consumer services	-0.19	0.00	-0.03	0.01	0.01
Public services	-0.18	0.01	-0.02	0.01	0.01
TOTAL	0	0	0	0	0

"nec" is "not elsewhere classified"

6. Climate Impacts

Finally, the proposed port fee would have a negative impact on efforts to mitigate carbon dioxide emissions. In scenario 2, which assumes that many carriers divert to Canadian and Mexican ports to avoid paying the port fee, carbon dioxide emissions would nearly double, since importers would need to use ground transportation to

move goods shipped to Mexico and Canada to their final U.S. destinations.

Table 8. Impact of Port Fees on CO_2 Emissions

	Scenario 1	Scenario 2
U.S. carbon emissions (metric tons)	131.1	227.2
Global carbon emissions (metric tons)	102.6	185.1
U.S. carbon emissions (% total CO_2 emissions)	2.73	4.73
Global carbon emissions (%)	0.27	0.50

Appendix: Methodology

The Model

The specific model used was the Global Trade Analysis Project (GTAP) model, with the most recent GTAP database, GTAP v11, released in April 2023. The structure of the v11 database is outlined by Aguiar et al (2019). We have updated the data here based on 2023 data. The model and its associated data are developed and maintained by a network of researchers and policymakers coordinated by the Center for Global Trade Analysis at the Department of Agricultural Economics at Purdue University. Guidance and base-level support for the model and associated activities are provided by the GTAP Consortium, which includes members from government agencies (e.g., the U.S. Department of Commerce, U.S. Department of Agriculture, U.S. Environmental Protection Agency, U.S. International Trade Commission, and the European Commission), international institutions (e.g., the Asian Development Bank, Organization for Economic Cooperation and Development, the World Bank, the United Nations, and the World Trade Organization), the private sector and academia. Dr. Francois is a member of the Consortium.

The model assumes that capital stocks are fixed at a national level. Firms are assumed to be competitive, and employ capital and labor to produce goods and services subject to constant returns to scale.[55] Products from different regions are modeled in terms of production and trade under an Armington-Eaton-Kortum framework. Trade elasticities are taken directly from the GTAP v. 11 database, as are substitution elasticities for value added.[56]

As the U.S. economy is essentially at full employment, we model labor market adjustment through changes in labor allocation and wages rather than total employment.

Data

The model incorporates data from a number of sources. Data on production and trade are based on input-output, final demand, and trade data from the GTAP database (see Aguiar, Narayanan & McDougall 2019). These data provide important information on cross-border linkages in industrial production, related to trade in parts and components. For the 2023 simulation, social accounting data are drawn directly from the most recent version of the GTAP

[55] Compared to dynamic CGE models and models with alternative market structures, the present assumption of constant returns to scale with a fixed capital stock is closest in approach to older studies based on pure input-output modeling of trade and employment linkages. In the present context, it can be viewed as generating a lower-bound estimate of effects relative to alternative CGE modeling structures.

[56] Technically the model corresponds analytically to a recent type of model known as an Eaton-Kortum model. See Bekkers et al (2018) and Bekkers et al (2023) for further technical discussion and derivations.

dataset, version 11 (released April 2023). Trade data (both exports and imports) exclude re-exports.[57] This dataset is benchmarked to 2017 and includes detailed national input-output, trade, and final demand structures for 160 countries and regions across 65 sectors. We have updated the trade and national accounts data to 2023.

The basic social accounting and trade data are supplemented with data on tariffs and non-tariff barriers from the World Trade Organization's integrated database and from the UNCTAD/World Bank WITS dataset. All tariff information has been concorded to GTAP model sectors within the version 11 database.[58]

Within the model, carbon emissions are linked explicitly to fossil fuel use by firms (including transport), government, and households, as well as emissions linked to industrial activities.

Model Sectors

Wheat	Petroleum, coal products
Rice	Chemical products
Other grains (corn, sorghum, barley, rye, etc.)	Basic pharmaceutical products
Oilseeds	Rubber and plastic products
Vegetables, fruit, nuts	Mineral products nec
Plant-based fibers	Ferrous metals
Crops nec	Metals nec
Livestock	Metal products
Animal products nec	Computer, electronic and optical products
Beef	Electrical equipment
Other meat products	Machinery and equipment
Vegetable oils and fats	Motor vehicles and parts
Dairy products	Transport equipment nec (ships etc.)
Sugar	Manufactures nec
Food products nec	Utilities
Beverages and tobacco products	Construction
Forestry	Trade
Fishing	Accommodation, food and service activities
Coal	Transport nec
Oil	Water transport
Gas	Air transport

[57] See https://www.gtap.agecon.purdue.edu/databases/contribute/reexports.asp.

[58] The GTAP database includes relatively more detail in sectors, particularly in agricultural, primary production, and processed foods than we can use here when mapping model results by sector to state employment data by sector. State employment data for most of these sectors are not available.

Minerals nec	Warehousing and support
Textiles	Communication
Wearing apparel	Finance, insurance, real estate
Leather products	Business services nec
Wood products	Consumer services
Paper products, publishing	Public services

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