

United States International Trade Commission

Recent Trends in U.S. Services Trade: 2023 Annual Report

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Preface

This report is the 27th in a series of annual reports on recent trends in U.S. services trade published by the U.S. International Trade Commission (Commission or USITC). Conducted under an investigation instituted by the Commission in 1993 under section 332(b) of the Tariff Act of 1930,¹ these reports draw on interviews with industry representatives as well as published sources to apprise the Commission's requestors and the public of global industry trends, regional developments, and competitiveness issues related to trade in services.

¹ On August 27, 1993, acting on its own motion under section 332(b) of the Tariff Act of 1930 (19 U.S.C. 1332(b)), the Commission instituted investigation no. 332-345, Annual Reports on U.S. Trade Shifts in Selected Industries. On December 20, 1994, USITC on its own motion expanded the scope of this report to include more detailed coverage of services industries. Under the expanded scope, USITC publishes two annual reports, *Shifts in U.S. Merchandise Trade* and *Recent Trends in U.S. Services Trade* (Recent Trends). Beginning in 2013, Recent Trends has rotated its coverage on an annual basis between four services industry categories: financial services, professional services, digital and electronic services, and distribution services. This year's report focuses on distribution services was published in September 2019.

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Abbreviations and Acronyms

Terms	Definitions
3PL	third-party logistics
5G	fifth generation wireless network
ACMI	aircraft, crew, maintenance, and insurance
AGOA	African Growth and Opportunity Act
AI	artificial intelligence
ATA	American Trucking Association
B2C	business-to-consumer
BEA	Bureau of Economic Analysis
BLS	Bureau of Labor Statistics
BVLOS	beyond visual line of sight
CBP	U.S. Customs and Border Protection
CISA	Cybersecurity and Infrastructure Security Agency
COVID-19	coronavirus disease 2019
D&D	detention and demurrage
DTLF	Digital Transport and Logistics Forum
eBL	electronic bill of lading
ESG	environmental and social governance
EU	European Union
FAA	Federal Aviation Administration
FMC	Federal Maritime Commission
FLOW	Freight Logistics Optimization Works
FTE	full-time equivalent
GATS	General Agreement on Trade in Services
GDP	gross domestic product
GSP	Generalized System of Preferences
ICT	information and communications technology
IMF	International Monetary Fund
IMO	International Maritime Organization
IoT	Internet of Things
IP	intellectual property
IT	information technology
JIT	just in time
LTL	less than truckload
MOU	memorandum of understanding
MNE	multinational enterprises
MOFA	majority-owned foreign affiliate
MOUSA	majority-owned U.S. affiliate
NAICS	North American Industry Classification System (U.S. Census Bureau)
ONE	Ocean Network Express
OSRA 22	Ocean Shipping Reform Act of 2022
RFID	radio-frequency identification
SME	small and medium-sized enterprise
TEU	20-foot equivalent units
TL	truckload
UBO	ultimate beneficial owner
UK	United Kingdom
UNCTAD	United Nations Conference on Trade and Development
UPS	United Parcel Service

Recent Trends in U.S. Services Trade: 2023 Annual Report

Terms	Definitions
USDOC	U.S. Department of Commerce
USDOE	U.S. Department of Energy
USDOJ	U.S. Department of Justice
USDOL	U.S. Department of Labor
USDOT	U.S. Department of Transportation
USITC	U.S. International Trade Commission
USPS	United States Postal Service
WTO	World Trade Organization

Executive Summary

This report covers recent trends in U.S. services trade and developments in services industries' competitiveness. In particular, it focuses on developments in U.S. trade in distribution services, especially in the context of recent volatility in consumer demand for goods imports and pandemic-related measures that disrupted transportation and distribution networks. The report includes specific discussions on retail supply chains, e-commerce, logistics, warehousing, maritime shipping, port services, trucking and rail, air cargo, and express delivery via drone. The developments are addressed in two chapters that focus on two overarching themes: (1) distribution networks adapting by changing trade patterns and adopting new technologies and (2) the transportation services industry adjusting to changes in demand, new market entrants, and labor issues.

Trade in services falls into two categories: cross-border transactions and transactions by foreign-owned affiliates. In 2021, the United States continued to be the world's largest exporter and importer of services.² In that year, U.S. cross-border services exports totaled \$771.9 billion (or 12.9 percent of global services exports), and U.S. cross-border services imports totaled \$524.9 billion (or 9.5 percent of global services imports). Sales of services by foreign affiliates of U.S.-owned firms (referred to here as affiliate sales) totaled \$1.6 trillion in 2020 (the latest year available). Purchases of services from U.S. affiliates of foreign-owned firms totaled \$1.2 trillion. Given the inherently local nature of many services—for example, some services may require in-person delivery or provision by locally regulated entities—U.S. sales of services through foreign affiliates of U.S.-owned firms are consistently larger than U.S. cross-border services exports.

Report Highlights

The United States Continues to Run a Trade Surplus in Both Cross-Border Services Trade and Foreign Affiliate Sales

In 2021, U.S. cross-border services exports exceeded imports, resulting in a trade surplus of \$247.0 billion. U.S. cross-border trade surpluses were recorded in most major services sectors, with the largest surpluses in professional services, financial services, and digital and electronic services. The United States' largest destination for services exports in 2021 was Ireland, followed by the United Kingdom (UK), the British Caribbean territories, and Canada. In that same year, the largest source of U.S. services imports was the UK, followed by Germany, Canada, Japan, and Bermuda.

In 2020, the most recent year for which data were available, affiliate sales exceeded affiliate purchases by a wide margin. In that year, sales of services by U.S.-owned foreign affiliates exceeded purchases from foreign-owned U.S. affiliates by \$470.3 billion. Overall, the UK was the largest market for services sales by U.S.-owned foreign affiliates, followed by Ireland and Canada. Affiliates of German-owned firms

² This report uses the U.S. Department of Commerce, Bureau of Economic Analysis' statistics and definitions of cross-border trade (see box 1.1).

in the United States accounted for the largest share of services purchases from all foreign-owned affiliates in the United States, followed by affiliates owned by firms in the UK and Canada.

Distribution Services Represented a Small Share of U.S. Cross-Border Services Exports but a Significant Share of U.S. Foreign Affiliate Sales

Distribution services—the focus of this report—include the wide range of activities that facilitate the movement of goods through the supply chain from producer to end consumer. Over the past several years, the distribution services sector has been affected by the unprecedented volatility in consumer demand for goods imports. The response to the COVID-19 pandemic increased the economy's reliance on global supply chains and the distribution services that enable them. At the same time, the pandemic-related measures disrupted transportation and distribution networks. This led to shipping delays, port congestion, and increases in freight rates through 2022, with freight rates remaining elevated through the beginning of 2023 before easing toward their pre-pandemic levels.

In 2021, distribution services accounted for \$55.0 billion (or 7.1 percent) of total cross-border services exports and \$91.2 billion (or 17.4 percent) of imports, resulting in a cross-border deficit of \$36.2 billion. Top markets for U.S. cross-border exports of distribution services included Japan, South Korea, and Germany. Top sources of imports were Japan, China, and Taiwan. In 2020, foreign distribution services affiliates of U.S.-owned companies recorded services sales of \$451.4 billion (accounting for 27.4 percent of total U.S. affiliate sales of services). Purchases of services from U.S. distribution services affiliates of foreign-owned companies totaled \$347.9 billion (or 29.5 percent of the total).

Retail, E-Commerce, Logistics, and Warehousing Adapt by Changing Trade Patterns and Adopting New Technologies

In the retail industry, demand shifts, supply constraints, and transportation bottlenecks related to the COVID-19 pandemic disrupted supply chains, beginning in early 2020. In response, retailers are holding larger inventories, identifying alternative suppliers, and increasing transparency in supply chains to mitigate the risk of future shocks. The response to the pandemic also reduced consumer demand for some services, such as travel, but increased demand for others, such as e-commerce. U.S. small and medium-sized retailers are increasingly using third-party marketplaces provided by e-commerce platforms—as well as payments and logistics services provided by outside firms—to reach foreign customers. Logistics firms have increased their adoption of paperless trade, including electronic bills of lading, and new technologies, like machine learning and data analytics, to improve efficiency. The industry has also developed new business models that emphasize increased collaboration among incumbent firms, startups, and government regulators. Increased goods imports beginning in 2020 led to a rapid rise in demand for warehousing services. This prompted substantial investment in new warehouse construction in the United States and other markets. Labor supply issues, as well as a rise in worker injuries, have also affected the provision of warehousing services and prompted increased investment in automation.

COVID-19-Related Disruptions Increased Demand for Transportation Services and the Industry Adjusted to New Market Entrants and Labor Issues

The transportation services sector experienced multiple economic shocks related to the COVID-19 pandemic. These included a consumer shift from in-person purchases to online retail purchases, volatile fuel prices, and disruptions to global value chains. A marked increase in consumer demand for retail goods in the wake of the pandemic initially overwhelmed global supply chains, causing shipping and airfreight rates to spike and resulting in historic profits for ocean carriers. These rate and profit increases, in turn, spurred governments to review maritime freight transport rules. Demand for goods transport via airfreight rose significantly. Firms in the e-commerce and maritime shipping sectors have recently established or significantly expanded their air cargo operations, as well as their investments in the logistics and warehousing services industries. Increased goods imports in the United States also resulted in heavy port congestion and significant delays, concurrently spurring long-term investments in port automation and expansion. Labor-related issues in the rail and trucking industries, resulting from worker demands for higher pay and better working conditions, have underscored the economic importance of these industries. The delivery of goods via drone has developed more slowly than industry participants predicted. Product offerings in a few U.S. and overseas locations are limited, but firms continue to pilot new drone delivery projects.

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Chapter 1 Introduction

The services sector is the largest sector of the U.S. economy, and the United States is the world's top cross-border exporter and importer of services.³ In 2021, the U.S. services sector accounted for 79.2 percent of U.S. gross domestic product (GDP) and 82.0 percent of total U.S. private employment.⁴ In the same year, U.S. cross-border services exports totaled \$771.9 billion and cross-border imports totaled \$524.9 billion, resulting in a \$247.0 billion trade surplus.⁵

Recent Trends in U.S. Services Trade (Recent Trends), published annually by the U.S. International Trade Commission (Commission or USITC), examines trends in U.S. services trade, global market and competitive conditions, and important U.S. trading partners for services, both in the aggregate and in selected industries. Each year, *Recent Trends* focuses on a specific category of services. This year, the report focuses on distribution services, a category of services trade that represents a wide range of activities that facilitate the movement of goods through the supply chain from producer to end consumer. In particular, the category includes transportation, wholesale and retail, and logistics services.⁶ Distribution services were last covered in the 2019 annual report. Three other services categories, covered in a four-year rotation, include digital and electronic, professional, and financial (last covered in 2022, 2021, and 2020, respectively).

This report is organized into five chapters. Chapter 1 gives an overview of the domestic U.S. services sector, global cross-border trade in services, and U.S. services trade (both cross-border trade and affiliate transactions) by services sector. Chapter 2 provides an overview of trends in cross-border trade and foreign affiliate sales and purchases for the distribution services category as a whole and for its three major component industry sectors: transportation, wholesale and retail, and logistics services.

Chapters 3 and 4 highlight important or emerging trends in selected subsectors of distribution services. Chapter 3 focuses on distribution networks, covering retail supply chains, the role of small and mediumsized enterprises in e-commerce, logistics services, and warehousing services. Chapter 4 focuses on transportation services, with sections on maritime shipping, ports services, road and rail freight, air cargo, and express delivery via drones.

³ WTO, "Trade in Commercial Services," accessed January 4, 2023.

⁴ USDOC, BEA, table 6.5D, "Full-Time Equivalent Employees, by Industry," September 30, 2022; USDOC, BEA, "Real Value Added by Industry," December 22, 2022. Value added is a measure of an industry's contribution to GDP and is the difference between the value of an industry's gross output and the cost of intermediate inputs. Services-supplying industries include utilities; wholesale trade; retail trade; transportation and warehousing; information; finance; insurance; real estate, rental, and leasing; professional and business services; educational services; healthcare and social assistance; arts, entertainment, recreation, accommodation, and food services; and other services, except government services. Goods-producing industries include mining; construction; manufacturing; and agriculture, forestry, fishing, and hunting.

⁵ USDOC, BEA, table 2.1, "U.S. Trade in Services, by Type of Service," July 7, 2022.

⁶ Previous versions of the distribution services-focused *Recent Trends* reports (2019 and 2015) have primarily focused only on logistics, maritime transport, and retail services.

Finally, chapter 5 summarizes the views expressed by participants at the Commission's 16th annual USITC Services Roundtable, held on November 2, 2022. The report also includes two appendixes. Appendix A summarizes recent services-related Commission publications and staff research, and appendix B presents underlying data for the figures included in this report. In addition, the Commission website has web-based interactive charts and tables associated with this report that allow users to explore U.S. services trade trends over time and for select industries and countries.⁷

Data: Sources, Categories, and Limitations

Data on trade in services tend to be more limited than data on trade in goods, partly because of the intangibility of services and the lack of customs data on services trade. As a result, this report relies on a variety of sources to present a comprehensive picture of trade in services. Official U.S. services trade data used in this report come from the Bureau of Economic Analysis (BEA) at the U.S. Department of Commerce (USDOC), which publishes annual data on both cross-border trade and affiliate transactions. These annual data are produced from a combination of surveys of U.S. firms, other administrative data (such as financial reports from the U.S. Department of State), and data from non-U.S. government sources.⁸ Together, cross-border trade and foreign affiliate transactions account for a substantial portion of total services trade via all four modes of supply specified in the General Agreement on Trade in Services (GATS) of the World Trade Organization (WTO).⁹ Box 1.1 and figure 1.A explain and illustrate the four modes of supply for services trade, as well as where each mode falls within the trade statistics.

Box 1.1 Services Trade "Modes of Supply" under the World Trade Organization General Agreement on Trade in Services

The General Agreement on Trade in Services identifies four modes of supply for services trade, or four ways that services can be traded:^a

Mode 1 is cross-border supply. In this mode, a service is supplied by an individual or firm in one country to an individual or firm in another country (i.e., the service crosses national borders). An example is a firm emailing (i.e., exporting) a digital file of an architectural design to a foreign client. This mode also captures transportation services, such as a ship delivering goods from a port in one country to a port in another country.

Mode 2 is consumption abroad. In this mode, an individual from one country travels to another country and consumes a service in that country. For example, a U.S. export of tourism services occurs when a foreign tourist purchases souvenirs, food, and lodging while vacationing in the United States.

Mode 3 is commercial presence. In this mode, a firm based in one country establishes a local affiliate in another country and supplies services through that affiliate. An example is a U.S.-based retailer

⁷ Interactive charts and associated alternative text are available at:

https://www.usitc.gov/publications/industry_econ_analysis_332/2023/recent_trends_us_services_trade_2023_an_nual_report.

⁸ For a list of the data the BEA uses to compile trade in services statistics, see USDOC, BEA, "U.S. International Economic Accounts: Concepts and Methods," June 2022, 17–19.

⁹ WTO, "Basic Purpose and Concepts," accessed January 11, 2023.

establishing a local affiliate in a foreign country for the purpose of selling products to consumers in that market.

Mode 4 is the temporary presence of natural persons. In this mode, an individual from one country travels short term to another country to supply a service—for instance, as a consultant, contract employee, or intracompany transferee at a foreign affiliate. An example is a U.S.-based airplane technician traveling abroad to service or repair an aircraft.

Figure 1.A summarizes how U.S. services are exported via these four modes of supply, as well as how the modes are differentiated in BEA data.^b Modes 1, 2, and 4 appear in the top half of the figure, under "trade in services." Mode 3 appears under "services supplied through foreign affiliates of U.S. multinational enterprises (MNEs)."



Figure 1.A Modes of supply in U.S. services trade

Source: Allen et al., "The Basics of How International Services Are Supplied," October 2018.

Note: MNEs = multinational enterprises.

^a WTO, "Basic Purpose and Concepts," accessed January 11, 2023.

^b After income generated through affiliate transactions has been repatriated to the United States, it appears as direct investment income in the U.S. balance of payments. USDOC, BEA, "U.S. International Economic Accounts: Concepts and Methods," June 2022, 122.

As defined by the BEA, cross-border services trade occurs when suppliers in one country sell services to consumers in another country, with people, information, or money crossing national borders. Firms also provide services to foreign consumers through affiliates established in host (i.e., foreign) countries.¹⁰ After income generated through affiliate transactions has been repatriated to the United States, it appears as direct investment income in the U.S. balance of payments.¹¹

¹⁰ USDOC, BEA, "U.S. International Economic Accounts: Concepts and Methods," June 2022, 262.

¹¹ USDOC, BEA, "U.S. International Economic Accounts: Concepts and Methods," June 2022, 122.

GATS mode 1 and mode 2 transactions, as well as some mode 4 transactions, are generally grouped together in the BEA's data on cross-border trade. Mode 3 transactions are included, with some exceptions, in the BEA's affiliate transactions data.¹²

This report focuses on the BEA's "private services" data. As a result, the export and import data presented throughout this report exclude government transactions, which primarily consist of services supplied in support of operations of the U.S. military and U.S. embassies in foreign countries.

Aggregated data on cross-border trade in services appear in the balance of payments statistics published quarterly for the United States by the BEA, and annually in the WTO's global services trade data.¹³ The term "commercial services" used in the WTO services trade data is roughly equivalent to the term "private services" used in BEA services trade data. Like the BEA's cross-border trade data, the WTO's cross-border trade data roughly correspond to modes 1, 2, and 4, as specified in GATS.¹⁴

The BEA also uses survey data to publish more detailed annual data for cross-border services trade and foreign affiliate transactions of the United States. These data are sorted by partner country and by industry at the finest level of detail that the BEA's survey and confidentiality policies allow. Data are suppressed for certain industries or sectors for which disclosure could potentially reveal confidential information about individual companies.¹⁵ Data on cross-border trade and foreign affiliate transactions are available for many subcategories of distribution services, including different modes of transportation, trade-related services, and wholesale and retail trade. More information on the data coverage for distribution services is available in chapter 2.

Beginning in 2009, the BEA began efforts to restructure its international trade data following the release of the IMF's *Balance of Payments and International Investment Position Manual, Sixth Edition (BPM6)*. The BEA implemented changes to bring U.S. services trade statistics in line with BPM6 gradually, expanding detail in its international trade in services statistics in 2014 and 2020.¹⁶ Most recently, the BEA made updates to services trade data for its July 2022 release by incorporating data from the 2019 *Benchmark Survey of Financial Services Transactions Between U.S. Financial Services Providers and Foreign Persons* into estimates of cross-border financial services imports and exports.¹⁷

The BEA's survey-based statistics are collected and published in two different ways. For cross-border services trade, statistics are based on the type of service traded. For services supplied through affiliates,

¹² USDOC, BEA, "U.S. International Economic Accounts: Concepts and Methods," June 2022, 263. Some statistics on services supplied through mode 4 may also be commingled with statistics on compensation of employees. Similarly, temporary intracompany transfers to affiliates may appear in foreign affiliate sales rather than cross-border statistics. The channel of delivery that service providers use is determined primarily by the nature of the service. For example, retail services are generally supplied through affiliates, but transportation services are generally supplied across borders.

¹³ WTO, "Trade in Commercial Services," accessed January 4, 2023; BEA, "Table 1.1 U.S. International Transactions," September 22, 2022.

¹⁴ WTO, World Trade Statistical Review 2022, 2022.

¹⁵ USDOC, BEA, "U.S. International Economic Accounts: Concepts and Methods," June 2022, 24, 247–48.

¹⁶ USDOC, BEA, "U.S. International Economic Accounts: Concepts and Methods," June 2022, 11, 13–14.

¹⁷ USDOC, BEA, "Annual Update of the U.S. International Transactions Accounts," July 2022, 3.

statistics are based on the affiliates' primary industry.¹⁸ As a result, comparability at the sector level between statistics for cross-border trade and foreign affiliate sales is limited. As an illustrative example, a company like Amazon.com, Inc. (Amazon)—a multinational technology firm focusing on e-commerce, cloud computing, online advertising, digital streaming, and artificial intelligence—would likely report cross-border trade data for different segments of its business, including trade in cloud computing services, audiovisual services, and transportation services, but may be classified as a retail service provider, given its large e-commerce segment. Thus, its foreign affiliate sales of cloud computing services category, in the BEA's affiliate transactions data.¹⁹

This report uses the latest available services trade data for each source described above. As of the date of publication, WTO cross-border data were available through 2021. Annual data on cross-border trade from the BEA were available through 2021 (with preliminary data available for 2022); BEA data on affiliate transactions were available through 2020. Because the latest year differs for which such data are available, data on market conditions in each specific industry covered in this report may span different years.

U.S. Services Sector

The U.S. services sector was the largest share of the U.S. economy in 2021. In real value-added terms, U.S. private service-supplying industries contributed \$13.7 trillion, or 79.2 percent, to U.S. GDP. By comparison, goods-producing industries contributed \$3.6 trillion (20.8 percent) to the GDP.²⁰

Services-supplying industries also accounted for the majority of full-time equivalent (FTE) employees in the U.S. economy in 2021, with 84.7 percent of all private employment, or 117.3 million FTE employees. Goods-producing industries accounted for 15.3 percent of private employment, or 21.2 million FTE employees.²¹

From 2017 to 2021, U.S. service-supplying industries increased real output by 10.5 percent, from \$12.4 trillion to \$13.7 trillion (figure 1.1), posting an average annual growth rate of 2.6 percent. This growth rate is faster than that of goods-producing industries, which increased at an average annual rate of roughly 1.2 percent during this same period.²² The number of FTE employees in U.S. services-supplying

¹⁸ USDOC, BEA, "U.S. International Economic Accounts: Concepts and Methods," June 2022, 238. See chapter 2 for further discussion of the ways that services trade data are classified, as well as information about sector-specific data collection and classification.

¹⁹ Transactions are reported by industry rather than type of product, and the affiliate transaction data include ancillary services provided by firms in the agriculture, manufacturing, and mining industries. For fiscal year 2021, Amazon reported that 51 percent of its net sales came from online and physical stores. Amazon.com, Inc., *Amazon, Annual Report, 2021*, 2022, 65; USDOC, BEA, "U.S. International Economic Accounts: Concepts and Methods," June 2022, 240.

²⁰ USDOC, BEA, "Real Value Added by Industry," December 22, 2022.

²¹ USDOC, BEA, table 6.5D, "Full-Time Equivalent Employees, by Industry," September 30, 2022. The BEA defines FTE employees as "equal [to] the number of employees on full-time schedules plus the number of employees on part-time schedules converted to full-time. The number of FTE employees in each industry is the product of the total number of employees and the ratio of average weekly hours per employee for all employees to average weekly hours per employee on full-time schedules."

²² USDOC, BEA, "Real Value Added by Industry," December 22, 2022.

industries increased by 7.6 percent from 2017 to 2021, compared to an increase of 5.9 percent for goods-producing industries.²³



Figure 1.1 Real value-added by U.S. industry, 2017–21

In trillions of dollars. Underlying data for this figure can be found in appendix B, table B.1.

Source: USDOC, BEA, "Real Value Added by Industry," September 29, 2022.

Notes: Estimates are chained 2012 dollars. For a further explanation of the use of chained U.S. dollars by the BEA, see USDOC, BEA, "Chaineddollar estimates," April 25, 2018. Private goods-producing industries include agriculture, forestry, fishing, and hunting; mining; construction; and manufacturing. Private service-producing industries include utilities; wholesale trade; retail trade; transportation and warehousing; information; finance, insurance, real estate, rental, and leasing; professional and business services; educational services, health care, and social assistance; arts, entertainment, recreation, accommodation, and food services; and other services, except government services.

Global Services Trade

The United States was the world's largest cross-border exporter of commercial services in 2021, supplying \$771.9 billion (12.9 percent) of global exports (figure 1.2). The United Kingdom (UK) and China followed, with \$415.4 billion (6.9 percent) and \$390.6 billion (6.5 percent), respectively, of total global services exports in 2021. The United States was also the largest global importer of services, accounting for \$524.9 billion (9.5 percent) of all cross-border services imports in 2021 (figure 1.3). Other large importing countries included China, which accounted for \$438.1 billion (7.9 percent) of imports, and Germany, which accounted for \$379.3 billion (6.8 percent).²⁴

²³ USDOC, BEA, table 6.5D, "Full-Time Equivalent Employees, by Industry," September 30, 2022. ²⁴ WTO, "Trade in Commercial Services," accessed January 4, 2023.



Source: WTO, Statistics Database, Time Series on International Trade, "Trade in Commercial Services," July 2022. Notes: Exports of commercial services exclude public sector transactions. Total services exports do not equal total services imports because of difficulty measuring and reporting services trade data. Total services exports do not equal total services imports because of difficulty measuring and reporting services trade data. The WTO reports data on global services trade, which are sourced from the IMF, Eurostat, OECD and national sources. The asymmetry between total exports and imports may come from differences in how sources are measured. Because of rounding, figures may not add to 100 percent.



Source: WTO, Statistics Database, Time Series on International Trade, "Trade in Commercial Services," July 2022. Notes: Imports of commercial services exclude public sector transactions. Total services exports do not equal total services imports because of difficulty measuring and reporting services trade data. Because of rounding, figures may not add to 100 percent.

International data on trade in services through foreign affiliates are considerably more limited than data on cross-border services trade. However, the latest available data for foreign affiliate sales in other markets suggest that the United States also represents the largest source of foreign affiliate sales globally, exceeding reported sales by foreign affiliates of EU and Chinese firms in 2019.²⁵

U.S. Cross-Border Services Trade

The United States was a net exporter of commercial services in 2021, with a cross-border trade surplus of \$247.0 billion. In 2021, U.S. cross-border exports of services increased by 9.6 percent. This rebound suggests some recovery from the initial negative shock of the COVID-19 pandemic in 2020, though exports have not yet returned to pre-pandemic levels (figure 1.4). Similarly, U.S. cross-border imports increased by 18.8 percent in 2021 but did not reach 2019 levels.²⁶

²⁵ 2019 represents the last year of available data for foreign affiliate sales for EU and Chinese firms. WTO, "FATS-Sales by Service Sector (Outward)," accessed January 4, 2023.

²⁶ USDOC, BEA, table 2.1, "U.S. Trade in Services, by Type of Service," July 7, 2022, 1.



Source: USDOC, BEA, table 2.1, "U.S. Trade in Services, by Type of Service," July 7, 2022.

The largest segment of both U.S. cross-border exports and imports in 2021 was professional services.²⁷ In that year, cross-border exports of professional services totaled \$282.6 billion (36.6 percent of total U.S. service exports), followed by financial services²⁸ (\$194.5 billion; 25.2 percent) and digital and electronic services²⁹ (\$116.9 billion; 15.2 percent) (figure 1.5). In 2021, cross-border imports of professional services totaled \$156.1 billion, or 29.7 percent of total cross-border service imports, followed by financial services (\$108.9 billion; 20.7 percent) and distribution services (\$91.2 billion; 17.4 percent) (figure 1.6).

In most service sectors, the United States ran a cross-border trade surplus, with the largest surplus in professional services (\$126.5 billion), followed by financial services (\$85.6 billion) and digital and electronic services (\$34.8 billion). The only sector to register a cross-border deficit was the distribution services sector (-\$36.2 billion).³⁰

²⁷ Professional services include the following BEA categories: accounting, auditing, and bookkeeping services; advertising services; architectural services; business, management consulting, and public relations services; education services; engineering services; health services; legal services, licenses for the use of outcomes of research and development; maintenance and repair services not included elsewhere; research and development services; and scientific and other technical services.

²⁸ Financial services include the following BEA categories: insurance services and financial services. Cross-border trade data from the BEA on financial services encompass securities services, banking services, insurance services, and rental and leasing services (excluding real estate). Other aspects of financial services, such as retail banking, are reported as affiliate transactions.

²⁹ Digital and electronic services include the following BEA categories: audiovisual services, computer services, computer software, information services, and telecommunications services.

³⁰ USDOC, BEA, table 2.1, "U.S. Trade in Services, by Type of Service," July 7, 2022. Distribution services include air transport services (e.g., airfreight and airport services); sea transport services (e.g., sea freight and port services);



Source: USDOC, BEA, table 2.1, "U.S. Trade in Services, by Type of Service," July 7, 2022. Note: Because of rounding, figures may not add to 100 percent.

other modes of transport (e.g., road and rail transport); and trade-related services (e.g., auction services, businessto-business transaction fees, internet-based commercial exchanges, and commissions paid to independent sales agents).



Source: USDOC, BEA, table 2.1, "U.S. Trade in Services, by Type of Service," July 7, 2022. Note: Because of rounding, figures may not add to 100 percent.

In 2021, Ireland was the largest single-country destination for U.S. cross-border services exports, and the UK was the largest single-country source of imports (figures 1.7 and 1.8).³¹ U.S. exports to Ireland totaled \$74.8 billion, or 9.7 percent of total U.S. services exports, with professional services (primarily research and development (R&D) services and related licenses and management consulting services) accounting for the largest share of exports. This is followed by the UK (\$67.8 billion; 8.8 percent), with financial services accounting for the largest share of exports; the British Caribbean territories (\$57.3 billion; 7.4 percent), a destination for primarily financial services; and Canada (\$56.1 billion; 7.3 percent), with professional services (primarily advertising) representing the largest share of exports. ³² The top sources for imports in 2021 included the UK (\$61.1 billion; 11.6 percent), the largest share being financial services; Germany (\$34.7 billion; 6.6 percent), with distribution services as the largest share; and Canada (\$33.1 billion; 6.3 percent), with digital and electronic services as the largest share.³³

³¹ Prior to the COVID-19 pandemic, the UK and Canada were typically the two largest destinations for U.S. crossborder services exports. Both countries imported a large amount of travel services from the United States, however travel services imports declined significantly during the pandemic. Ireland's trade with the United States, in which research and development services and other intellectual property-related services feature heavily, were less affected.

³² Firms' global tax strategies explain some of the geographic trends in R&D services activities and trade, such as R&D service exports to Ireland. See USITC, *Recent Trends in U.S. Services Trade, 2021*, chapter 2: "Special Topic: Understanding Trade Statistics for Research and Development Services". Similarly, as a destination for U.S. financial services exports, the Cayman Islands and other international financial centers in the Caribbean reportedly provide favorable regulations, streamlined company registration procedures, and zero percent taxation rates for most income. See USITC, *Recent Trends in U.S. Services Trade, 2020*, July 2020, 38. The British Caribbean islands, referred to by the BEA as "UK Islands, Caribbean," includes the following four UK overseas territories: the British Virgin Islands, the Cayman Islands, Montserrat, and the Turks and Caicos Islands.

³³ USDOC, BEA, table 2.2, "U.S. Trade in Services, by Type of Service and by Country or Affiliation," July 7, 2022.



Source: USDOC, BEA, table 2.2, "U.S. Trade in Services, by Type of Service and by Country or Affiliation," July 7, 2022. Notes: The British Caribbean islands, referred to by the BEA as "UK Islands, Caribbean," includes the following UK overseas territories: the British Virgin Islands, the Cayman Islands, Montserrat, and the Turks and Caicos Islands. Because of rounding, figures may not add to 100 percent.



In percentages. Underlying data for this figure can be found in appendix B, table B.8.





Source: USDOC, BEA, table 2.2, "U.S. Trade in Services, by Type of Service and by Country or Affiliation," July 7, 2022. Note: Because of rounding, figures may not add to 100 percent.

Cross-Border Trade: Preliminary 2022 Data

In addition to the cross-border trade data presented above for 2021, preliminary cross-border services trade data are also available for 2022.³⁴ Preliminary data on U.S. cross-border services trade for 2022 show that total services exports were 15.9 percent higher in 2022 compared to 2021 (table 1.1). During this period, exports in most sectors grew significantly. The most notable increase was in travel and passenger fares, for which exports increased by 98.3 percent. Other sectors with large increases in exports during this period included air transport (excluding passenger fares) (25.1 percent increase) and research and development services (19.4 percent increase). In contrast, financial and insurance services saw small decreases in exports between 2021 and 2022 (-0.8 percent and -4.0 percent, respectively).³⁵

in billions of dollars. h.i.e. = not included elsewhere.		
Services category	2021	2022
Financial services	171.7	170.4
Professional and management consulting services	132.5	142.2
Research and development services	47.2	56.3
Travel and passenger fares	83.0	164.5
Telecommunications, computer, and information services	59.8	67.6
Technical, trade-related, and other business services	37.8	42.1
Personal, cultural, and recreational services	23.9	26.0
Air transport (excludes passenger fares)	28.6	35.8
Sea transport	19.6	20.0
Insurance services	22.7	21.8
Other services n.i.e.	145.1	147.5
Total cross-border exports	771.9	894.3

Table 1.1 Total U.S. private cross-border services exports (preliminary), by category, 2021–22

 In billions of dollars. n.i.e. = not included elsewhere.

Source: USDOC, BEA, table 3.1, "U.S. International Trade in Services," March 23, 2023.

Notes: Data for 2022 are preliminary. Data exclude public sector services transactions. Because of rounding, figures may not add to totals shown. Research and development services includes licenses for the use of outcomes of research and development. Other services include maintenance and repair services n.i.e., other modes of transportation, construction, licenses to reproduce or distribute computer software, and audiovisual products.

Preliminary data on U.S. cross-border services imports in 2022 also show considerable increases in sector-specific imports compared to 2021 (table 1.2). Travel and passenger fares posted the largest growth in imports (119.5 percent), followed by sea transport (32.3 percent) and financial services (10.4 percent). Imports also increased in all other services sectors except for insurance services, which decreased slightly (-0.5 percent).³⁶

³⁴ These data include more aggregated services categories than the individual distribution services categories presented in chapter 2 of this report.

³⁵ USDOC, BEA, table 3.1, "U.S. International Trade in Services," December 21, 2022.

³⁶ USDOC, BEA, table 3.1, "U.S. International Trade in Services," December 21, 2022.

In billions of donars, hille Thermoladed elsewhere.		
Services category	2021	2022
Financial services	49.5	54.7
Professional and management consulting services	63.6	66.8
Research and development services	32.9	34.8
Travel and passenger fares	73.5	161.3
Telecommunications, computer, and information services	43.1	46.7
Technical, trade-related, and other business services	33.1	35.4
Personal, cultural, and recreational services	28.3	29.4
Air transport (excludes passenger fares)	28.7	30.3
Sea transport	55.9	73.9
Insurance services	59.4	59.1
Other services n.i.e.	56.9	62.6
Total cross-border imports	524.9	655.0

Table 1.2 Total U.S. private cross-border services imports (preliminary), by category, 2021–22.

 In billions of dollars. n.i.e = not included elsewhere.

Source: USDOC, BEA, table 3.1, "U.S. International Trade in Services," December 21, 2022.

Notes: Data for 2022 are preliminary. Data exclude public sector services transactions. Because of rounding, figures may not add to totals shown. Research and development services includes licenses for the use of outcomes of research and development. Other services n.i.e. includes maintenance and repair services n.i.e., other modes of transportation, construction, licenses to reproduce or distribute computer software, and audiovisual products.

Affiliate Transactions

Overall, U.S. sales and purchases of services through foreign affiliates (based on the affiliates' primary industry) were consistently larger than U.S. cross-border services exports and imports (based on type of service) during 2016–20. The latest data available from the BEA on affiliate transactions are for 2020. In that year, sales of services by U.S.-owned foreign affiliates abroad totaled \$1.6 trillion—a 4.7 percent decline compared to 2019—after experiencing average annual growth of 5.4 percent during 2016–19.³⁷ Similarly, purchases of services from foreign-owned affiliates in the United States declined by 4.6 percent to \$1.2 trillion in 2020, following average annual growth of 7.4 percent during 2016–19. Throughout the entire 2016–20 period, the value of services sales by U.S.-owned foreign affiliates exceeded purchases of services from foreign-owned affiliates in the United States (figure 1.9).³⁸

³⁷ USDOC, BEA, table 4.1, "Services Supplied to Foreign Persons by U.S. MNEs through Their MOFAs, by Industry of Affiliate and by Country of Affiliate," October 19, 2022.

³⁸ USDOC, BEA, table 5.1, "Services Supplied to U.S. Persons by Foreign MNEs Through Their MOUSAs, by Industry of Affiliate and by Country of UBO," October 19, 2022.



In billions of dollars. Underlying data for this figure can be found in appendix B, table B.9.

Source: USDOC, BEA, table 4.1, "Services Supplied to Foreign Persons by U.S. MNEs through Their MOFAs, by Industry and Affiliate and by Country of Affiliate," October 19, 2022; table 5.1, "Services Supplied to U.S. Persons by Foreign MNEs through Their MOUSA, by Industry of Affiliate and by Country of UBO," October 19, 2022.

Notes: MNEs = multinational enterprises; MOFAs = majority-owned foreign affiliates; MOUSA = majority-owned U.S. affiliate; UBO = ultimate beneficial owner. Sales by U.S.-owned foreign affiliates include services supplied by majority-owned foreign affiliates of U.S. parent firms. Purchases from foreign-owned U.S. affiliates include services supplied by MOUSAs of foreign parent firms.

In 2020, distribution services³⁹ accounted for the largest share of services sales by foreign affiliates of U.S.-owned firms (\$451.4 billion; 27.4 percent), followed by financial services⁴⁰ (\$320.9 billion; 19.5 percent) and digital and electronic services⁴¹ (\$272.5 billion; 16.5 percent) (figure 1.10).⁴² Top markets for sales of services by U.S.-owned affiliates included the UK (\$274.5 billion), Ireland (\$172.2 billion), and Canada (\$121.3 billion).43

³⁹ For affiliate sales, distribution services include the following three BEA categories: retail trade, wholesale trade, and transportation and warehousing.

⁴⁰ Financial services include banking and insurance services.

⁴¹ Digital and electronic services include broadcasting services; computer systems design and related services; data processing, hosting, and related services; motion picture and sound recording; software publishing; telecommunications services; and other information services.

⁴² Following the BEA definition, "U.S. firms" are entities established in the United States that have less than 50 percent foreign ownership. USDOC, BEA, "U.S. International Economic Accounts: Concepts and Methods," June 2022, 229. For more information on the treatment of firm ownership in foreign affiliate data, see USDOC, BEA, "How Are BEA's Statistics on the Activities of U.S. Multinational Enterprises (MNEs) Affected by the Complex Corporate Structures of MNEs," January 23, 2020.

⁴³ USDOC. BEA, table 4.1, "Services Supplied to Foreign Persons by U.S. MNEs through Their MOFAs, by Industry of Affiliate and by Country of Affiliate," October 19, 2022.

Figure 1.10 U.S. services: Affiliate sales by U.S.-owned foreign affiliates, by industry, 2020

In percentages. Underlying data for this figure can be found in appendix B, table B.10.





Source: USDOC, BEA, table 4.1, "Services Supplied to Foreign Persons by U.S. MNEs through Their MOFAs, by Industry of Affiliate and by Country of Affiliate," October 19, 2022.

Notes: MNEs = multinational enterprises; MOFAs = majority-owned foreign affiliates; MOUSAs = majority-owned U.S. affiliates; UBO = ultimate beneficial owner. Sales by U.S.-owned foreign affiliates include services supplied by majority-owned foreign affiliates of U.S. parent firms. Because of rounding, figures may not add to 100 percent. "Manufacturing" includes ancillary services provided by goods manufacturers. "All other" includes ancillary services provided in the mining, agriculture, and other sectors, as well as suppressed data.

Distribution services also accounted for the largest share of U.S. purchases from U.S.-based affiliates of foreign firms in 2020 (\$347.9 billion; 29.5 percent), followed by financial services (\$224.4 billion; 19.0 percent) and digital and electronic services (\$152.9 billion, 13.0 percent) (figure 1.11). German-owned affiliates in the United States accounted for the largest share of foreign affiliate purchases (\$170.4 billion), followed by UK-owned (\$160 billion) and Canadian-owned (\$143.9 billion) affiliates.⁴⁴

⁴⁴ USDOC, BEA, table 5.1, "Services Supplied to U.S. Persons by Foreign MNEs Through Their MOUSAs, by Industry of Affiliate and by Country of UBO," October 19, 2022.

Figure 1.11 U.S. services: Purchases from foreign-owned U.S. affiliates, by industry, 2020

In percentages. Underlying data for this figure can be found in appendix B, table B.11.



Purchases from foreign-owned U.S. affiliates total: \$1.2 trillion

Source: USDOC, BEA, table 5.1, "Services Supplied to U.S. Persons by Foreign MNEs though Their MOUSAs, by Industry of Affiliate and by Country of UBO," October 19, 2022.

Notes: Purchases from foreign-owned U.S. affiliates includes services supplied by majority-owned U.S. affiliates of foreign parent firms. Because of rounding, figures may not add to 100 percent. "Manufacturing" includes ancillary services provided by goods manufacturers. "All other" includes ancillary services provided in the mining, agriculture, and other sectors, as well as suppressed data.

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Recent Trends in U.S. Services Trade: 2023 Annual Report
Chapter 2 Distribution Services

Overview

Distribution services include the wide range of activities that facilitate the movement of goods through the supply chain—from producer to end user. Wholesale and retail services firms form the core of the distribution services industry. Logistics and transportation services companies provide vital connections between manufacturers, wholesalers, retailers, and final customers. The distribution services industry also includes several types of firms that ease the conveyance of intermediate and final goods through complex—and increasingly global—distribution networks. These intermediaries include, for example, freight forwarders (which typically consolidate cargo for delivery by air or ocean carriers) and third-party logistics providers (which coordinate and manage the movement of goods through each link of the supply chain).⁴⁵

An efficient distribution services sector enables the global trading system and improves overall economic welfare. By contrast, inefficient distribution services can lead to misallocation of resources and increasing costs.⁴⁶ Generally, "lower transport costs are associated with the integration of markets. These linkages support economic development and contribute to the growth in income."⁴⁷ Efficient distribution firms also enable global consumers to benefit more fully from the liberalization of trade restrictions, offering them access to a diverse array of products at lower prices.⁴⁸

U.S. Trade in Distribution Services

This section provides an overview of the composition of U.S. international trade in distribution services, in terms of both cross-border trade and foreign affiliate sales. Similar to most other services sectors, cross-border trade flows of distribution services tend to be significantly smaller than foreign affiliate sales and purchases. For example, foreign affiliate sales includes wholesale and retail trade, which combined are roughly four times as large as cross-border trade in transportation services.

⁴⁵ WTO, "Distribution Services: Background Note by the Secretariat," October 29, 2010; SelectUSA, "The Logistics and Transportation Industry," accessed December 22, 2022; DSV, What is Freight Forwarding?," accessed December 22, 2022; Blume Global, "What Services Do Third-Party Logistics Providers Offer?," accessed December 22, 2022.

⁴⁶ For example, ". . . if distribution services are unreliable and infrequent, or if a country lacks third-party logistics providers who efficiently handle small shipments, firms are likely to maintain higher inventory holdings—at every stage of the supply chain. The costs of financing large inventories can be significant, especially in countries with high real interest rates." Mattoo, *A Handbook of International Trade in Services*, 2007, 356–59; WTO, "Services: Sector by Sector, Distribution Services," accessed December 23, 2022.

⁴⁷ Mattoo, A Handbook of International Trade in Services, 2007, 356–59.

⁴⁸ Because the costs associated with distribution make up a significant portion of the retail price of most goods typically 10–50 percent—the distribution sector plays a major role in price formation, with more efficient systems facilitating lower prices. Pilat, "Regulation and Performance," 1997, 3–4.

Cross-Border Trade⁴⁹

In 2021, U.S. cross-border exports of distribution services grew by 17.4 percent to \$55.0 billion, accounting for 7.1 percent of total U.S. cross-border exports. Top destinations for U.S. exports included Japan (8.8 percent), the Republic of Korea (South Korea) (8.3 percent), Germany (8.2 percent), Canada (8.0 percent), and China (5.5 percent) (figure 2.1).⁵⁰

Figure 2.1 Distribution services: U.S. cross-border exports, by trading partner, 2021

Total in billions of dollars; exports by trading partner in percentages. Underlying data for this figure can be found in appendix B, <u>table B.12</u>.



Export total: \$55.0 billion

Source: U.S. Department of Commerce (USDOC), Bureau of Economic Analysis (BEA), table 2.2, "U.S. Trade in Services, by Type of Service and by Country or Affiliation, 2021," July 7, 2022.

Notes: Distribution services comprise four categories as defined by the Bureau of Economic Analysis (BEA): sea transport, air transport, other modes of transport, and trade-related services. Because of rounding, figures may not add to 100 percent. Of the countries listed in figure 2.1, the BEA suppressed the "trade-related services" category in 2021 for Canada, France, and China to avoid the disclosure of data of individual companies. As a result, the shares for these countries may be understated.

U.S. cross-border imports of distribution services totaled \$91.2 billion in 2021, accounting for 17.4 percent of total U.S. cross-border imports and representing a 47.7 percent increase in such imports compared to 2020. Top sources of cross-border imports included Japan (9.6 percent), China (9.3 percent), Taiwan (8.7 percent), Denmark (8.1 percent), and Switzerland (7.4 percent) (figure 2.2). As

⁴⁹ For the purposes of this report, cross-border exports and imports of distribution services include the following U.S. Department of Commerce (USDOC) Bureau of Economic Analysis (BEA) categories: sea transport, air transport (freight and port services only; passenger services are excluded), other modes of transport, and trade-related services.

⁵⁰ Of the countries listed in the figure 2.1, the BEA suppressed the "trade-related services" category in 2021 for Canada, France, and China to avoid the disclosure of data of individual companies. As a result, the shares for these countries may be understated. USDOC, BEA, table 2.2, "U.S. Trade in Services, by Type of Service and by Country or Affiliation," July 7, 2022.

mentioned in chapter 1, distribution services was the only services sector to register a cross-border deficit in 2021 (\$36.2 billion). During 2017–20, the trade deficit associated with distribution services grew consistently, from \$7.2 billion in 2017 to \$14.8 billion by the end of 2020.

Figure 2.2 Distribution services: U.S. cross-border imports, by trading partner, 2021

Total in billions of dollars; imports by trading partner in percentages. Underlying data for this figure can be found in appendix B, <u>table B.13</u>.



Import total: \$91.2 billion

Source: USDOC, BEA, table 2.2, "U.S. Trade in Services, by Type of Service and by Country or Affiliation," July 7, 2022. Notes: Distribution services comprise four categories as defined by the Bureau of Economic Analysis (BEA): sea transport, air transport, other modes of transport, and trade-related services. Because of rounding, figures may not add to 100 percent.

Air transport⁵¹ represented the largest share of U.S. cross-border exports of distribution services, with 52.1 percent (figure 2.3). Sea transport was the largest share of U.S. cross-border imports, accounting for 61.3 percent imports figure 2.4). Conversely, sea transport and air transport accounted for the second-largest shares of U.S. distribution services cross border exports (35.5 percent) and imports (31.4 percent), respectively.

⁵¹ For the purposes of this report, air transport consists of freight and port services; passenger services are excluded.

Figure 2.3 Distribution services: U.S. cross-border exports, by industry, 2021

Total in billions of dollars; exports by industry in percentages. Underlying data for this figure can be found in appendix B, table B.14.



Export total: \$55.0 billion

Source: USDOC, BEA, table 2.1, "U.S. Trade in Services, by Type of Service," July 7, 2022. Notes: Because of rounding, figures may not add to 100 percent. The "Other modes of transport" category includes postal services; port services for rail; and freight services performed via truck, rail, pipeline, and space transport. Trade-related services cover commissions on goods and services transactions payable to merchants, commodity brokers, dealers, auctioneers, and commission agents.

Figure 2.4 Distribution services: U.S. cross-border imports, by industry, 2021

Total in billions of dollars; imports by industry in percentages. Underlying data for this figure can be found in appendix B, <u>table</u> <u>B.15</u>.

Import total: \$91.2 billion



Source: USDOC, BEA, table 2.1, "U.S. Trade in Services, by Type of Service," July 7, 2022.

Notes: Because of rounding, figures may not add to 100 percent. The "Other modes of transport" category includes postal services; port services for rail; and freight services performed via truck, rail, pipeline, and space transport. Trade-related services cover commissions on goods and services transactions payable to merchants, commodity brokers, dealers, auctioneers, and commission agents.

Affiliate Transactions

In 2020, the latest year for which data are available, sales by U.S.-owned foreign affiliates abroad in the distribution services sector were \$451.4 billion.⁵² Purchases from the affiliates of foreign-owned companies located in the United States totaled \$347.9 billion. Wholesale trade accounted for the largest share of both sales and purchases (52.6 percent and 55.8 percent, respectively). Retail trade made up the second-largest share of both categories (25.9 percent of sales and 25.1 percent of purchases) (figures 2.5 and 2.6).



Source: USDOC, BEA, table 4.1, "Services Supplied to Foreign Persons by U.S. MNEs Through Their MOFAs, by Industry of Affiliate and by Country of Affiliate," October 19, 2022.

Notes: MNEs = multinational enterprises; MOFAs = majority-owned foreign affiliates. Because of rounding, figures may not add to 100 percent.

⁵² For the purposes of this report, affiliate sales and purchases of distribution services include the following BEA categories: wholesale trade, retail trade, and transportation and warehousing.

Figure 2.6 Distribution services: Purchases from foreign-owned U.S. affiliates, by industry, 2020

Total in billions of dollars; purchases by industry in percentages. Underlying data for this figure can be found in appendix B, table B.17.



Total: \$347.9 billion

Source: USDOC, BEA, table 5.1, "Services Supplied to U.S. Persons by Foreign MNEs through Their (MOUSAs), by Industry of Affiliate and by Country of UBO," October 19, 2022.

Notes: MNEs = multinational enterprises; MOUSAs = majority-owned U.S. affiliates; UBO = ultimate beneficial owner. Because of rounding, figures may not add to 100 percent.

Trends in U.S. Trade in Distribution Services by Sector

This section provides additional detail on trade in distribution services for the four industries included in the cross-border trade category (sea transport, air transport, other modes of transport, and trade-related services) and the three industries included in the foreign affiliate sales category (wholesale trade, retail trade, and other transportation and warehousing). Recent developments and trends in several of these subsectors are discussed in chapters 3 and 4. The special topic section at the end of this chapter provides an overview of how the COVID-19 pandemic impacted international services trade. Additional detail on services trade—including data on the industry composition of U.S. services trade with major trading partners and data on U.S. trade in services industries not covered in this report—is available in the interactive tables accompanying this report.⁵³

⁵³ Interactive charts and associated alternative text are available at <u>https://www.usitc.gov/publications/industry_econ_analysis_332/2023/recent_trends_us_services_trade_2023_an_nual_report</u>.

Cross-Border Trade

Sea Transport

Sea transport consists of freight services and port services. U.S. freight services exports include receipts of U.S. vessel operators for transporting U.S. goods exports to foreign ports and transporting goods between foreign ports. U.S. freight services imports include U.S. payments to foreign vessel operators for transporting U.S. goods imports from foreign ports to U.S. ports. Freight services also include short-term operating leases of transportation equipment and crew, such as for a single voyage. U.S. port services exports include the value of nonfuel goods and services procured by foreign carriers in U.S. ports; imports include the value of nonfuel goods and services procured by U.S. carriers in foreign ports.⁵⁴

U.S. cross-border exports of sea transport services changed little during 2017–20, declining at an average annual rate of only 0.8 percent during the period, but grew by 10.2 percent to \$19.6 billion in 2021 (figure 2.7). U.S. cross-border imports, on the other hand, grew by 63.6 percent to \$55.9 billion in 2021, substantially faster than the 2.9 percent average annual growth rate during 2017–20.



Figure 2.7 Sea transport: Cross-border exports and imports, 2017–21

Source: USDOC, BEA, table 2.1, "U.S. Trade in Services, by Type of Service," July 7, 2022.

⁵⁴ USDOC, BEA, U.S. International Economic Accounts: Concepts and Methods, June 2022, 96.

Air Transport

For the purposes of this report, air transport consists of freight and airport services; passenger services are excluded. U.S. airfreight services exports cover the transport by U.S. air carriers of U.S. goods exports from the United States to foreign points and the transport of goods between two foreign points. U.S. imports cover the transport by foreign air carriers of U.S. goods imports from foreign countries to U.S. points. Airport services include the value of nonfuel goods and services procured by foreign air carriers in U.S. airports (exports) and by U.S. air carriers in foreign airports (imports).⁵⁵

In 2021, U.S. cross-border exports of air transport services totaled \$28.6 billion, up 25.2 percent compared to 2020. Similarly, U.S. imports of these services increased by 32.2 percent to \$28.7 billion in 2021. During 2017–19, exports increased at an average annual rate of 2.2 percent and imports increased at an average annual rate of 4.1 percent, before declining 18.2 and 8.0 percent, respectively, in 2020. (figure 2.8).



Figure 2.8 Air transport: Cross-border exports and imports, 2017–21

Source: USDOC, BEA, table 2.1, "U.S. Trade in Services, by Type of Service," July 7, 2022.

⁵⁵ USDOC, BEA, U.S. International Economic Accounts: Concepts and Methods, June 2022, 98.

Other Modes of Transport

The "Other modes of transport" category includes postal services; port services for rail; and freight services performed via truck, rail, pipeline, and space transport.⁵⁶

In 2021, U.S. exports of other modes of transport grew by a relatively modest 2.8 percent to \$4.8 billion. Overall, such exports were relatively unchanged during 2017–21, with the 2021 value slightly lower than that of 2018 (figure 2.9). On the other hand, U.S. imports of such services trended downward during 2017–20—exhibiting an average annual decline of 3.0 percent—but grew by 14.3 percent to \$4.0 billion in 2021.



Source: USDOC, BEA, table 2.1, "U.S. Trade in Services, by Type of Service," July 7, 2022. The "Other modes of transport" category includes postal services; port services for rail; and freight services performed via truck, rail, pipeline, and space transport.

Trade-Related Services

Trade-related services cover commissions on goods and services transactions payable to merchants, commodity brokers, dealers, auctioneers, and commission agents. For example, these services include the auctioneer's fee or agent's commission on sales of ships, aircraft, and other goods.⁵⁷

U.S. exports of trade-related services grew by 31.4 percent to \$2.0 billion in 2021, as compared to an average annual decline of 11.1 percent posted during 2017–20 (figure 2.10). In that same year, U.S. imports of such services increased by 10.2 percent, rebounding after a decline in 2020.

⁵⁶ USDOC, BEA, U.S. International Economic Accounts: Concepts and Methods, June 2022, 99.

⁵⁷ IMF, Balance of Payments and International Investment Position Manual, 2009, 179.



In billions of dollars. Underlying data for this figure can be found in appendix B, table B.21.

Figure 2.10 Trade-related services: Cross-border exports and imports, 2017–21

Source: USDOC, BEA, table 2.1, "U.S. Trade in Services, by Type of Service," July 7, 2022. Trade-related services cover commissions on goods and services transactions payable to merchants, commodity brokers, dealers, auctioneers, and commission agents.

Affiliate Transactions

Wholesale Trade

The wholesale trade sector comprises businesses engaged in wholesaling merchandise, generally without transformation, and rendering services incidental to the sale of merchandise. The wholesaling process is an intermediate step in the distribution of merchandise. Wholesalers are organized to sell or arrange the purchase or sale of (1) goods for resale (goods sold to other wholesalers or retailers), (2) capital or durable nonconsumer goods, and (3) raw and intermediate materials and supplies used in production. Wholesalers sell merchandise to other businesses and normally operate from warehouses or offices. In general, wholesaling is characterized by sales in large volumes, though durable nonconsumer goods may be sold in single units.⁵⁸

Sales by U.S.-owned foreign affiliates in the wholesale trade sector totaled \$237.5 billion in 2020, down 5.7 percent compared to the previous year (figure 2.11). Similarly, purchases from foreign-owned U.S. affiliates in this sector declined by 3.3 percent to \$194.1 billion from 2019 to 2020. During 2016–19, sales by U.S.-owned foreign affiliates in the wholesale trade sector grew at an average annual rate of 2.9 percent and purchases by foreign-owned U.S. affiliates grew by an average annual rate of 3.6 percent.

⁵⁸ USDOC, BEA, Guide to International Classifications for International Surveys 2022, April 2022, 56.



Source: USDOC, BEA, table 4.1, "Services Supplied to Foreign Persons by U.S. MNEs through Their MOFAs, by Industry of Affiliate and by Country of Affiliate," October 19, 2022; table 5.1, "Services Supplied to U.S. Persons by Foreign MNEs through Their MOUSAs, by Industry of Affiliate and by Country of UBO," October 19, 2022.

Notes: MNEs = multinational enterprises; MOFAs = majority-owned foreign affiliates; MOUSAs = majority-owned U.S. affiliates; UBO = ultimate beneficial owner.

Retail Trade

The retail trade sector comprises businesses selling merchandise, generally without transformation, and rendering services incidental to the sale of merchandise. Retail establishments typically sell merchandise to the general public for personal or household consumption, but some also serve business and institutional clients.⁵⁹

In 2020, sales by retail trade affiliates of U.S. companies in foreign countries declined by 2.9 percent to \$117.0 billion. Purchases from foreign affiliates in the United States fell by 0.7 percent to \$87.3 billion in 2020 (figure 2.12). By contrast, sales and purchases grew at average annual rates of 3.6 percent and 11.3 percent, respectively, during 2016–19.

⁵⁹ USDOC, BEA, Guide to International Classifications for International Surveys 2022, April 2022, 64.



Source: USDOC, BEA, table 4.1, "Services Supplied to Foreign Persons by U.S. MNEs through Their MOFAs, by Industry of Affiliate and by Country of Affiliate," October 19, 2022; table 5.1, "Services Supplied to U.S. Persons by Foreign MNEs through Their MOUSAs, by Industry of Affiliate and by Country of UBO," October 19, 2022.

Notes: MNEs = multinational enterprises; MOFAs = majority-owned foreign affiliates; MOUSAs = majority-owned U.S. affiliates; UBO = ultimate beneficial owner.

Transportation and Warehousing

The transportation and warehousing sector comprises businesses providing transportation and cargo, scenic and sightseeing transportation, support activities related to transportation, and warehousing and storage for goods.⁶⁰

In 2020, sales by foreign affiliates of U.S. companies in the transportation and warehousing sector declined by 2.4 percent to \$96.9 billion, a sharp contrast to the 11.1 percent average annual growth rate recorded during 2016–19 (figure 2.13). Similarly, purchases of such services from U.S. affiliates of foreign companies declined by 2.6 percent in 2020, markedly different compared to the average annual growth of 12.6 percent during the previous four years.

⁶⁰ USDOC, BEA, *Guide to International Classifications for International Surveys 2022*, April 2022, 68. The BEA definition includes passengers in the definition of transportation and warehousing.





Source: USDOC, BEA, table 4.1, "Services Supplied to Foreign Persons by U.S. MNEs through Their MOFAs, by Industry of Affiliate and by Country of Affiliate," October 19, 2022; table 5.1, "Services Supplied to U.S. Persons by Foreign MNEs through Their MOUSAs, by Industry of Affiliate and by Country of UBO," October 19, 2022.

Notes: MNEs = multinational enterprises; MOFAs = majority-owned foreign affiliates; MOUSAs = majority-owned U.S. affiliates; UBO = ultimate beneficial owner.

Special Topic: International Trade during the **COVID-19** Pandemic

The response to the COVID-19 pandemic disrupted U.S. and global trade in both goods and services, beginning in March 2020. Understanding the impacts of the response to the COVID-19 pandemic on trade is particularly salient for distribution services because of their close relationship with goods trade. During the pandemic, a variety of factors such as limits on cross-border movement of people, crew quarantines, limited passenger air travel and airfreight capacity, and consolidated shipping routes negatively affected distribution services. Such services also contributed to the trade recovery from the pandemic by responding to increased demand for goods imports when consumer preferences shifted.

Initial government responses to the pandemic (aimed at minimizing the spread of the COVID-19 virus worldwide) had the secondary effect of disrupting trade. More specifically, limits on cross-border movement of people and other restrictions on international travel limited services trade conducted via travel of the producer or consumer of the service (General Agreement on Trade in Services (GATS)mode 2 and mode 4, as described in detail in chapter 1, box 1.1).

For goods trade and distribution services that support goods trade, limits on the movement of people, including crew quarantines, introduced delays at border crossings and limited marine crew disembarkments. Furthermore, because many passenger flights also carry cargo, reduced demand for

passenger travel services led to a decrease in the number of passenger flights that could be used to ship smaller packages.⁶¹ Local restrictions, such as those limiting the types of workers who could be on a job site, also indirectly impacted trade in both goods and services. In the early stages of the pandemic, manufacturing slowdowns in China related to quarantines, roadblocks, and factory closings led container shipping firms to consolidate routes and cancel scheduled sailings beyond major ports.⁶²

Consumer preferences also shifted during 2020 and 2021 because of COVID-19-related measures (including lockdowns and travel restrictions). From January 2020 to January 2021, consumer expenditure on durable goods rose 25.5 percent and spending on services declined by 3.9 percent. Spending on both goods and services declined between March and May 2020, although spending on goods had surpassed pre-COVID-19-pandemic levels by June 2020 and spending on services did not exceed pre-pandemic levels until May 2021.⁶³ A large portion of the decline in services expenditure was due to decreased spending on travel. For example, U.S. imports of travel services (when a U.S. resident travels abroad) declined 27.9 percent from 2019 to 2020 and still had not recovered to pre-pandemic levels by the end of 2022. Conversely, imports of maritime shipping services (which carry imported goods) rose by 4.6 percent from 2019 to 2020 and by 126.4 percent from 2019 to 2022.⁶⁴

Despite the growth in distribution services in the wake of the COVID-19 pandemic, trends in other services such as travel resulted in an overall decline in services spending in 2020 and a slower recovery in overall services spending thereafter. Between the first and second quarters of 2020, global cross-border trade in goods declined by 23 percent and global trade in services declined 30 percent.⁶⁵ For the United States, goods and services exports both experienced a sharp decline beginning in the second quarter of 2020, followed by a gradual recovery thereafter to pre-pandemic levels (figure 2.14). The decline in U.S. goods exports was larger than the decline in U.S. services exports, both in terms of magnitude (\$111.4 billion vs. \$35.3 billion) and percentage change (27.8 percent vs. 17.4 percent). Goods exports recovered more quickly than services exports. For U.S. goods exports, seasonally adjusted quarterly export values reached pre-pandemic levels by the first quarter of 2021. U.S. services exports did not reach pre-pandemic levels until the fourth quarter of 2021.

⁶¹ WTO, Cross-Border Mobility, COVID-19 and Global Trade, August 25, 2020, 6–7.

⁶² USITC, *Trade Shifts 2020*, November 2021; Bradsher and Chokshi, "Virus Disrupts China's Shipping, and World Ports Feel the Impact," February 27, 2020.

⁶³ FRED, "Personal Consumption Expenditures: Services," accessed April 26, 2023; FRED, "Personal Consumption Expenditures: Durable Goods," accessed April 26, 2023.

⁶⁴ USDOC, BEA, table 3.1, "U.S. International Trade in Services," March 23, 2023.

⁶⁵ WTO, "World Trade Statistical Review 2021," 2021, 10.



Figure 2.14 U.S. cross-border exports of goods and services, quarterly, seasonally adjusted, quarterly, 2018-2022



In the case of U.S. imports, the magnitude of the decline from the first guarter of 2020 to the second quarter was larger for goods imports (\$86.0 billion) than services imports (\$34.9 billion) (figure 2.15). In terms of percentage, however, the services decline (25.6 percent) was larger than the decrease in goods imports (14.4 percent). Additionally, goods imports returned to pre-pandemic levels by the third quarter of 2020, increasing at a faster rate than during the pre-pandemic period. In contrast, services imports did not recover until the third quarter of 2021. This rapid recovery in goods imports likely reflects the sharp swings in U.S. consumer demand during the pandemic. Consumer preferences shifted from purchasing services (like travel) toward recreational goods (like consumer electronics and sporting equipment). Purchases of durable goods likely also rose during the pandemic because of an increase in disposable incomes resulting from stimulus payments and other fiscal policy measures.⁶⁶

Source: USDOC, BEA, table 1.1, "U.S. International Transactions," September 22, 2022.

⁶⁶ Tauber and Van Zandweghe, "Why Has Durable Goods Spending Been So Strong during the COVID-19 Pandemic?," July 7, 2021.

2018-2022



Figure 2.15 U.S. cross-border imports of goods and services, quarterly, seasonally adjusted, quarterly,

Source: USDOC, BEA, table 1.1, "U.S. International Transactions," September 22, 2022.

The impact of the COVID-19 pandemic on services trade varied considerably by sector, likely because of the varying degree to which service exporters were able to shift their operations online in the face of COVID-19 pandemic-related travel restrictions. Benz et al. (2020) found that for Organisation for Economic Co-operation and Development countries, pandemic-related declines in services trade were less severe for more digitally intensive services than other types of services.⁶⁷ Similarly, Ando and Hayakawa (2022) found that travel, transport, and construction services—which rely less on the internet to trade than other types of services—were the most negatively affected by the pandemic. The same study found, however, that trade in services that could be provided remotely like computer services experienced no significant effect.⁶⁸ Differences in the composition of a country's trade flows also likely contributed to the overall magnitude of the decline in services trade during the pandemic. For example, Minondo (2021) found that, because Spain exports a higher share of travel services relative to other European Union (EU) members, its overall services exports posted a larger decline than those of other EU countries during the pandemic.⁶⁹

Consistent with the results summarized above, at the sector level, there was considerable variation in the effect of the initial pandemic shock and recovery on U.S. imports and exports of services (table 2.1). The largest declines in U.S. cross-border services exports between the first and second quarters of 2020 were in travel services (-66.4 percent), distribution services (-18.9 percent), and charges for intellectual property (-18.6 percent). For U.S. cross-border services imports during those same quarters, travel services also experienced the largest decline (-91.2 percent), followed by charges for intellectual property (-15.6 percent) and professional services (-13.0 percent).

Notably, U.S. distribution services imports declined by a much smaller amount than distribution services exports, likely reflecting the increased U.S. consumer demand for recreational and durable goods during

⁶⁷ Benz, Gonzales, and Mourougane, The Impact of COVID-19 International Travel Restrictions on Services-Trade Costs, July 6, 2020.

⁶⁸ Ando and Hayakawa, "Impact of COVID-19 on Trade in Services," June 1, 2022, 101–31.

⁶⁹ Minondo, "Impact of COVID-19 on the Trade of Goods and Services in Spain," January 1, 2021, 58–76.

the pandemic, described above. For both exports and imports, the decline in charges for intellectual property is driven primarily by franchise fees and is likely due to pandemic-related closures of hospitality and restaurant businesses during stay-at-home orders.⁷⁰ For example, between March and August 2020, 32,700 franchise businesses in the United States were closed, with industry experts estimating that roughly two-thirds of the franchise closures were temporary.⁷¹ U.S. exports of professional and electronic services saw relatively small losses, and financial services sectors saw a small increase in exports during this period. For U.S. imports, financial services posted a relatively small loss and U.S. imports of electronic services increased slightly.

(percentage)		
Sector	Change in U.S. exports (percentage)	Change in U.S. imports (percentage)
Professional services	-0.6	-13.0
Distribution services	-18.9	-7.2
Financial services	0.1	-1.1
Electronic services	-5.8	0.1
Travel services	-66.4	-91.2
Charges for IP	-18.6	-15.6
Other services	-1.7	-0.2
Total services	-17.6	-25.6

Table 2.1 Change in U.S. cross-border services trade by sector, quarterly (Q), from Q1 to Q2, 2020 (percentage)

Source: USDOC, BEA, table 3.1, "U.S. International Trade in Services," September 22, 2022.

Data on the share of services that are traded directly over the internet are scarce. However, survey data from the UK suggest that, in response to COVID-19-pandemic-related travel disruptions, certain industries were able to shift delivery of services from GATS modes 2 and 4 (where a consumer or individual service supplier travels abroad to purchase or supply a service) to mode 1 (i.e., trade via internet delivery or other means that do not require cross-border travel).⁷² Between 2019 and 2020, UK services exporters in the financial services increased their share of mode 1 trade by 8.5 percentage points, from 86.1 percent to 94.7 percent.⁷³ Other business services—which like professional services contains a large number of activities that can be performed over the internet—increased their share of mode 1 exports by 19.4 percentage points, from 69.5 percent to 89.0 percent.⁷⁴ This increase in remote services provision also supported growth in the electronic services sector through increased demand for cloud computing services to facilitate remote work and sharply higher consumer demand for at-home entertainment such as video games and streaming services.⁷⁵

⁷¹ FRANdata, Six-Month COVID Impact on Franchising, September 2020.

⁷⁰ Other types of intellectual property are included in other sector totals. Software-related charges for IP are part of the electronic services category, but research and development is in the professional services category.

⁷² Mode 1 can also be a substitute for modes 2 and 4, for example educational services can be provided in person when a student or teacher travels abroad (modes 2 and 4), but also through online delivery (mode 1). See text box 1.1 in chapter 1 for a more detailed discussion of the four modes of supply used to categorize types of services trade.

⁷³ Financial services excludes insurance in the UK ONS data. The insurance sector is reported separately, and saw a small increase in mode 1 trade, from 90.5 percent in 2019 to 90.8 percent in 2020.

⁷⁴ Scott, "UK Trade in Services by Modes of Supply: 2020," February 25, 2022.

⁷⁵ USITC, *Recent Trends 2022*, May 2022, 47, 85–87.

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Chapter 3 Distribution Networks Adapt by Changing Trade Patterns and Adopting New Technologies

This chapter highlights aspects of distribution networks that provide services that coordinate and enable the movement of goods along supply chains and ultimately to consumers. The networks described in this chapter comprise retail supply chains, e-commerce, logistics, and warehousing.⁷⁶ Changing patterns of demand during the COVID-19 pandemic led to a decrease in spending on certain services like travel and restaurants and an increase in spending on goods, especially those ordered online. This shift highlighted the importance of supply chains and logistics and, coupled with shipping delays and port congestion, led firms to rethink existing production and inventory practices.

In the retail sector, firms are now focusing on supply chain resilience and adaptability by identifying alternative suppliers, building inventories, and increasing transparency among suppliers. In the e-commerce sector, platforms are offering services—including payments and logistics services—to small and medium-sized enterprise (SME) sellers to facilitate transactions and provide access to new customers and international markets. In the third-party logistics sector, firms are increasingly adopting new digital technologies and business models to improve efficiency and reduce costs. Finally, in the warehousing sector, growth in goods imports and e-commerce sales led to substantial investment in warehouse construction, although demand began to wane in 2022 as import growth declined. The warehousing sector also saw increases in labor supply issues and injury rates.

Retail Services: Supply Chain Transformation

Retail supply chains were severely disrupted by the COVID-19 pandemic, which precipitated significant demand shifts, supply constraints, and transportation bottlenecks. For U.S. retailers, the pandemic highlighted the limits of longstanding global supply chain practices such as just-in-time (JIT) inventory management, sourcing from a small number of large suppliers/vendors often based long distances from the U.S. market, geographical concentration of suppliers, and a lack of transparency in supply chains.

To mitigate potential disruptions retailers are focusing on supply chain resilience and adaptability, including building inventories to moderate future supply shocks. In response to overconcentration of supply, retailers are broadening their supply bases by identifying alternative supply, including sourcing closer to markets (re-shoring and nearshoring), and identifying additional transport and logistics providers to increase resiliency. Retailers are also increasing transparency in supply chains by forming closer and more direct relationships with suppliers, enabling them to understand and plan for

⁷⁶ Given the inherently local nature of many of these services, which often require close interaction with customers (such as retail) or in-person handing of goods (such as warehousing), they are predominantly offered through foreign affiliates rather than through cross-border trade. Services such as e-commerce or logistics may be provided through both cross-border trade and foreign affiliate transactions.

bottlenecks and potential vulnerabilities. Increased investment in digital technologies, such as advanced analytics and artificial intelligence applications, is also contributing to more efficient and resilient retail supply chains.

Market Conditions

Retail services are the final stage in the merchandise distribution process whereby merchants sell goods directly to consumers for final consumption.⁷⁷ Retailers operate via physical "brick-and-mortar" stores and increasingly through multiple non-store channels, including business-to-consumer (B2C) e-commerce.⁷⁸ Global retail e-commerce sales were estimated to be \$27.3 trillion in 2022.⁷⁹ The U.S. retail services sector is the world's largest, valued at \$5.6 trillion in 2020 (latest available official U.S. government data).⁸⁰ In 2020, the world's three largest retailers by revenue were U.S. firms—Walmart, Amazon, and Costco Wholesale Corporation.⁸¹ More current private sector data indicate that the U.S. retail industry employed 19.7 million workers at 3.4 million establishments and generated revenues of \$6.9 trillion in 2022 (table 3.1).

Year	Revenue (billion \$)	Establishments (thousands)	Employment (thousands)
2018	5,945	3,154	17,787
2019	6,003	3,145	17,793
2020	6,118	3,159	17,930
2021	6,672	3,290	19,083
2022	6,923	3,363	19,653

Table 3.1 U.S. retail revenue,	establishments,	and emplo	yment,	2018-22
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Source: IBISWorld, "Retail Trade in the U.S.," August 2022.

Retail Supply Chains

The retail supply chain comprises the processes and logistics activities (including services) that focus on managing the flow of goods as they are transformed from raw materials to final products and supplying products/merchandise to final consumers.⁸² Supply chains encompass a broad array of services sectors, including manufacturing services, transport and shipping services, warehousing, and third-party logistics (3PL), among others. For example, mobile phones assembled in China and destined for U.S. retailers may pass through various distribution services providers—including truck, rail, and air transportation firms;

⁷⁷ Retailers generally sell merchandise that they have not transformed (i.e., the retailer does not manufacture the merchandise) to the public for personal use, but some retailers sell to non-household purchasers (businesses, government, and others). U.S. Census Bureau, NAICS, "2022 NAICS Definition," Retail Trade, Sector 44–45, accessed February 12, 2020.

⁷⁸ U.S. Census Bureau, North American Classification System, "2017 NAICS Definition," Retail Trade, Sector 44–45, accessed March 15, 2019; USITC, *Recent Trends in U.S. Services Trade, Annual Report 2019*, 2019, 97–98.

⁷⁹ Statista, "Total Retail Sales Worldwide from 2020 to 2025," April 13, 2022.

⁸⁰ U.S. Census Bureau, "Annual Retail Trade Survey (ARTS) Tables," January 13, 2022.

⁸¹ Statista, "The World's Top Retailers by Revenue," May 5, 2022.

⁸² UMD, Online Business, "What Is Supply Chain Management, and Why Is It Important?," accessed December 13, 2022; Hufford, "What Is Retail Supply Chain Management," November 21, 2019; Baxter, "What Is Retail Supply Chain Management?," March 18, 2022.

ports; and warehouses—before reaching a retail outlet, all of which may be coordinated by logistics services suppliers.

U.S. retailers rely heavily on global suppliers for inputs and finished products. This arrangement has benefitted their profitability through lower costs, greater product variety, and higher volumes.⁸³ The dependence on foreign supply varies by industry. For example, U.S. apparel retailers source about 90 percent of their products from abroad, but the U.S. meat industry sources almost exclusively from domestic suppliers.⁸⁴ One of the product sectors most heavily dependent on foreign supply is consumer goods, broadly defined as "goods that are used or bought for use primarily for personal, family, or household purposes."⁸⁵ In 2019 (before the COVID-19 pandemic), total U.S. imports by value of consumer goods were \$949.4 billion, led by China with \$211.7 billion (22 percent of total foreign supply), Mexico with \$107.8 billion, Canada with \$103.4 billion, and Japan with \$56.6 billion.⁸⁶

Pandemic Disruption

The demand shifts, supply constraints, and transportation bottlenecks caused by COVID-19-pandemicrelated disruptions were the "most dramatic stress test of the past 75 years" for global supply chains and exposed the fragility and limits of the global supply system.⁸⁷ According to a survey of global retail executives, the revenues of 94 percent of U.S. retail firms were negatively impacted by the pandemic.⁸⁸ The same survey indicated that the main pandemic-related challenges for retailers were substantial customer demand shifts and a lack of supply chain flexibility to react quickly to changes in demand (see the discussion of COVID-19-pandemic-related effects in chapter 2 of this report).⁸⁹ The White House Council of Economic Advisors estimates that the U.S. retail industry was the third-most disrupted sector of 17 major U.S. economic sectors, with more than 50 percent of retail businesses experiencing pandemic-induced supply disruptions in 2020.⁹⁰ Moreover, the pandemic-related economic shock hurt SME retailers. During the early months of the pandemic in 2020, the number of open small retail businesses dropped by 25.5 percent in the week of April 12, 2020, compared with January (before pandemic-related closings), before recovering midyear.⁹¹ According to the Federal Reserve, an estimated 240,000 small businesses closed permanently in 2020.⁹² Many small retailers went out of

⁸³ Global supply chains give global exposure and broader perspective for U.S. retail firms. Michalowicz, "5 Benefits of Using Global Supply Chains," November 26, 2018.

⁸⁴ IBISWorld, "Retail Trade in the U.S.," August 2022, 21.

⁸⁵ Examples of consumer goods include clothing, appliances, furniture, cars, etc. "U.S. Uniform Commercial Code: § 9-102. Definitions and Index of Definitions," no date, accessed December 20, 2022.

⁸⁶ World Bank, WITS database, "United States Consumer Goods Imports by Country 2019," accessed January 11, 2023.

⁸⁷ Witham, "Supply Chain Lessons Learned," September 9, 2021; Economist, "Retail Supply Chains," 2020, 4; McKinsey, "The Supply-Chain Solution," November 13, 2020.

⁸⁸ Compared with 75 percent of retailers in Europe, and 78 percent in the Asia-Pacific region, Economist, "Retail Supply Chains," 2020, 4.

⁸⁹ Economist, "Retail Supply Chains," 2020.

⁹⁰ Manufacturing and construction were the first and second most impacted industries, respectively. Helper, Soltas, "Why the Pandemic Has Disrupted Supply Chains," June 17, 2021.

⁹¹ Open is defined by having financial transactions activity. Opportunity Insights, "The Economic Tracker Database," accessed February 10, 2023.

⁹² USITC calculation of small business closures in excess of "typical" closures; Federal Reserve data as reported in Bhattarai, "In the Supply Chain Battle of 2021," November 7, 2021.

business. On the other hand, the largest U.S. retailers (Walmart and Amazon) reported increased profits in 2020 at the height of the pandemic.⁹³

Pandemic-related supply distortions were costly for global retailers. Losses to global retailers due to the inventory distortions resulting from pandemic-related supply and demand imbalances were estimated to total \$580 billion in 2020.⁹⁴ Additionally, the costs to global retail supply chain operators and manufacturers were estimated to total \$1.2 trillion in 2020.⁹⁵ For grocery retailers and mass merchandisers (e.g., Walmart and Target), the costs of out-of-stock and overstock merchandise were estimated at \$745.4 billion globally in 2020.⁹⁶ For the U.S. apparel and footwear sectors, which are heavily dependent on foreign supply chains, supply disruptions were estimated to cost between \$9 billion and \$17 billion in 2022 alone.⁹⁷

U.S. retail supply disruptions, precipitated by pandemic-related measures, are illustrated by significant shifts in U.S. retailers' inventories-to-sales ratios.⁹⁸ According to monthly data collected by the U.S. Bureau of Economic Analysis (BEA) (figure 3.1), the U.S. inventories-to-sales ratio initially surged in early 2020, when demand contracted as pandemic-related shutdowns were enacted across the United States and stores' inventories of unsold products increased. Later in 2020, the inventories-to-sales ratio plummeted when consumers purchased more from retailers as pandemic-related restrictions eased. As of September 2022, U.S. retailers' inventories had only partially recovered and were well below historical levels.

⁹³ Profits rose by over 56 percent for Walmart and Amazon in 2020. Stateler, "Amazon and Walmart Have Raked in Billions in Additional Profits," December 22, 2020.

⁹⁴ Statista, "Inventory Distortion Costs," January 13, 2022.

⁹⁵ Statista, "Inventory Distortion Costs," January 13, 2022.

⁹⁶ Statista, "Worldwide Inventory Distortion in Grocery Retail 2020," January 13, 2022.

⁹⁷ This value also Including Canada. Kearney, "Disruption Threatens Profitable Growth," January 25, 2022.

⁹⁸ The inventories-to-sales ratio shows "the relationship of the end-of-month values of inventory to the monthly sales." For example, a ratio of 1.5 indicates that retailers have inventories on hand to cover one and a half months of sales. U.S. Census Bureau, "Retailers: Inventories to Sales Ratio," accessed January 12, 2023.



Figure 3.1 U.S. retail: Monthly inventories-to-sales ratio (seasonally adjusted), 2004–22

Source: U.S. Census Bureau, Manufacturing and Trade Inventories and Sales; Retailers: U.S. Total Seasonally Adjusted Inventories/Sales Ratio, accessed January 26, 2023.

Retail Supply Chain Challenges and Innovations

For U.S. retailers, the pandemic demonstrated the limits of global supply chain practices established in the 1980s and it also demonstrated the need to adapt to new market and supply conditions.⁹⁹ For decades, the strategy of U.S. supply chain management was to reduce costs through global sourcing, low-cost supply, and minimal inventory.¹⁰⁰ Retailers used several practices to achieve this goal, including JIT inventory management; sourcing from a small number of large suppliers/vendors often based long distances from the U.S. market; and geographical concentration of supply, particularly China.¹⁰¹ The global supply model has also been characterized by a general lack of transparency regarding links along the supply chain.¹⁰²

More than two years following the onset of the pandemic, retail supply chain management is transforming. An article in the Harvard Business Review notes that the era of a "relatively benign"

⁹⁹ West, "Six Ways to Improve Global Supply Chains," July 12, 2022; Bomin, Rigobon, and Rigobon, From Just in Time, to Just in Case, October 12, 2020.

¹⁰⁰ Shih, "Are the Risks of Global Supply Chains Starting to Outweigh the Rewards?," March 21, 2022. ¹⁰¹ Lewis, "Supply Chain Sovereignty and Globalization," October 19, 2022; World Economic Forum, "How the COVID-19 Pandemic Has Changed Supply Chain Practices," January 14, 2022.

¹⁰² For more information on efforts to improve supply chain transparency, see box 3.1 in this section. Lewis, "Supply Chain Sovereignty and Globalization," October 19, 2022; World Economic Forum, "How the COVID-19 Pandemic Has Changed Supply Chain Practices," January 14, 2022.

international trade environment characterized by distant and extensive global supply chains, which existed for 30 years, is likely over.¹⁰³ Industry observers note that the new focus is on building supply chains that are more flexible, resilient, and regionalized to reduce complexity and uncertainty.¹⁰⁴ According to a survey of retail supply chain executives, the strategic priority as the pandemic began to ease is simplifying supply chains and developing strengthened relationships with suppliers to enhance adaptability.¹⁰⁵ Such innovations include nearshoring, re-shoring, and diversifying supply. Some of these supply-chain developments had been occurring before the COVID-19 pandemic began but were accelerated by its onset.¹⁰⁶

Just-in-Time (JIT) Inventory Management

Industry sources indicate that the reliance on JIT inventory management became a major supply chain vulnerability for U.S. and global retailers during the pandemic.¹⁰⁷ Under the JIT approach, retailers stocked only items that were needed immediately and relied on supply chains to deliver and refresh stocks quickly. This allowed firms to maximize capital investment, minimize shelf life issues for certain products, and manage seasonal shifts in demand without the risk and additional cost of "obsolete inventory."¹⁰⁸ JIT inventory management enabled retailers and distributors to lower their costs by eliminating the need to build or lease additional storage space to hold inventory. However, substantial pandemic-related demand shifts and shortages across a large number of retail sectors reduced the benefits of the JIT inventory supply model as retailers ran out of stock that could not be replenished.¹⁰⁹

In response to disruptions, retailers began focusing on supply chain resilience and adaptability, including building inventory stocks to moderate future supply shocks.¹¹⁰ The Cybersecurity and Infrastructure Security Agency (CISA) reported that, although inventory is expensive, the pandemic has reset the balance between cost efficiency and business resiliency.¹¹¹ To minimize the possibility that inventory may be inadequate to meet demand, retailers (as well as wholesalers and manufacturers) are expanding their product inventories and warehousing capacity. For example, retailers such as Nordstrom, PVH, and Gap have used "pack-and-hold" strategies, in which they over-order merchandise to prevent depleted inventories and keep unsold inventory for future sale instead of deeply discounting such merchandise.¹¹²

¹⁰⁷ CISA, *Building a More Resilient ICT Supply Chain*, November 2020. The JIT inventory management model used for decades by U.S. businesses allowed retailers to adapt to fluctuating market demand and improve profitability through inventory reduction. Witham, "Supply Chain Lessons Learned," September 9, 2021.

 ¹⁰³ Shih, "Are the Risks of Global Supply Chains Starting to Outweigh the Rewards?," March 21, 2022.
¹⁰⁴ See, e.g., Gyan Consulting, "How Can Digital Technologies Help Businesses Build Supply Chain Resilience?," February 7, 2023.

¹⁰⁵ Economist, "Retail Supply Chains," 2020.

¹⁰⁶ Harapko, "How Covid-19 Impacted Supply Chains," January 6, 2023; Smith, "U.S. and European Firms Face \$1 Trillion in Costs to Relocate," accessed January 13, 2023.

¹⁰⁸ Abraham, "COVID-19 Means You Need to Diversify," February 28, 2020.

¹⁰⁹ Witham, "Supply Chain Lessons Learned," September 9, 2021.

¹¹⁰ FTI Consulting, "Supply Chain Disruption," September 1, 2022; CISA, *Building a More Resilient ICT Supply Chain*, November 2020.

¹¹¹ CISA, *Building a More Resilient ICT Supply Chain*, November 2020, ii–iii, 1, 31.

¹¹² Hufford and Terlep, "Fading Supply-Chain Problems," November 17, 2022.World Economic Forum, "How the COVID-19 Pandemic Has Changed Supply Chain Practices," January 14, 2022.

Retailers are also increasing capacity by investing in distribution services such as warehousing and transportation services.¹¹³ For example, during the height of the pandemic-related supply disruptions in 2021, retailers such as Walmart, Home Depot, and IKEA chartered their own cargo ships to ensure stocks of merchandise.¹¹⁴ Amazon has invested in additional warehousing globally and is expanding its logistics fleet by adding airplanes and trucks to increase capacity and speed up deliveries.¹¹⁵ Target has increased storage capacity near ports to reduce shipping delays.¹¹⁶ Keeping additional stocks, however, has increased costs for retailers. As supply chain disruptions eased in 2022, some large retailers faced surplus inventories that were sold at discounted prices or warehoused.¹¹⁷

Concentrated Supply

Disruptions brought about by pandemic-related measures, trade and national security concerns, climate change, and digital automation have brought into focus the risks to retailers and manufacturers of concentrated supply.¹¹⁸ The focus on low-cost supply often led firms to source from a single or limited number of suppliers (often in one country), which increased risks.¹¹⁹ Analysis of supply chains since the onset of the COVID-19 pandemic has suggested that diversifying supply is critical for retailers.¹²⁰ Retail analysts are pointing out the benefits of multisourcing and identifying alternative supply to broaden supply bases, transport, and logistics providers, to increase resiliency.¹²¹ In some cases, supply chains are becoming increasingly based in or near the region of consumption to reduce dependence on a limited number of distant suppliers.¹²² For example, U.S. retail suppliers are examining onshoring (bringing production back to the United States) and nearshoring (moving production to countries near the United States, such as Canada and Mexico).¹²³ The advantages of balancing production with consumption regionally include shorter supply lines and transportation times, lower shipping costs, and more predictable political environments.¹²⁴ For U.S. retailers, the North American region provides large markets and both skilled and low-cost labor.¹²⁵ For example, many global firms focused on the U.S. retail

 ¹¹³ World Economic Forum, "How the COVID-19 Pandemic Has Changed Supply Chain Practices," January 14, 2022.
¹¹⁴ Miranda, "Big Retailers Book Pricey Private Cargo Ships," August 20, 2021.

¹¹⁵ For more information on nontraditional firms entering the air cargo market, see the Air Cargo section in chapter 4. Palmer, "Amazon Is Spending Big to Take on UPS and FedEx," April 30, 2021.

¹¹⁶ Hufford and Terlep, "Fading Supply-Chain Problems," November 17, 2022.

¹¹⁷ Petro, "Retail Inventory Glut Is About To Get Ugly," October 7, 2022.

¹¹⁸ Smith, "U.S. and European Firms Face \$1 Trillion in Costs to Relocate," accessed January 13, 2023.

¹¹⁹ CISA, *Building a More Resilient ICT Supply Chain*, November 2020, 2.

¹²⁰ Abraham, "COVID-19 Means You Need to Diversify," February 28, 2020; McKinsey, "The Supply-Chain Solution," November 13, 2020.

¹²¹ Hufford, "What Is Retail Supply Chain Management," November 21, 2019; McKinsey, "The Supply-Chain Solution," November 13, 2020; Gyan Consulting, "How Can Digital Technologies Help Businesses Build Supply Chain Resilience?," February 7, 2023.

¹²² Berthiaume, "Survey: Retailers Shift Supply Chain," March 11, 2021; IMD, "A Post Covid-19 Outlook," August 19, 2022, 2; ERIKS, "Supply Chain Globalisation v Regionalisation," accessed February 27, 2023.

¹²³ Wilson, "Nearshoring Heads List," December 12, 2022; Dewart, "Nearshoring Offers Advantages," December 7, 2022; West, "Six Ways to Improve Global Supply Chains," July 12, 2022; Mahoney, "U.S.-Mexico Trade Growth to Remain Steady in 2023," December 27, 2022.

¹²⁴ Shih, "Are the Risks of Global Supply Chains Starting to Outweigh the Rewards?," March 21, 2022; West, "Six Ways to Improve Global Supply Chains," July 12, 2022.

¹²⁵ Shih, "Are the Risks of Global Supply Chains Starting to Outweigh the Rewards?," March 21, 2022.

and wholesale market are shifting production to Mexico to serve the U.S. market.¹²⁶ Logistics hubs are also reportedly moving closer to consumer markets as part of supply chain transformation.¹²⁷ A 2021 survey of supply chain professionals indicated that 88 percent of U.S. SME retailers are shifting or plan to shift at least a portion of their supply to the United States.¹²⁸

For certain sectors, such as textiles, sourcing is relatively easy to move—alternatives to China are numerous and include other Asian countries (such as India and Pakistan) and Latin American countries (such as Mexico).¹²⁹ However, certain manufacturing centers that supply retailers are much more difficult and expensive to relocate. This includes electronics production where China has a well-developed assembly infrastructure that cannot be easily set up in other countries.¹³⁰ According to a study by Bank of America, shifting all export-related manufacturing that is not destined for Chinese consumption out of China would cost U.S. and European firms \$1 trillion dollars.¹³¹

Supply Chain Transparency

The pandemic-related disruptions also highlighted a lack of transparency between retailers and their suppliers. Retailers reportedly did not have insight into upstream supply problems and were unable to track inputs from second- and third-tier suppliers.¹³² One survey notes that only 2 percent of retail firms have visibility into supply chains beyond their first- and second-tier suppliers.¹³³ Analysis since the onset of the pandemic has suggested that having closer and more direct relationships with suppliers enables retailers to better understand and plan for bottlenecks and potential supply vulnerabilities.¹³⁴ Technology is a critical tool for increasing communication across the supply chain and increasing resiliency of supply.¹³⁵ More specifically, the increased use of digital supply chain management technologies—including blockchain, fifth generation (5G), and artificial intelligence (AI)—is assisting retailers with end-to-end information flows and boosting collaboration and information sharing throughout the supply chain.¹³⁶ According to a 2020 survey, 50 percent of retail firms added new supply chain analytics in 2020 in response to disruptions. In the same survey, 86 percent of retail firms planned investment in supply chain digital technology in 2021 and future years.¹³⁷

¹²⁶ Wilson, "Nearshoring Heads List," December 12, 2022; Montgomery, "From Nearshoring to Cooperative Procurement," December 19, 2022.

¹²⁷ ERIKS, "Supply Chain Globalisation v Regionalisation," accessed February 27, 2023.

¹²⁸ Wilson, "Nearshoring Heads List," December 12, 2022.

¹²⁹ Abraham, "COVID-19 Means You Need to Diversify," February 28, 2020.

¹³⁰ Abraham, "COVID-19 Means You Need to Diversify," February 28, 2020.

¹³¹ Smith, "U.S. and European Firms Face \$1 Trillion in Costs to Relocate," accessed January 13, 2023.

¹³² Tier one suppliers are the direct suppliers of the final product, tier two suppliers supply the tier one suppliers, and tier three suppliers in turn supply the tier two suppliers. CISA, *Building a More Resilient ICT Supply Chain*, November 2020; Avetta, "What Is the Difference between Tier 1, 2, and 3 Suppliers and Why Do They Matter?," accessed March 1, 2023.

¹³³ Alicke, Barriball, and Trautwein, "How COVID-19 Is Reshaping Supply Chains," November 23, 2021.

¹³⁴ World Economic Forum, "How the COVID-19 Pandemic Has Changed Supply Chain Practices," January 14, 2022;CISA, *Building a More Resilient ICT Supply Chain*, November 2020.

¹³⁵ Economist, "Retail Supply Chains," 2020, 3.

¹³⁶ For more information on the use of technology to increase visibility in supply chains and transportation, see the Logistics section. Economist, "Retail Supply Chains," 2020.

¹³⁷ Alicke, Barriball, and Trautwein, "How COVID-19 Is Reshaping Supply Chains," November 23, 2021.

Issues of forced labor in supply chains have gained attention in recent years from producers, consumers, governments, and nongovernmental organizations. Retail firms, among others, are taking steps to prevent forced labor from being used in their supply chains, and logistics providers are creating new technologies to increase supply chain transparency and better track the origins of products. For information on how technologies are being used to detect forced labor in supply chains, see box 3.1.

Box 3.1 Improving supply chain transparency to detect forced labor

Section 307 of the Tariff Act of 1930, as amended (section 307), prohibits the importation of goods into the United States that are "mined, produced, or manufactured wholly or in part in any foreign country by convict labor or/and forced labor or/and indentured labor under penal sanctions."^a More recent legislation has imposed additional requirements related to forced labor for imports of products from certain countries or regions. For example, the Countering America's Adversaries Through Sanctions Act of 2017 prohibits the importation of merchandise from North Korea pursuant to section 307, unless U.S. Customs and Border Protection (CBP) finds by clear and convincing evidence that these goods "were not produced with convict labor, forced labor, or indentured labor under penal sanctions."^b In addition, the Uyghur Forced Labor Prevention Act creates a rebuttable presumption that all goods produced in the Xinjiang region of China qualify as goods produced by forced labor as defined under section 307, unless CBP determines by clear and convincing evidence that the goods were not produced with forced labor.^c

State-level policies also play a role. For example, the California Transparency in Supply Chains Act of 2010 requires certain companies to report their efforts to "eradicate slavery and human trafficking from its direct supply chain."^d The products the U.S. Department of Labor identifies as having the most incidents involving the use of forced or child labor are certain agricultural commodities (such as sugarcane, coffee, cotton, and cocoa), minerals (such as gold), and manufactured goods (such as apparel).^e

If CBP finds forced labor was used to produce goods in violation of section 307, it will issue a withhold release order that prevents these goods from being imported into the United States.^f The number of withhold release orders issued by CBP increased in recent years, with CBP issuing no orders between 2001 and 2015, 4 orders in 2016, and 38 orders between 2018 and 2022. As of January 2023, the CBP had a total of 55 active orders in place across the world, with China accounting for the vast majority of these orders.^g CBP has also issued monetary penalties related to forced labor, such as a \$575,000 penalty in 2020 for imported stevia products (a sugar substitute) made with forced labor in China.^h In addition, in June 2022 CBP launched an enforcement strategy for the Uyghur Forced Labor Prevention Act.ⁱ

To comply with these requirements and meet the concerns of investors and consumers, many firms are investing in efforts to increase visibility into their supply chains. Supply chain mapping software allows firms to create a "social network" of their suppliers. The firm invites its direct suppliers (often called first-tier suppliers) to use the software, then encourages those firms to invite their suppliers (the second tier), and so on to eventually build a map of its entire supply chain.^j However, as suppliers change, these maps can quickly become obsolete and require constant updating.^k To address this, as well as take advantage of the new market for products to assist in compliance with recent policies, U.S. startups such as Sourcemap and Altana have begun using machine learning and data analytics to allow firms in a range of industries to better understand their supplier networks and identify risks, including the use of forced labor in product inputs.¹ Blockchain technology had been expected to improve supply chain visibility, but

its current use is limited to pilot projects in a few commodity industries such as cocoa, coffee, and palm oil.^m

It is often difficult to identify when the production of goods involves forced labor. The firms themselves or third parties (which range from specialized consultancies to nonprofits) often need to conduct audits of labor practices. These audits can vary in quality—in at least one instance, CBP found that such an audit was insufficient because of inadequate interviews of workers.ⁿ One law firm noted that compliance with the Uyghur Forced Labor Prevention Act may require extensive documentation on supply chains in addition to independent audits of production sites.^o Even in regions considered to be at high risk of forced labor (and which are thus subject to additional scrutiny or the outright prohibition of imports), suppliers may not always correctly identify the place of origin for inputs. As a result, for cotton products, some firms have turned to DNA and isotope testing to identify the growing region for cotton to avoid using cotton sourced from the Xinjiang region of China.^p To deal with these issues, many firms have also engaged in both government- and industry-led initiatives to share best practices for avoiding forced labor and human trafficking in supply chains.^q

produced in Xinjiang, see Carlson and Weaver, "Disentangling the Knot: Identifying U.S. and Global Exposure to Xinjiang Cotton," October 2022. ^d California Civil Code, § 1714.43. For a list of countries with similar policies, see Mullins, "An Investor Guide to Addressing Forced Labor in the Apparel Industry," July 2020; Lobdell, "Forced Labor and Supply Chain Risk: What Companies Need to Know," May 29, 2020.

^e The agricultural sector had the largest number of products listed, followed by manufacturing and mining/quarrying. U.S. Department of Labor, *2022 List of Goods Produced by Child Labor or Forced Labor*, 2022.

^f Importers have three months to contest the withhold release order. U.S. Customs and Border Protection, "Forced Labor: What Is Forced Labor," accessed January 12, 2023.

^g U.S. Customs and Border Protection, "Withhold Release Orders and Findings List." Accessed January 12, 2023.

^h U.S. Customs and Border Protection, "CBP Collects \$575,000 from Pure Circle U.S.A. for Stevia Imports Made with Forced Labor," August 13, 2020.

¹ The United States and Japan also created a multi-agency task force to promote international labor standards in supply chains in January 2023. Lobdell, "Forced Labor and Supply Chain Risk: What Companies Need to Know," May 29, 2020; U.S. Trade Representative, "Forced Labor Enforcement Task Force Launches Enforcement Strategy for the Uyghur Forced Labor Prevention Act," June 17, 2022; Shalal, Brunnstrom, "U.S., Japan Launch Task Force on Rights and Labor Standards in Supply Chains," January 6, 2023.

^j Bonanni, "Forced Labor Is Embedded in Supply Chains. Here's How to Root It Out," June 16, 2021.

^k Gaur, Osadchiy, and Udenio, "Research: Why It's So Hard to Map Global Supply Chains," October 31, 2022.

¹ Sourcemap, "Supply Chain Transparency Pioneer Sourcemap Launches Forced Labor Due Diligence Solution Ahead of U.S. Legislation,"

accessed January 12, 2023; Kerner, "Al-Powered Supply Chain Visibility Boosted as Altana Raises \$100M," October 6, 2022; Altana, "Illuminating the Xinjiang Forced Labor Ecosystem," accessed April 3, 2023.

^m Dotson, "Heifer and IBM Use Blockchain and AI to Help Honduran Coffee and Cocoa Farmers," July 7, 2021; Weiss, "Can Blockchain Make Chocolate More Just?," September 25, 2022; Ferrer, "Unilever and SAP Pilot Blockchain Technology Supporting Deforestation-Free Palm Oil," March 22, 2022; Ferrer, "Blockchain Platform Tackles Cocoa Supply Chain Scandals and Farmer Poverty," March 15, 2022. For more on the use of blockchain for traceability in the cocoa sector, see chapter 6 of USITC, "U.S. Trade and Investment with Sub-Saharan Africa: Recent Trends and New Developments," March 2020.

ⁿ Watts, "Trade Compliance Flash: Forced Labor in Supply Chains: CBP's Latest Ruling Provides Insight into CBP Scrutiny of Third-Party Audit Reports," April 19, 2021.

^o Ropes & Gray, "Complying with the Uyghur Forced Labor Prevention Act – a Detailed Compliance Roadmap," June 28, 2022.

^p Adnas, "Cotton Supply Chain Protection," accessed January 12, 2023; Swanson, "How A.I. and DNA Are Unlocking the Mysteries of Global Supply Chains," April 7, 2023.

^q U.S. Department of Labor, "Mapping of Initiatives on Forced Labour and Human Trafficking in Global Supply Chains," 2018.

^a 19 U.S.C. § 1307. The Trade Facilitation and Enforcement Act of 2015 repealed the "consumptive demand" clause for section 307, which had allowed for goods produced by forced labor to be imported "if the goods were not produced in such quantities in the United States as to meet the consumptive demands of the United States.". Pub. L. No. 114-125, § 910, 130 Stat. 239 (2016) (amending 19 U.S.C. § 1307).

^b Pub. L. No. 115-44, § 321(b), 131 Stat. 886, 952 (2017) (amending 22 U.S.C. § 9241a, which creates presumption under 19 U.S.C. § 1307). ^c Pub. L. No. 117-78, § 3, 135 Stat. 1525, 1529 (2021) (codified at 22 U.S.C. § 6901 note). For more information on trade issues related to cotton

Outlook

Although pandemic-related disruptions have eased, some supply chain disruptions are expected to continue and the retail supply chain is not likely to return to pre-pandemic levels of productivity and efficiency, i.e., low-cost supply with timely delivery.¹³⁸ Another significant trend for the U.S. retail supply chain in response to the pandemic disruptions will be the increased adoption of, and investment by retailers in, digital technologies.¹³⁹ Technologies such as AI and machine learning, robotics, data analytics, blockchain, and the Internet of Things (IoT) will be increasingly used throughout the supply chain (from suppliers to customers) to increase efficiency and resiliency and mitigate future supply disruptions.¹⁴⁰ Industry observers have commented that sustainability will be a key focus for U.S. retailers going forward. Supply chains built on improving environmental, social, and governance (ESG) standards are viewed as critical for the global retail industry in the years ahead.¹⁴¹ Sustainability is also increasingly in demand by customers and investors and is expected to lead to increased profitability in the industry.¹⁴²

E-commerce Services: U.S. Small and Medium-Sized Enterprises (SMEs) and Cross-Border E-Commerce

E-commerce has expanded rapidly in recent years. Many e-commerce services allow SMEs to compete with established larger firms. Global e-commerce marketplace platforms, such as Amazon and eBay, a company that facilitates consumer-to-consumer and business-to-consumer (B2C) sales, allow third-party SMEs (including individual sellers/traders) to identify and connect with buyers globally. Online payment services, including PayPal and Apple Pay, are securing transactions for SME sellers and buyers, and increasing the confidence in SME cross-border online trade. Logistics providers, including express delivery firms such as UPS and FedEx, are managing many of the key tasks for online SME exporters, including international shipping and trade compliance, ground logistics, and last mile delivery. Cross-border e-commerce (selling goods online across borders) is expected to expand at about double the rate of domestic e-commerce in the coming years, a trend that will likely benefit SMEs.

¹³⁸ Dignan, "Supply Chain Outlook for 2023," December 6, 2022; Liddell, "The Supply Chain Trends," December 8, 2022.

¹³⁹ Hippold, "How Supply Chain Technology Will Evolve in the Future," April 10, 2022.

¹⁴⁰ The Internet of Things refers to the networking capability that allows information to be sent to and received from objects and devices (such as fixtures and kitchen appliances) using the internet. *Merriam-Webster*, "Internet of Things," accessed May 17, 2023. Hippold, "How Supply Chain Technology Will Evolve in the Future," April 10, 2022; Gyan Consulting, "How Can Digital Technologies Help Businesses Build Supply Chain Resilience?," February 7, 2023; Wholesale Central, "How Technology Is Improving Supply Chains in 2023," September 13, 2022.

¹⁴¹ Zingery, "Some 2023 Perspicacity on the Retail Supply Chain," December 28, 2022; Retalon, "Sustainable Supply Chains in 2023," November 2, 2021; Moore, "How to Create More Sustainable Supply Chains," December 21, 2022; NRF, "10 Retail Industry Predictions for 2023," January 4, 2022.

¹⁴² Retalon, "Sustainable Supply Chains in 2023," November 2, 2021; Moore, "How to Create More Sustainable Supply Chains," December 21, 2022; NRF, "10 Retail Industry Predictions for 2023," January 4, 2022.

Market Conditions

B2C E-Commerce

B2C e-commerce has expanded rapidly in recent years. Worldwide, retail e-commerce sales jumped from \$3.0 trillion in 2018 to an estimated \$5.7 trillion in 2022 (figure 3.2). In terms of market share, global B2C e-commerce sales grew from an 8.6 percent share of total retail sales in 2016 to an estimated 19.7 percent share in 2022.¹⁴³ This growth was driven by rapid advancement in, and adoption of, information and communication technology (ICT), including the global surge in mobile phone usage.¹⁴⁴

A COVID-19 pandemic-related spike caused global B2C e-commerce to increase by 25.7 percent in 2020 and by 17.1 percent in 2021, as consumers shifted from in-person to online shopping.¹⁴⁵ For example, one source indicates that during the pandemic e-commerce grew more than four times faster than the pre-pandemic rate in Spain and the United Kingdom and more than three times faster in the United States.¹⁴⁶ In 2021, as the pandemic eased, shoppers returned to brick-and-mortar stores causing the B2C e-commerce growth rate to decline. The following year, growth slowed and stabilized at the pre-pandemic rate.¹⁴⁷



Figure 3.2 Global business-to-consumer ("B2C") e-commerce sales, 2018–22

Source: Statista, "Retail E-Commerce Sales Worldwide," September 21, 2022. Note: * = the estimated business-to-consumer sales for 2022.

By country, China was the leading global e-commerce market in 2020, accounting for more than half (52 percent) of global B2C online sales. The United States was the world's second-largest retail e-commerce

¹⁴³ Statista, "E-Commerce as Percentage of Total Retail Sales Worldwide," November 25, 2022.

¹⁴⁴ USITC, "Global Digital Trade 1," August 2017, 148–49.

¹⁴⁵ Statista, "Global E-Retail Growth Rate 2017–26," November 28, 2022.

¹⁴⁶ McKinsey & Company, "How E-Commerce Share of Retail Soared," March 5, 2021.

¹⁴⁷ Influencer Marketing Hub, "The State of ECommerce," October 27, 2022.

market with a 19 percent global share in 2020.¹⁴⁸ The U.S. Census Bureau reports that U.S. retail ecommerce sales were \$815 billion in 2020, or 14.6 percent of total U.S. retail sales of \$5.6 trillion.¹⁴⁹ According to an industry source, B2C sales as a share of U.S. retail transactions rose steadily during the latest 10-year period, from 5.8 percent of total retail sales in 2013 to 16.1 percent in 2022 (figure 3.3).





Source: Statista, "E-Commerce as Percentage of Total Retail Sales Worldwide," November 25, 2022.

Cross-Border B2C E-Commerce

Official government data are not available on cross-border e-commerce sales, but estimates from various other sources indicate that global B2C e-commerce sales across borders are significant and growing.¹⁵⁰ The United Nations Conference on Trade and Development (UNCTAD) estimates that total cross-border B2C e-commerce sales were \$440 billion in 2019 and the top three B2C e-commerce exporters that year were China (\$105 billion), the United States (\$90 billion), and the United Kingdom (UK) (\$38 billion).¹⁵¹ Another source estimated that global cross-border B2C e-commerce sales were even higher, at \$562.1 billion in 2018, and forecasts they will expand to \$4.9 trillion by 2027.¹⁵² The cross-border share of retail e-commerce grew from 15 percent of total online sales in 2016 to an

¹⁴⁹ Latest available official U.S. data. U.S. Census Bureau, "E-Stats 2020," accessed November 29, 2022.

¹⁴⁸ eMarketer, "These Are the Top Global Ecommerce Markets," July 14, 2021.

¹⁵⁰ OECD, "Unpacking E-Commerce," 2019, 9, 55; IBISWorld, "Third-Party Logistics," September 2022, 15.

¹⁵¹ UNCTAD, Estimates of Global E-Commerce 2019, 2021, 6.

¹⁵² Zion Market Research, "Global Cross-Border B2C E-Commerce," August 20, 2019. Unlike domestic e-commerce, which surged during the pandemic, cross-border e-commerce was more disrupted; however, online sales "bounced back" guickly when economies reopened. The Paypers, "Cross-Border Payments and Ecommerce Report 2020–2021," December 2020; International Post Corporation, "Cross-Border E-Commerce Shopper Survey," January 2022, 9.

estimated 22 percent in 2022, according to a firm that supplies market and consumer data.¹⁵³ In a 2019 report, the financial services firm, Visa, noted that consumers have been shopping online across borders for better prices, quality, and goods that are not available in their domestic market.¹⁵⁴ An estimated 52 percent of global online shoppers made purchases from overseas websites in 2021.¹⁵⁵

Survey data from a cooperative association of 25 national postal services show that China was the leading country of origin for cross-border e-commerce in 2021, accounting for 35 percent of global purchases.¹⁵⁶ Chinese consumers are also substantial cross-border e-commerce shoppers. One firm reports that 155 million Chinese shoppers made cross-border e-commerce purchases in 2021.¹⁵⁷ Chinese shoppers reportedly make cross-border purchases, particularly of Western-branded products, according to quality, product availability, and value factors.¹⁵⁸ The United States was the second-leading country of origin for cross-border e-commerce shopping, supplying 14 percent of cross-border retail purchases in 2021.¹⁵⁹ U.S. B2C retail sellers made up about 27 percent or 2.5 million sellers of an estimated 9.1 million online retailers worldwide.¹⁶⁰ Cross-border sales accounted for an estimated 3 percent of total U.S. and Chinese e-commerce revenues in 2022. For certain European countries, the share was as high as 31 percent.¹⁶¹ In terms of consumption, one firm reported that 37 percent of U.S. online shoppers purchased from overseas retail websites in 2021.¹⁶²

SME Cross-Border E-Commerce

For U.S. SME retailers, engaging foreign consumers online is an attractive outlet to increase sales.¹⁶³ However, by virtue of their size and comparative lack of resources, SMEs face significant challenges in accessing foreign markets. According to survey data, challenges for online retailers selling abroad include logistics, customs and compliance, managing cross-border risk, customer delivery expectations, tracking shipments, and processing foreign currencies.¹⁶⁴ SME retailers, in particular, are challenged by high fixed costs of exporting and are less likely to sell internationally compared to well-resourced large

¹⁵³ Data from DHL, Forrester Research, and Practical Ecommerce as compiled by Statista, *Cross Border E-Commerce*, April 2019, 6.

¹⁵⁴ Visa, Visa Global Merchant ECommerce Study, August 2019, 2.

¹⁵⁵ Statista, "Share of Online Shoppers Buying from Overseas or Local Websites as of 2021," March 22, 2022. Data from ClearSale and Sapio Research as compiled by Statista, "Share of Online Shoppers Buying from Overseas or Local Websites as of 2021," March 22, 2022.

¹⁵⁶ International Post Corporation, "Cross-Border E-Commerce Shopper Survey," January 2022, 9.

¹⁵⁷ Data on number of shoppers from 100ec.cn. Data on value from MOFCOM China as compiled by Statista, "Number of Cross-Border Online Shoppers in China," August 30, 2022; Statista, "Gross Merchandise Volume of China's E-Commerce Market from 2011 to 2021," November 18, 2022. Value of trade based on author calculation using IMF exchange rate data, IMF, "Representative Exchange Rates," accessed February 8, 2023.

¹⁵⁸ Davis, "Despite Tensions, Many Chinese Online Shoppers Still Covet Western Goods," June 21, 2022.

¹⁵⁹ International Post Corporation, "Cross-Border E-Commerce Shopper Survey," January 2022, 9.

¹⁶⁰ Hodge, "23 Ecommerce Statistics To Know in 2022," July 5, 2022.

¹⁶¹ Statista, "Distribution of Domestic and Cross-Border E-Commerce Revenues in 2022," June 27, 2022.

¹⁶² Data from ClearSale and Sapio Research as compiled by Statista, "Share of Online Shoppers Buying from Overseas or Local Websites as of 2021," March 22, 2022.

¹⁶³ U.S. Small Business Administration, "Table of Small Business Size Standards," December 19, 2022. SMEs are defined by the U.S. Dept of Commerce as firms with 500 or fewer employees.

¹⁶⁴ Data from eft Supply Chain & Logistics Business Intelligence as compiled by Statista, "Cross Border E-Commerce," April 2019, 29.

firms.¹⁶⁵ About 40 percent of global small retail businesses engage in cross-border trade, compared with 71 percent of medium-sized businesses and 92 percent of large firms, according to data from a report by Visa.¹⁶⁶ In addition, retailers with websites are more likely to sell internationally. About two-thirds of retailers that use e-commerce—including SMEs—sell across borders, the Visa report adds.¹⁶⁷ Data on U.S. SME e-commerce exports are not available, but according to one econometric study, SMEs' share of exports increases with the development of the internet in their home countries.¹⁶⁸ More specifically, the study found that internet development in an exporting country has a significant and negative effect on the share of exports by leading exporters, which implies a larger share is supplied by SMEs.¹⁶⁹ This analysis suggests that U.S. exporting SMEs benefit from the highly developed U.S. internet infrastructure.¹⁷⁰

Online Platforms as Facilitators of SME Exports

Connecting with and selling to consumers through digital channels, such as well-established global ecommerce marketplace platforms, enables SMEs to reduce the fixed costs of exporting and lowers the barriers for SME retailers exploring and starting sales in overseas markets.¹⁷¹ Such online platforms allow SMEs (including individual sellers and traders) to identify and connect with buyers globally and compete with established larger firms.¹⁷² Online platforms aid SME sellers with low up-front costs and, in many cases, transform fixed costs into variable costs; for example, sellers pay fees for each sale instead of large up-front fees. SMEs benefit from economies of scale provided by the platforms, which translates into better and less costly services. Moreover, online platforms that operate in multiple foreign markets give sellers access to many markets through a single platform.¹⁷³ Marketplace platforms incur minimal costs from adding third-party sellers to their services. They benefit from these sellers by charging fees for website views and clicks and transaction fees for goods sold.¹⁷⁴

U.S. platforms are leaders in global online retail sales. In 2020, Amazon reportedly led with 26 percent of global cross-border e-commerce purchases; China's AliExpress, owned by the Alibaba Group, was

¹⁶⁵ Visa, Visa Global Merchant ECommerce Study, August 2019, 3.

¹⁶⁶ Visa, Visa Global Merchant ECommerce Study, August 2019, 5.

¹⁶⁷ Visa, *Visa Global Merchant ECommerce Study*, August 2019, 2.

¹⁶⁸ The study's author uses internet penetration (share of internet users in a country) and telecommunications infrastructure based on data transfer speed and system capacity, including submarine cable capacity, as measures of internet development. For more information on internet development, see Sun, "The Internet and SME Participation in Exports," December 1, 2021.

¹⁶⁹ Sun, "The Internet and SME Participation in Exports," December 1, 2021, 1.

¹⁷⁰ Sun, "The Internet and SME Participation in Exports," December 1, 2021, 1.

¹⁷¹ Sun, "The Internet and SME Participation in Exports," December 1, 2021, 1.

¹⁷² OECD, "Unpacking E-Commerce," 2019, 80.

¹⁷³ OECD, "Unpacking E-Commerce," 2019, 80.

¹⁷⁴ Amazon has been criticized, however, for charging high sales, referral, fulfillment, and advertising fees to thirdparty sellers (and such fees have been increasing in recent years). Amazon has also been accused of hindering competition, including by penalizing sellers that offer products at lower prices on platforms that charge lower fees. In 2020, a class action lawsuit was filed against Amazon by consumers in 18 states over its pricing policies for thirdparty vendors (as of January 2023, the lawsuit was still ongoing). Amazon also reached a settlement with the European Commission in 2020 regarding discriminatory policies against third-party sellers. Fuqua School of Business, Duke University, "How Online Marketplaces," February 17, 2020; Mitchell, "Amazon's Toll Road," December 2021; Scarcella, "Amazon Loses Bid to Toss Consumer Antitrust Lawsuit," January 5, 2023; European Commission, "Antitrust: Commission Accepts Commitments by Amazon," December 20, 2002.

second with 19 percent; and eBay was third with a 10 percent share.¹⁷⁵ The firm eBay reportedly has about 18 million sellers (28 percent U.S.-based) and reports transactions in 190 markets.¹⁷⁶ It reports that most eBay sellers (primarily SMEs) have cross-border sales in more than one market, with over half of its listed retailers selling in three or more foreign markets in 2021.¹⁷⁷ Amazon, operating in 185 markets, notes it has more than 2 million global third-party SMEs registered with the platform and reportedly added 20,000 U.S. SME third-party exporters in 2021, with total SME exports on its platform reaching \$2.2 billion during the year.¹⁷⁸ AliExpress reportedly has more than 10,000 independent merchants (mostly SMEs) serving about 230 global markets in 2021.¹⁷⁹ Many marketplace platforms also offer complementary services for firms that use their platform. Such services include translation services (which translate e-commerce websites into native languages in many markets), logistics and fulfillment, customer service, software services, warehousing, road freight, and other delivery services. For example, eBay's Global Shipping Program offers export facilitating services to sellers, including SMEs, that include shipping, customs clearance, taxes, tracking, and insurance.¹⁸⁰

Amazon's Fulfillment by Amazon provides logistics services—including warehousing, shipping, and data analytics—for domestic and international third-party sellers.¹⁸¹ In addition, the Amazon Global Selling Program furnishes listing services, communications services in local languages, currency conversion, international shipping, and customs services for third-party SMEs conducting international sales.¹⁸² AliExpress Shipping provides end-to-end logistics, tracking, customer service, and dispute resolution services for its sellers.¹⁸³ One of Africa's largest marketplace platforms, Jumia, offers logistics, payments, and advertising service for SMEs, including exporters.¹⁸⁴

Payments Services

Access to finance and payments services for cross-border transactions is essential for SMEs selling to foreign markets.¹⁸⁵ Reliable and trusted payment services decrease "significant [cross-border] counterparty risks;" i.e., purchasers' concerns they will not receive products and sellers' concerns about being paid, particularly for cross-border transactions.¹⁸⁶ The rise of cross-border e-commerce has coincided with increased availability and use of digital payment services, including mobile wallets such as PayPal, Alipay, Google Pay, and Apple Pay, and this trend is gaining popularity in most global markets.¹⁸⁷ Online payment services, as well as traditional credit card services, secure transactions for both parties, which

¹⁷⁵ International Post Corporation, "Cross-Border E-Commerce Shopper Survey," January 2022, 12.

¹⁷⁶ O'Sullivan, "EBay Statistics Overview," December 21, 2022; Daly, "Demand for 'Made in USA' Products Spurs Growth at Alibaba.Com," March 15, 2022; eBay, "Our Company - EBay Inc.," accessed January 18, 2023.

¹⁷⁷ eBay Inc, "Small Business Report," 2022.

¹⁷⁸ Silberstein, "Amazon Wants to Help U.S. SMBs," October 22, 2021; Amazon, Amazon Small Business, 2021, 11.

¹⁷⁹ Bhardwaj, "60+ Ali Express Stats, Facts and Reports for 2021," September 27, 2021.

¹⁸⁰ OECD, "Unpacking E-Commerce," 2019, 80.

¹⁸¹ Amazon, Amazon Small Business, 2021, 5.

¹⁸² Amazon, "How to Sell Internationally with Amazon Global Selling," accessed April 3, 2023; Amazon, "Amazon Global Selling," accessed January 17, 2023.

¹⁸³ AliExpress, "AliExpress Shipping," accessed January 17, 2023.

¹⁸⁴ Jumia Group, "Jumia SME Tool Kit," accessed January 9, 2023.

¹⁸⁵ OECD, Trade Finance for SMEs in the Digital Era, 2021, 7.

¹⁸⁶ OECD, Trade Finance for SMEs in the Digital Era, 2021, 7.

¹⁸⁷ Taggart, "Cross-Border ECommerce Statistics and Trends," June 23, 2022; Trustana, "Why You Need Cross-Border Payments," April 4, 2022.
increases confidence in SME cross-border online trade. Such payment services also lower costs and increase the speed and transparency of transactions, compared with more traditional cross-border banking transactions that rely on significant financial infrastructure not typically available to SMEs.¹⁸⁸ However, with the growth of online cross-border SME trade and the associated increase in small value international transactions, traditional banks are now providing low-cost transaction services through the Society for Worldwide Interbank Financial Telecommunication (Swift) system. The Swift Go service for small businesses and consumers processes low-value payments at low cost through its 11,000 institutions operating in 200 countries.¹⁸⁹

Logistics and Fulfilment

For cross-border SME traders that may be exporting directly through their own websites or not using marketplace platform services, logistics companies offer a range of trade facilitation services. Logistics firms routinely manage many key tasks, including international shipping and trade compliance, ground logistics and last mile delivery, and fulfillment services such as packing and warehousing, for online SME exporters.¹⁹⁰ According to industry sources, express delivery firms often assist SMEs with complex and changing international customs and paperwork requirements (designed for large shipments), which are very burdensome for small-scale SME e-commerce exporters.¹⁹¹ Logistics providers—including large express delivery services such as UPS, FedEx and DHL—offer a variety of integrated supply chain services.¹⁹² Examples of such services include FedEx Global Trade Manager; UPS destination-specific web-based guides for clients; and DHL's suite of online shipping tools for exporters.¹⁹³

Outlook

Cross-border e-commerce is expected to expand at about double the rate of domestic e-commerce in the coming years, with about 20 percent of online sales expected to be cross-border transactions through 2025.¹⁹⁴ B2C e-commerce growth is expected to continue to be driven by advances in digital technology, which have benefited SME e-commerce exporters. In particular, increased adoption and use of artificial intelligence, increased use of chatbots for customer service, and increased social commerce (i.e., social-media-based e-commerce) are expected to drive e-commerce growth.¹⁹⁵ Spending by global

¹⁸⁸ Trustana, "Why You Need Cross-Border Payments," April 4, 2022; McKinsey, A Vision for the Future of Cross-Border Payments, 2018.

¹⁸⁹ Swift, "New Swift Go Service Transforms Low-Value Cross-Border Payments," July 27, 2021.

¹⁹⁰ OECD, "Unpacking E-Commerce," 2019, 23, 44; Moritsch, "The Challenges of Cross-Border International Trade," November 30, 2022.

¹⁹¹ Industry representatives, interview by USITC staff, January 11, 2023.

¹⁹² IBISWorld, "Third-Party Logistics," September 2022, 5.

¹⁹³ Reddington, "How To Leap Over Import And Export Hurdles," July 7, 2020. FedEx also provides extensive online courses on topics related to SME exporting and importing. FedEx Newsroom, "FedEx Helps SMEs Tap Into New Cross-Border Opportunities Through On-Demand Videos," June 17, 2021; UPS, "International Shipping Made Easy," accessed January 17, 2023; DHL, "DHL Shipping Tools," February 22, 2023.

¹⁹⁴ Google, "Guide to Cross Border Ecommerce," accessed December 5, 2022; Post & Parcel, "One in Every 5 E-Commerce Transactions," October 13, 2021.

¹⁹⁵ Yadav, "Cross-Border B2c E-Commerce Market Trends," November 21, 2022; Accenture, "See Why Shopping Is Set for a Social Revolution," January 2, 2022; Heethuis, "Four Ways Artificial Intelligence Is Transforming E-Commerce," February 15, 2022.

consumers on online marketplaces, which accounted for 40 percent of online spending in 2021, is expected to continue to expand.¹⁹⁶ This trend likely will benefit SMEs as platforms are seeking to increase participation by SMEs. Third-party SME marketplace sales are expected to be the largest and fastest growing segment in retail sales value globally in the coming years.¹⁹⁷

Third-Party Logistics Services: Technological Innovation and New Business Models

Providers of logistics services facilitate the transportation and distribution of goods among suppliers, producers, and consumers. Traditionally, logistics services have included freight forwarding; multimodal transport (the contractual transportation of goods using multiple modes such as air and road); warehousing and storage; tracking and tracing; and customs brokerage. Increasingly, these services have expanded to include auxiliary services such as order fulfillment, product repair, inventory management, returns processing, consulting services, and related information technology (IT) services. Logistics services can be housed internally within a transportation or distribution company or provided by second-, third-, fourth-, or sometimes fifth-party logistics (2PL, 3PL, 4PL, and 5PL) companies.¹⁹⁸ 3PL firms, the general focus of this section, may offer some or all the services discussed above.

The logistics services industry is characterized by many firms operating predominantly in their immediate region. Though growth slowed at the onset of the COVID-19 pandemic, the U.S. logistics services industry grew quickly in the second half of 2020 and experienced growth each year between 2019 and 2022. Recent developments in the logistics services industry include increased adoption of AI and machine learning technologies, the integration of the Internet of Things, and paperless trade. The industry has also experienced new partnerships and acquisitions to their business models.

Market Conditions

The logistics services industry is largely fragmented, in contrast to many of the other distribution services industries described in this chapter. The largest 3PL firm globally by revenue, Kuehne+Nagel (Switzerland), accounted for only 2.9 percent global logistics revenues in 2021, up slightly from 2.5 percent in 2016 (table 3.2), according to most recent data available. In recent years, the industry has moved toward a slight consolidation because of the COVID-19 pandemic-related disruptions and geopolitical disruptions, to offer more comprehensive logistics services and expand regional operations.¹⁹⁹ Six of the top 10 firms gained a small fraction of global market share between 2017 and 2021. Kuehne+Nagel, for instance, acquired another logistics firm Apex International (United States) in

¹⁹⁶ Rajagopal, "Impact of Consumer Spending," May 5, 2022.

¹⁹⁷ The Customer, "Third-Party Sales Through Online Marketplaces," July 26, 2022; Verdon, "How Direct-to Marketplace Strategies," May 26, 2021.

¹⁹⁸ A 2PL offers transportation services for the supply chain, usually owning or leasing its trucks, ships, or planes in operation. A 3PL offers 2PL services as well as warehousing, customs brokerage, and supply chain management services. A 4PL centrally manages the activities of all contracted second- and third-party providers. A 5PL offers supply chain-wide consulting services and strategies. Generally, 3PL firms that also provide 4PL and 5PL services are characterized as 3PLs. See USITC, *Recent Trends in U.S. Services Trade: 2019 Annual Report*, September 2019, for more information.

¹⁹⁹ Delavin, "Covid-19 Pushes Logistics Sector Consolidation—Asia Cargo News," July 20, 2021, 19.

2021 to expand its operations in the Asia Pacific region and its freight forwarding capabilities.²⁰⁰ Similarly, in 2022, A. P. Moller-Maersk (Denmark) acquired LF Logistics, a Hong Kong-based logistics firm, to grow its logistics service offerings to Asian consumers.²⁰¹ The continued prevalence of small and medium-sized enterprises that operate regionally, coupled with the interchangeability of many logistics services, results in high competition among firms.²⁰²

Table 3.2 Logistics services: Top 10 global third-party logistics firms by revenue, 2021; and globalmarket share, 2016 and 2021

		2021 Revenue	2016 Global	2021 Global
Company	Headquarters	(billion \$)	market share (%)	market share (%)
Kuehne+Nagel	Switzerland	40.8	2.5	2.9
DHL Supply Chain & Global	Germany	37.7	3.3	2.7
Forwarding				
DSV	Denmark	28.9	1.3	2.1
DB Schenker Logistics	Germany	27.6	2.1	2.0
C.H. Robinson Worldwide	United States	22.4	1.6	1.6
Sinotrans	China	19.1	0.9	1.4
Nippon Express	Japan	18.6	2.1	1.3
Expeditors	United States	16.5	0.8	1.2
UPS Supply Chain Solutions	United States	14.6	0.8	1.0
CEVA Logistics	Switzerland	12.0	0.8	0.9

In billions of dollars and percentages.

Source: Armstrong & Associates, "Top 3PLs: A&A's Top 50 Global Third-Party Logistics Providers (3PLs)," June 24, 2017; Armstrong & Associates, "Global 3PL Market Size Estimates," August 15, 2018; Armstrong & Associates, "Top 3PLs: A&A's Top 50 Global Third-Party Logistics Providers (3PLs)," September 20, 2022; Armstrong & Associates, Downshift, January 2023.

Although servicing global supply chains, most logistics firms largely provide services to producers, exporters/importers, and retailers in their domestic markets (although some firms supply services in foreign markets through affiliates).²⁰³ As key facilitators of trade, logistics services providers operating in regions heavily engaged in international trade benefit from the resulting high demand for their services.²⁰⁴ As the largest global goods importer, the United States is also the largest market for logistics services, accounting for \$231.5 billion (24.1 percent) of global 3PL services revenues in 2020, followed

²⁰⁰ Delavin, "Covid-19 Pushes Logistics Sector Consolidation - Asia Cargo News," July 20, 2021, 19; Apex Logistics International Inc., "Apex Joins the Kuehne+Nagel Group and Hence Becomes a Market Leader on the Transpacific Route," May 12, 2021.

²⁰¹ Predominately a container shipping line and vessel operator, Maersk also offers supply chain management services. For more information on Maersk, see the section in chapter 4 on Maritime Shipping. *Economist,* "Investments in Ports Foretell the Future of Global Commerce," January 14, 2023.

²⁰² For a more comprehensive discussion on the competitive environment of 3PLs see USITC, *Recent Trends in U.S. Services Trade: 2019 Annual Report*, September 2019, 48; Maldonado, *Third-Party Logistics Industry Report*, September 2022, 20.

²⁰³ 3PL logistics services are not explicitly identified within cross-border services trade data. They are more readily identified in foreign affiliate sales data under "support activities for transportation" and "other transportation and warehousing," using NAICS code 488. Foreign affiliate services trade are sales by firms with different foreign ownership. For more information see chapter 2. USDOC, BEA, Guide to Industry Classifications for International Surveys, 2017, 64.

²⁰⁴ Maldonado, *Third-Party Logistics in the US*, January 25, 2023, 16.

by China (23.6 percent) (figure 3.4).²⁰⁵ Other individual country markets make up less than 5 percent of global revenues.²⁰⁶

Figure 3.4 Logistics services: Third-party logistics revenues by country, 2020

In percentages. Underlying data for this figure can be found in appendix B, table B.30.



Total revenues: \$961.8 billion

Source: Armstrong & Associates, "Global 3PL Market," October 19, 2021.

Globally, logistics services revenues grew to \$1.4 trillion in 2021, up from \$961.8 billion in 2020 and \$870 billion in 2017.²⁰⁷ In the United States, the logistics services industry has largely recovered from an initial slowdown at the beginning of the COVID-19 pandemic and grew at an annualized rate of 5.3 percent during 2017–22 because of heightened consumer spending, particularly in e-commerce.²⁰⁸ In 2022, U.S. logistics services revenue grew by 2.3 percent compared to 8.8 percent in 2021.²⁰⁹ Pandemic-related closures and movement restrictions intensified staffing shortages across the global logistics services industry. These shortages persist and the industry has been further affected by increased labor

 ²⁰⁵ World Bank, WITS database, "Top Exporters and Importers by Country 2020," accessed April 5, 2023.
²⁰⁶ Armstrong & Associates uses global revenue to calculate market size. Armstrong & Associates, "Global 3PL

Market," October 19, 2021.

²⁰⁷ Armstrong & Associates, *Downshift*, January 2023; Armstrong & Associates, "Global 3PL Market," June 25, 2017; Berman, "Armstrong Report Takes a Look at a 'Downshifting' in the Global 3PL Market," accessed March 3, 2023; Armstrong & Associates, "Global 3PL Market," October 19, 2021.

²⁰⁸ For discussion on recent trends in e-commerce and retail services see the respective sections in this chapter. Maldonado, *Third-Party Logistics Industry Report in the US*, September 2022, 7, 9, 11.

²⁰⁹ Maldonado, *Third-Party Logistics in the US*, January 25, 2023, 9, 11; Mordor Intelligence, "Third-Party Logistics (3PL) Market Share, Size, Trends (2022 - 27)," accessed December 14, 2022.

costs, geopolitical disruptions, and economic uncertainty.²¹⁰ In a 2022 survey, 56 percent of 3PL firms reported that labor shortages have impacted their supply chain operations.²¹¹

Technological Innovation

Logistics firms are adopting new technology and digitization to improve efficiency and reduce costs, partially because of increased demand, labor shortages, and product availability issues related to the COVID-19 pandemic.²¹² An industry survey found that the majority of 3PLs firms were "actively implementing or are researching and reviewing/augmenting their supply chain operations with new technology and/or automation" to address talent shortages.²¹³ Prominent innovations include AI and machine learning, Internet of Things (IoT) integration, and paperless trade.²¹⁴

Logistics firms use AI and machine learning to analyze data on business operations to improve predictive performance, competitiveness, efficiency, and supply management.²¹⁵ For example, Canadian 3PL shipping, freight, and courier firm Purolator couples an AI model with detailed historical sales information to forecast future sales and contract win rates and to develop stronger sales coaching tools.²¹⁶ Similarly, logistics firms may use machine-learning models to combine data that are traditionally separated—such as transactions, freight, and internal systems data—to predict prices and boost firm competitiveness. A case study showed that one 3PL firm implementing this technology achieved a 98 percent quote acceptance rate.²¹⁷ Other AI and machine learning uses include supplier performance monitoring, demand forecasting, inventory management, revenue management, and transportation planning.²¹⁸ An industry survey by the management consulting firm McKinsey & Company found that AI-enabled supply-chain management has improved key performance indicators such as logistics costs, inventory levels, and service levels for early adopters.²¹⁹

Many logistics firms have accelerated the integration of the IoT into warehouse, truck, package, and personnel management in response to the COVID-19 pandemic.²²⁰ Novel live-tracking IoT technologies—

²¹⁰ Langely, *2023 27th Annual Third-Party Logistics Study: The State of Logistics Outsourcing*, 2023, 9, 28; Dilip Bhattacharjee et al., *Reimagining Supply-Chain Jobs to Attract and Retain Workers*, December 10, 2021.

²¹¹ Langely, 2023 27th Annual Third-Party Logistics Study: The State of Logistics Outsourcing, 2023, 5.

²¹² Yonder, "Logistics Executives Investing in AI/ML to Address Disruptions, E-Commerce and Labor Shortages, According to Blue Yonder Survey," May 25, 2021, 1, 4.

²¹³ Langely, 2023 27th Annual Third-Party Logistics Study: The State of Logistics Outsourcing, 2023, 37.

²¹⁴ Unipart Logistics, "Top 10 Technology Trends Transforming Logistics," January 7, 2019, 10.

²¹⁵ Al and machine learning is a key input in automation that addresses labor shortage concerns and occurs throughout the supply chain including robotics in warehousing, drone processing/delivery, and autonomously guided vehicles transport. For more information on automation in warehousing see Warehousing Services later in this chapter. For more on drones and advancements in trucking, see chapter 4. Langely, *2023 27th Annual Third-Party Logistics Study: The State of Logistics Outsourcing*, 2023.

²¹⁶ SalesChoice, "An AI Solution for B2B Sales," December 25, 2020; Gordon, "The Rise Of AI In The Transportation And Logistics Industry," September 5, 2021.

 ²¹⁷ Quote acceptance rates are the fraction of quotes that buyers accept, which results in sales. Trigent, "AI/ML-Powered Price Predictor Enables 3PL to Achieve 98% Acceptance of Quotes," accessed January 18, 2023.
²¹⁸ Singh, "Artificial Intelligence and Machine Learning in SCM," June 16, 2022; Herrmann, *Human-Machine Teaming in AI Driven Supply Chains*, May 2020, 16.

²¹⁹ Alicke et al., *Succeeding in the AI Supply-Chain Revolution*, April 2021, 3.

²²⁰ Inmarsat Corporate Website, "Inmarsat Research Programme 2021: Industrial IoT in the Time of COVID-19," 2021; Gordon, "The Rise Of AI In The Transportation And Logistics Industry," September 5, 2021.

such as sensors, mobile applications, and smart wearables—connect wirelessly along the supply chain in real time. Firms then use cloud technology and mobile applications to capture these data and provide detailed delivery information as well as customer service.²²¹ These data enable greater use of AI and machine learning technologies and improve transparency along supply chains. For example, the use of radio-frequency identification (RFID) has facilitated real-time parcel tracking, reduced labor needs through increased efficiency and worker productivity, and facilitated integration of other supply chain technologies.²²² RFID technology improves upon barcodes by using radio frequency technology (rather than light) to decode tags. This distinction allows several advantages that are also labor saving. RFID tags can store more information than barcodes and hundreds of RFID tags can be read at once without being positioned in direct proximity to RFID scanners. Recent innovations in RFID technology such as cheaper, smaller, and more sensitive RFID tags have made them increasingly cost effective for use along supply chains in inventory and warehouse management.²²³

Another innovation that industry observers expect to significantly improve logistics operations and reduce costs is the transition to paperless trade or digitized trade forms. The International Chamber of Commerce projects that paperless trade could increase G7 trade volumes by 43 percent between 2019 and 2026, reducing compliance, documentation, and transportation costs by up to 81 percent and reduce average border compliance time from 25 days to less than a day.²²⁴ A notable example is an electronic bill of lading (eBL). eBLs are contracts that provide detail about goods shipped, their origin and destination, and the shipper, carrier, and receiver of the shipment (consignee).²²⁵ The Digital Container Shipping Association estimates that eBLs could save the container shipping industry \$4 billion annually, estimated at a 50 percent adoption rate across shipments.²²⁶

Barriers to the digitization of bills of lading vary despite increased efficiency and cost reductions associated with eBLs. Though some firms remain concerned about the legal treatment of eBLs across borders, others do not view regulations as a prominent obstacle to eBL adoption because international guidelines for regulations permitting eBLs have existed since the 1990s and eBL providers have legal frameworks in place.²²⁷ Concerns that eBLs might be vulnerable to fraud have been minimized by recent

²²¹ Ashcroft, "Top 10: strategic benefits of IoT tech," June 28, 2022; Meola, "How AI and IoT Devices Will Revolutionize Supply Chain Logistics and Management in 2022," April 15, 2022.

²²² Peerbits, "Complete Guide on RFID and Its Applications in Supply Chain Management and Logistics," May 10, 2022.

²²³ Maldonado, *Third-Party Logistics in the US*, January 25, 2023, 27; RFID Label, "Advancements of RFID Technology," November 13, 2020; Miller, "RFID and Sensor Tech Get Cheaper, Faster and More Pervasive," September 7, 2021.

²²⁴ G7 countries include Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States. United Kingdom International Chamber of Commerce, "G7—Creating Modern Digital Trade Ecosystem," accessed January 18, 2023, 2, 18, 21.

²²⁵ An alternative characterization is that eBLs serve as (1) a contract between carriers and receivers of goods, (2) a receipt of freight, and (3) the official transfer of good ownership. Daninhirsch, "Contactless Delivery, Safety Precautions Accelerate Adoption of Electronic Bills of Lading," September 25, 2020; International Cargo Express, "Bill Of Lading Explained," October 28, 2022.

²²⁶ DCSA, DCSA Takes on EBL Standardisation, Calls for Collaboration, May 19, 2020, 1.

 ²²⁷ Daninhirsch, "Contactless Delivery, Safety Precautions Accelerate Adoption of Electronic Bills of Lading,"
September 25, 2020; Comité Maritime International, "Rules for Electronic Bills of Lading," accessed January 18,
2023; Casanova et al., *Digitizing Trade Documentation and the Bill of Lading*, October 4, 2022; DCSA, "Survey,"

innovations such as blockchain, which creates an auditable ledger of transactions.²²⁸ Still, adoption has been slow among firms, regulators (outside of those early adopters), banks, and insurers with less than 1.2 percent of bills of lading issued electronically as of 2021.²²⁹ During the COVID-19 pandemic, the use of eBLs accelerated because they assisted in addressing transit delays and safety concerns.²³⁰

A lack of standardization across entities and a resulting inoperability between platforms has slowed adoption of eBLs.²³¹ In response, several organizations have sought to standardize eBL documentation, including BIMCO, a global shipping association of about 2,000 shipowners in more than 130 countries, and the Digital Container Shipping Association. In 2021, Singapore became one of the first nations to amend its existing Electronic Transactions Act to adopt (with modifications) the United Nations Commission on International Trade Law Model Law on Electronic Transferable Records, a globally harmonized legal framework for transferable documents or instruments that applies to eBLs. Singapore expects the change to promote more domestic and cross-border electronic transactions, and has collaborated with the Digital Container Shipping Association for eBL implementation and promotion.²³² In late 2022, eBL solution provider CargoX experienced rapid growth in users following improvements to interoperability between its platform and another eBL solution provider edoxOnline.²³³

Overall, barriers to technology adoption and digital transformation in logistics services include complexity, cost, data security, and privacy. Many logistics firms are operating on legacy systems that are difficult to upgrade or costly to replace, and the hardware and ICT needed for many technologies, such as IoT, is expensive. Data security and privacy concerns also pose a challenge to the use of digital tools among logistics firms as cyber security attacks and risks of threats have increased in recent years.²³⁴

Increased digitization and use of IoT devices coupled with a fragmented industry with varying levels of cybersecurity increase exposure to ransomware, phishing, or cyberattacks that target IoT devices.²³⁵

Noting cyberattacks, pandemics, climate shocks, geopolitical competition and other conditions, the U.S. President signed Executive Order 14017 of February 24, 2021, "America's Supply Chains," with the policy objective of strengthening the resilience of America's supply chains and stating that "[t]he United States needs resilient, diverse, and secure supply chains to ensure our economic prosperity and national security."²³⁶ To address this order, the Department of Transportation completed a report in 2022 with

²³⁵ Brown, "The Rising Risk of Cybercrime in the Supply Chain," October 13, 2022.

January 17, 2023; Manaadiar, "FIT Alliance Survey Reveals Promise for Growth in Use of Electronic Bill of Lading," January 17, 2023; Government of Singapore, Maritime and Port Authority of Singapore, "Electronic Bills of Lading," July 30, 2021.

²²⁸ DCSA, *DCSA Takes on EBL Standardisation, Calls for Collaboration*, May 19, 2020, 2. See *Recent Trends 2019*, box 4.2 for more on blockchain with eBLs.

²²⁹ DCSA, "DCSA Begins Final Phase of EBL Platform Interoperability Proof of Concept," July 12, 2022.

²³⁰ BIMCO, "Electronic Bills of Lading See Surge in the Wake of COVID-19," June 16, 2022.

²³¹ BIMCO, "E-Bills of Lading," July 14, 2022.

²³² Infocomm Media Development Authority, "Electronic Transactions Act Amended," February 1, 2021; Government of Singapore, Maritime and Port Authority of Singapore, "Electronic Bills of Lading," July 30, 2021.

²³³ CargoX, "Companies Flock to Electronic Bills of Lading Sparked by Spike in Users of the CargoX Platform," January 24, 2023.

 ²³⁴ PricewaterhouseCoopers, "Shifting Patterns," 2016; Brown, "The Rising Risk of Cybercrime in the Supply Chain,"
October 13, 2022; Bisson, "Cybersecurity Gaps and Opportunities in the Logistics Industry," March 2, 2021.

²³⁶ Exec. Order No. 14017, 86 Fed. Reg. 11849 (March 1, 2021).

recommendations on how to improve supply chain security which included providing supply chain stakeholders access to cybersecurity tools and education.²³⁷

New Business Models

Facing unprecedented market conditions, the logistics services industry has augmented its traditional business models by increasing collaboration with governments, startups, and incumbent firms within the industry for greater efficiency and cost reductions.

Governments have launched partnerships with logistics services firms to facilitate cooperation between regulators and industry participants. In 2015, the EU established the Digital Transport and Logistics Forum (DTLF) as a platform "for structural dialogue, provision of technical expertise, cooperation and coordination between the Commission, Member States and the transport and logistic sector."²³⁸ One of its goals is digital interoperability and data exchange, which industry participants expect to decrease administrative costs as well as improve efficiency in supply chains and in enforcement of EU freight transport rules.²³⁹ In March 2022, the U.S. White House announced the Freight Logistics Optimization Works (FLOW) initiative, a data-sharing partnership among 18 firms including logistics companies, trucking firms, warehousing firms, ports, and non-logistics businesses such as Land-O-Lakes, Albertsons, Target, and True Value.²⁴⁰ The initiative aims to improve supply chain resilience, help speed up delivery times, and reduce consumer costs.²⁴¹ Some industry participants have noted that the initiative lacks representation among subsectors—notably logistics software companies—though several view the data-sharing initiative as an overall improvement.²⁴²

Logistics firms have also collaborated with, invested in, or acquired logistics-technology startups to create end-to-end visibility across supply chains.²⁴³ Many of these startups leverage AI, machine learning, mobile applications, IoT, blockchain, and cloud technologies to service firms across the logistics industry. For example, FlexPort provides a digital platform using cloud computing and AI for logistics companies, buyers, and sellers that connects a firm's supply chain management operations to e-commerce, payments, and digital advertising suppliers. One of Flexport's key features is the integration of traditionally siloed information from various participants of the supply chain into one cohesive interface that allows firms to track goods from production to retail.²⁴⁴

²⁴¹ The White House, "Fact Sheet: Biden-Harris Administration Announces New Initiative," March 15, 2022;

²³⁷ USDOT, Supply Chain Assessment of the Transportation Industrial Base: Freight and Logistics, February 2022, xii, 3, 72–73.

²³⁸ European Commission, "Digital Transport and Logistics Forum (DTLF)," accessed December 12, 2022.

²³⁹ European Commission, "Digital Transport and Logistics Forum (DTLF)," accessed December 12, 2022.

²⁴⁰ The White House, "Fact Sheet: Biden-Harris Administration Announces New Initiative," March 15, 2022.

Berman, "White House FLOW Initiative Gets Mixed Reviews from Industry Stakeholders," March 16, 2022. ²⁴² Berman, "White House FLOW Initiative Gets Mixed Reviews from Industry Stakeholders," March 16, 2022; USDOT, "DOT, Supply Chain Companies Collaborate to Speed Up Movement of Goods, Cut Costs for Consumers," August 10, 2022.

²⁴³ Vartabedian, "Logistics Companies Move to Snatch Up Supply-Chain Tech Startups," February 22, 2022; Murray, "Logistics Industry Sheds Paperwork in Race to the Digital Frontier," January 4, 2023.

²⁴⁴ McKinsey, "Funding for Logistics Startups," June 6, 2022; Flexport, "Technology Platform for Global Logistics," accessed April 5, 2023.

Alternatively, many existing logistics firms have invested in their digital capabilities.²⁴⁵ Investments in logistics start-ups were valued at \$12.6 billion in 2020 and \$24.6 billion in 2021, with more than 70 percent funding growth during 2014–21.²⁴⁶ In 2021, UPS acquired Roadie, a gig economy platform that enables drivers to reduce delivery times and expand delivery of abnormal packages, such as oversized packages, insufficiently packaged, or perishable goods.²⁴⁷ Several other logistics firms—including U.S.-based GXO, India-based Mahindra, and Denmark-based A. P. Moller-Maersk—have also announced interest in acquiring or have acquired startups in recent years.²⁴⁸ In 2023, Northstar.VC—a venture capital firm specializing in supply chain and finance technology—and Allcargo (India) entered a strategic partnership to invest in logistics technology solutions firms such as Stord, a U.S.-based cloud provider for supply chains.²⁴⁹

As some firms in the industry have acquired or invested in logistics-tech startups, others have formed partnerships with incumbent firms in the logistics and retail industries.²⁵⁰ Service and data-sharing collaborations across firms have the potential to increase revenues, market access, competitiveness, and supply chain resiliency.²⁵¹ For example, XPO Logistics (United States) entered a long-term partnership with Mercedes-Benz Parts Logistics UK in March 2020 to manage and digitally integrate Mercedes-Benz UK parts distribution, reduce costs, and increase efficiency.²⁵² In October 2022, DHL partnered with e-commerce firm BigCommerce to offer BigCommerce merchants access to DHL's express delivery network as well as shipping and logistics services.²⁵³ In August 2022, DHL also partnered with American Eagle Outfitters to launch Quiet Platforms delivery network to offer improved low-cost delivery to shippers.²⁵⁴

In the years ahead, global logistics industry observers anticipate increased globalization and more competition, particularly because of nontraditional adjacent firms entering the logistics services sector.²⁵⁵ A growing number of firms with existing logistics assets in industries such as e-commerce and retail have launched or plans to enter the 3PL logistics services sector in upcoming years. For example, in

²⁴⁵ McKinsey, "Funding for Logistics Startups," June 6, 2022.

²⁴⁶ McKinsey, "Funding for Logistics Startups," June 6, 2022.

 ²⁴⁷ Roadie technology platform enables local same-day delivery service for goods that are not compatible with UPS's existing network, such as oversized packages, insufficiently packaged, or perishable goods, and is expected to add additional UPS small package capabilities. Black, "UPS to Acquire Same-Day Delivery Startup Roadie to Speed Service," September 10, 2021; UPS, "UPS Enters into Agreement to Acquire Roadie," September 10, 2021.
²⁴⁸ GXO, "GXO Ramps up Search for Innovative Technologies," July 10, 2022; The Hindu Bureau, "Mahindra Logistics Picks 10 Tech Start-Ups for Collaboration under Incubator Programme," September 22, 2022; A. P. Moller-Maersk, "Maersk Makes Another Move into E-Commerce with Its First Tech Acquisition," September 15, 2021.
²⁴⁹ Northstar.vc, "Northstar.vc Partners with World's Largest LCL Consolidator Allcargo Group to Explore Investments in Growing LogTech Sector," January 18, 2023; Chowdhury, "Allcargo Open to Buying Tech Startups in the Logistics Space," November 8, 2022.

²⁵⁰ Global Market Insights, "Third-Party Logistics Market Size, Share Report 2023–2032," November 2022.

²⁵¹ Mordor Intelligence, "Third-Party Logistics (3PL) Market Share, Size, Trends (2022–27)," accessed December 14, 2022.

²⁵² XPO Logistics, "XPO Logistics Partners with Mercedes-Benz to Provide Extensive UK Transportation Solutions," March 4, 2020.

²⁵³ Daleo, "DHL Partners with BigCommerce on B2B and B2C Delivery," October 4, 2022.

²⁵⁴ Rogers, "Gap Launches 3PL Distribution Platform," August 24, 2022.

²⁵⁵ Maldonado, *Third-Party Logistics in the US*, January 25, 2023, 23–24; Faber, *Freight Packing and Logistics Services in the US*, August 2022, 12, 27–29.

2022, Amazon announced its plans to offer private global fulfillment services that uses its software and warehousing.²⁵⁶ In August 2022, Gap launched GPS Platform Services allowing its logistics services and fulfilment centers to be used by other retailers.²⁵⁷ That same month, Fresh Del Monte announced two logistics services deals that makes its distribution network and cold storage infrastructure available for third parties.²⁵⁸

Outlook

According to industry observers, concerns regarding the potential for a recession, high energy costs, or reduced consumer spending and industrial production may contribute to slower growth or a decline in the U.S. logistics services industry in 2023.²⁵⁹ Looking forward over the next five years, mergers and acquisitions are expected to continue as firms seek to remain competitive and expand service offerings, particularly in foreign markets.²⁶⁰ Observers also expect energy and transport costs as well as supply chain challenges to increase because of the Russian invasion of Ukraine, which may further depress the U.S. industry's growth.²⁶¹ Still, the U.S. logistics industry revenue is expected to grow at an annual rate of 2.8 percent between 2023 and 2028.²⁶²

Warehousing Services: Demand Growth and Labor Issues

Warehousing refers to the storage and distribution of goods over time. Warehousing services are closely related to retail, e-commerce, logistics, and other services. For example, warehouse merchandise typically transitions to retailers on its way to final consumers,²⁶³ or to e-commerce providers when physical goods are sold online,²⁶⁴ and warehousing firms often store and manage goods as they transition between these services providers. Sales by foreign affiliates of U.S.-owned companies of transportation and warehousing services exceed purchases from U.S. affiliates of foreign-owned companies, while the availability of labor and automation are important factors in the warehousing sector.

²⁵⁶ King, "Amazon leans into logistics as a service," January 11, 2023; Amazon, "New Innovations and Insights from Amazon's Accelerate 2022 Seller Conference," September 29, 2022.

²⁵⁷ Rogers, "Gap Launches 3PL Distribution Platform," August 24, 2022; Gap Inc., "GPS Platform Services," accessed February 10, 2023.

 ²⁵⁸ Fresh Del Monte, "Fresh Del Monte Doubles Down on Logistics Services With 2 New Deals," August 1, 2022.
²⁵⁹ Murray, "Supply Chain 'Normal' Appears on Horizon, With Sights Set on March," October 9, 2022; Maldonado, *Third-Party Logistics in the US*, January 25, 2023, 9.

²⁶⁰ Berger, "Logistics Giant DSV Targets U.S. in Renewed Acquisition Drive," August 12, 2022; Delavin, "Covid-19 Pushes Logistics Sector Consolidation - Asia Cargo News," July 20, 2021; Berger, "Maersk Is Hungry for More U.S. Logistics Companies," February 15, 2022; Maldonado, *Third-Party Logistics Industry Report in the US*, September 2022, 14.

²⁶¹ Maldonado, *Third-Party Logistics in the US*, January 25, 2023, 13.

²⁶² Maldonado, *Third-Party Logistics in the US*, January 25, 2023, 7.

²⁶³ See the retail section in earlier in this chapter.

²⁶⁴ See the e-commerce section earlier in this chapter.

Market Conditions

U.S. and global markets for warehousing services are large and growing. Warehousing is not specifically tracked in cross-border international trade data, but BEA data on affiliate transactions reveal a growing U.S. surplus in "other transportation and warehousing." Services supplied to foreign persons by U.S.-owned affiliates in this category increased from \$32.9 billion in 2016 to \$48.3 billion in 2020.²⁶⁵ Services purchased by U.S. persons from foreign-owned affiliates in the United States rose from \$24.8 billion to \$32.9 billion.²⁶⁶ Another source estimates that global warehousing and storage revenues totaled about \$477.0 billion in 2022.²⁶⁷ Also, the Bureau of Labor Statistics (BLS) estimates that the number of U.S. workers employed in warehousing and storage occupations grew significantly, from 909,000 in 2016 to 1,657,000 in 2021.²⁶⁸

In response to shifts in consumer demand triggered by the COVID-19 pandemic, global demand for warehousing services sharply increased starting in mid-2020.²⁶⁹ This prompted substantial investment in new warehouse construction. As of November 2022, a record 689 million square feet of warehouse space was under construction in the United States.²⁷⁰ Additionally, one commercial real estate firm estimated that the United States would need 330 million square feet of additional warehouse space by 2025 to accommodate growth in e-commerce sales.²⁷¹

The growing demand for space is associated with fewer warehouse vacancies and higher warehouse costs. Warehouse vacancies were down to 0.6 percent at Inland Empire, California (a distribution hub for Los Angeles), in the second quarter of 2022, compared to 3.3 percent during the second quarter of 2019.²⁷² Furthermore, warehousing property costs in 52 global markets increased by an average of 8.4 percent from June 2021 to June 2022.²⁷³ Warehouses have also been affected by supply chain delays; a 2022 report estimated that about \$29.3 billion of partially assembled goods were waiting in UK warehouses because the necessary raw materials, ingredients, and component parts had not yet been delivered by suppliers for their completion.²⁷⁴

The demand for goods started to cool in mid-2022, and this led to increased inventory in warehousing storage.²⁷⁵ By one estimate, outbound warehouse orders declined 33 percent year-over-year in late

during the COVID-19 Pandemic" in chapter 2 of this report.

²⁶⁵ USDOC, BEA, table 4.1, "Services Supplied to Foreign Persons by U.S. MNEs through Their MOFAs, by Industry of Affiliate and by Country of Affiliate," December 7, 2022.

²⁶⁶ USDOC, BEA, table 5.1, "Services Supplied to U.S. Persons by Foreign MNEs though Their MOUSAs, by Industry of Affiliate and by Country of UBO," December 7, 2022.

²⁶⁷ Research and Markets, *Warehousing and Storage Market: Global Industry Trends, Share, Size, Growth, Opportunity, and Forecast 2023–2028*, January 2023.

 ²⁶⁸ USDOL, BLS, "Occupational Employment and Wage Statistics: OEWS Data," accessed December 6, 2022.
²⁶⁹ Gose, "Red-Hot Warehouse Market Faces a Reality Test," August 23, 2022. Also see box 2.1 "International Trade

²⁷⁰ Sisson, "For Want of an Insulation Screw," November 15, 2022.

²⁷¹ CBRE, "CBRE: U.S. Will Need 330M Sq. Ft. of Additional Distribution Space by 2025," June 22, 2021.

 ²⁷² Baertlein, "America's Biggest Warehouse Is Running Out of Room. It's About to Get Worse," August 2, 2022.
²⁷³ Tostevin, *Global Warehousing Costs*, July 2022.

²⁷⁴ King, "Supply Chain Issues Sees Goods Sitting in Warehouses," December 14, 2022. Based on £23.6 billion pounds sterling at a £1 GBP to \$1.24 rate on December 14, 2022. Exchange Rates UK, "British Pound to U.S. Dollar Spot Exchange Rates for 2022," accessed April 3, 2023.

²⁷⁵ Baertlein, "America's Biggest Warehouse Is Running Out of Room. It's About to Get Worse," August 2, 2022.

2022.²⁷⁶ Real estate data reveal a similar pattern, as new leases for U.S. warehouse space increased quickly from an estimated 149 million square feet in the second quarter of 2020 to a peak of 251 million square feet in the second quarter of 2021, then hovered at 241 million square feet in the following quarter, and eventually fell to 163 million square feet in the third quarter of 2022.²⁷⁷

Amazon expanded its warehouse development significantly in 2021, but in 2022 the company noted that it had overestimated the projected growth rate and started selling some of that land and property. For example, Amazon sold its facility in Milpitas, a warehouse near San Francisco, to Dermody Properties.²⁷⁸ One warehouse firm predicted that U.S. warehouse development will continue to fall in 2023 because of increased capital costs, with a projected 60 percent year-over-year decline in development and a 10 percent increase in rent.²⁷⁹

Labor Supply Issues and Injuries

Industry groups have reported shortages in warehouse labor. Warehousing tends to be very labor intensive and, by one estimate, labor can account for up to 65 percent of the total cost of warehouse fulfillment.²⁸⁰ One survey found that 60 percent of U.S. warehouse businesses struggled to keep pace with increased demand in 2021.²⁸¹ Another suggests that warehouse labor shortages are partly caused by a generation gap and the retirement of older workers.²⁸² Internationally, a 2022 study found that 53 percent of the Asia-Pacific region's warehouse operators reported difficulty in finding workers.²⁸³

Labor supply issues in warehousing have been accompanied by an increase in wages. By one estimate, average wages for workers in U.S. warehousing, wholesalers, and manufacturers increased by about \$2.54 per hour in 2021.²⁸⁴ Additionally, the BLS estimates that warehouse and storage workers increased from \$19.77 per hour in October 2017, to \$22.42 per hour in October 2022.²⁸⁵ In the UK, limited labor availability motivated some warehouses to offer as much as 30 percent in pay increases during the 2021 peak season.²⁸⁶

The demand for warehouse labor surged at the onset of the COVID-19 pandemic, and people in the industry have expressed concern that this demand surge may not last. In a U.S. survey released in early 2022, 48 percent of light industrial businesses said that this market uncertainty has increased interest in hiring temporary labor.²⁸⁷ After a rapid increase from 355,000 in March 2020, to 637,000 in December

²⁸² Berkshire Grey, "Berkshire Grey Research Finds 64 Percent of Chief Supply Chain Officers Say Generation Gap Is a Leading Cause of the Labor Shortage in Warehouses," August 31, 2022.

²⁷⁶ LaRocco, "Big Decline in Warehouse Shipments Is Latest Sign of the Consumer Pullback," October 10, 2022.

 ²⁷⁷ Young, "America's Red-Hot Warehouse Market Shows Signs of Cooling," October 14, 2022.
²⁷⁸ Rogers, "Amazon Unloading Property It Bought for New Warehouses," January 31, 2023.

²⁷⁹ Colorean, "ILLS, Marshauss Davidement to Lit 7 Veer Low in 2022, Drelaxie Cove", December

 ²⁷⁹ Solomon, "U.S. Warehouse Development to Hit 7-Year Low in 2023, Prologis Says," December 8, 2022.
²⁸⁰ This cost does not include shipping. F. Curtis Barry and Company, "Managing Your Warehouse Labor to Reduce Overall Expenses," accessed February 23, 2023.

²⁸¹ Straight, "Survey: 73% of Warehouse Operators Can't Find Enough Labor," February 18, 2022.

²⁸³ Frontier Enterprise, "Warehouse Workplaces Improve Amid Labor Shortage," June 22, 2022.

²⁸⁴ Instawork, "The State of Warehouse Labor: Staying Flexible in 2022," accessed April 6, 2023.

²⁸⁵ USDOL, BLS, "Databases, Tables, and Calculators by Subject," accessed March 27, 2023. Not seasonally adjusted.

²⁸⁶ Berry, "UK Labor Shortages Put Warehouses in Crisis as Peak Season Starts," accessed February 9, 2023.

²⁸⁷ Straight, "Survey: 73% of Warehouse Operators Can't Find Enough Labor," February 18, 2022.

2021, job openings in transportation, warehousing, and utilities settled at 451,000 in November 2022.²⁸⁸ Preliminary estimates for transportation, warehousing, and utilities suggest an increase in employees who left voluntarily (from 195,000 in November 2021 to 303,000 in November 2022), as well as layoffs and discharges (from 78,000 in November 2021 to 110,000 in November 2022).²⁸⁹

Warehouse labor supply issues may be partly driven by debilitating worker injuries (like musculoskeletal disorder) as well as fatalities.²⁹⁰ The BLS estimates that, in 2021, the U.S. warehousing and storage industry had 5.5 work-related injury and illness cases per 100 full-time equivalent workers (FTEs).²⁹¹ In comparison, overall U.S. work-related injury and illness cases per 100 FTEs were 2.7 in 2021.²⁹² The U.S. warehousing and storage industry also had 46 fatalities in 2021, more than double the 21 fatalities in 2020.²⁹³

Among other countries, Britain had 16 fatal injuries in the transportation and storage industry in 2021–22, a slight increase from its five-year average of 14 fatal injuries,²⁹⁴ and an estimated 2,520 nonfatal warehousing injuries.²⁹⁵ Singapore had five fatal injuries in transportation and storage between January and June of 2022, an annualized projected rate of 3.9 per 100,000 workers (construction was its top contributor to fatal injuries at 10 workers), as well as 29 major injuries and 767 minor injuries.²⁹⁶

Outlook

Several warehouse firms are investing in automation and new technologies, such as conveyors and robotic arms. For example, Walmart and the Kroger Company have both invested in warehouse automation.²⁹⁷ Amazon is also a major investor in automation, and is estimated to have accounted for 38 percent of all U.S. investment in warehouse automation in 2021.²⁹⁸

²⁸⁸ FRED, "Job Openings: Transportation, Warehousing, and Utilities," accessed April 3, 2023.

²⁸⁹ USDOL, BLS, "Databases, Tables, and Calculators by Subject," accessed April 3, 2023.

²⁹⁰ Nixdorf, Lewis, and Long, "Meet the Amazon Warehouse Workers Paying the Price for Fast, Free Shipping," December 5, 2022.

²⁹¹ USDOL, BLS, "Industry at a Glance: Warehousing and Storage: NAICS 493," accessed January 9, 2023.

²⁹² USDOL, BLS, "Injuries, Illnesses, and Fatalities," accessed January 26, 2023. Notably, in 2021 the share of Black or African American workers fatally injured on the job was 12.6 percent of total fatalities, an all-time high. USDOL, BLS, "National Census of Fatal Occupational Injuries in 2021," December 16, 2022.

²⁹³ USDOL, BLS, "Industry at a Glance: Warehousing and Storage: NAICS 493," accessed January 9, 2023.

²⁹⁴ Government of Great Britain, HSE, "Work-Related Fatal Injuries in Great Britain, 2022," November 23, 2022, 8.

²⁹⁵ Government of Great Britain, HSE, *Transportation and Storage Statistics in Great Britain*, November 2022, 18.

 ²⁹⁶ Government of Singapore, Ministry of Manpower, "Workplace Safety and Health Report, January – June 2022,"
2022, 8, 12, 14, 16.

²⁹⁷ Walmart is a retailer of a variety of goods and services, including groceries, sporting goods, apparel, and pharmaceuticals. Kroger is primarily a retailer of groceries and certain household goods.

²⁹⁸ Seitz, "Labor Shortage Spurs Drive to Automate Warehouses," October 7, 2022. One example of Amazon's investment in warehousing technology is a new stowing system at an Amazon warehouse in Bolton, England that relies on computer vision and monitoring from workers in India and Costa Rica. It aims to accelerate stowing and eliminate the need for handheld scanners. Another is Amazon's Kiva (succeeded by Hercules and Xanthus), a selfdriving robot that transport goods to employees, which allows the elimination of aisles and more room to be used for storage. Furthermore, Amazon's Sparrow uses rubber-tipped vacuum devices to pick up items and places them in other containers. Astorgano, "An Offshore Workforce Is Training Amazon's Warehouse-Monitoring Algorithms," November 21, 2022; Day, "Amazon Is Running Out of Warehouse Workers. Cue the Robots," December 6, 2022.

In a 2020 survey, 49 percent of the respondents planned to invest in "shuttle system-robot hybrids" (mobile automated carts that transport items around warehouses) within the next three years to improve their warehouse technologies.²⁹⁹ Another firm predicted that global warehouse automation would grow about 15 percent annually and reach \$41 billion by 2027.³⁰⁰

The future impact of robots on employment and injury rates in the warehousing industry is unclear. Warehouse personnel are concerned that automation will eliminate jobs but optimistic that automation could also make the remaining jobs safer and increase workplace speed and predictability. A 2022 survey by Accenture of warehouse personnel in the United States, the UK, France, Spain, and China reported that about 60 percent of workers and supervisors had a favorable view of automation.³⁰¹

²⁹⁹ Placek, "Investments in Emerging Technologies in Warehouse Automation Worldwide 2020," September 28, 2022.

³⁰⁰ LogisticsIQ, "Warehouse Automation Market," 2022.

³⁰¹ The survey used a series of video interviews with 34 warehouse workers and 33 frontline supervisors across the United States, the UK, France, Spain, and China. Using sentiment analysis and natural language processing, the study estimated that the overall sentiment of workers and supervisors toward automation was about 40 percent negative and 60 percent positive. Lui et al., "Research: How Do Warehouse Workers Feel About Automation?," February 11, 2022.

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American Booksellers Association. "Unfulfilled: Amazon and the American Retail Landscape," November 2022. <u>https://www.bookweb.org/sites/default/files/diy/FinalUnfulfilled-Report.pdf</u>.

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Chapter 4 Transportation Services Adjust to Changes in Demand, New Market Entrants, and Labor Issues

This chapter highlights transportation services, which move goods from producers to consumers and underpin global supply chains.³⁰² The transportation services described in this chapter comprise maritime shipping, ports, air cargo, trucking and rail, and express delivery via drone. In recent years, the global transportation system has experienced multiple supply disruptions and large swings in consumer demand due to the COVID-19 pandemic, as well as challenges with labor supply and the development of new business models. At the same time, various policies—including cabotage restrictions (the transport of goods or passengers between two points in the same country)—affect the competitive landscape for transportation services.³⁰³

In the maritime shipping sector, increased consumer demand for goods (including faster growth in ecommerce sales) and the resulting rise in freight rates in a consolidated industry generated large profits for ocean carriers. In turn, this led to increased ship orders, gaining the attention of regulators in certain markets. In the ports sector, increased goods imports in many markets, including the United States, led to congestion and delays, helping to spur longer-term investments in automation and expansion. In the air cargo sector, increased demand for goods transport via airfreight led to higher rates and the entry of new firms into the market. Labor-related issues in the trucking and rail sectors threatened to create disruptions because workers sought improved conditions and higher pay. Furthermore, the market for drone delivery has grown more slowly than some had predicted, but firms have still begun pilot projects and other small-scale product offerings.

³⁰² Exports and imports of transportation services reflect the revenues of firms that provide these services, not the value of the goods transported by these firms. U.S. transportation exports represent the revenue generated by U.S. firms for transporting goods from the United States abroad or transporting goods between foreign points, where allowed. U.S. transportation imports represent the revenue generated by foreign carriers for transporting goods from abroad to the United States, or within the United States, where allowed. Payments by U.S. firms to U.S. transportation providers, as well as payments by foreign firms to foreign carriers, are not recorded as international trade. U.S. exports and imports of transportation services do not correspond exactly to the movement of goods to and from the United States. Services in this chapter are predominantly, but not entirely, captured in cross-border services trade data.

³⁰³ Cabotage can be either via ship (maritime cabotage), air (aviation cabotage), or land. WTO, "Glossary: Cabotage," accessed February 24, 2023; AOPA, "Cabotage and Aviation Rules Relating to Cabotage on International Flights," December 31, 2017; FMCSA, "Cabotage," accessed February 25, 2023.

Maritime Shipping: Increased Demand and Government Scrutiny

Maritime freight transport services (also called maritime shipping) encompass transport of cargo on ships between coastal (or deep-sea) ports; transport between coastal ports and inland lakes and waterways; and short-term operating leases of transportation equipment and crew, such as for a single voyage.³⁰⁴ The maritime shipping industry has been a linchpin of the global economy and continues to recover from challenges brought about by the response to the COVID-19 pandemic. During the pandemic, goods continued to flow through the shipping industry, which faced multiple challenges such as container and ship capacity and allocation issues, volatile fuel prices, crew health and safety concerns, the war in Ukraine (which affected trade in petroleum products, grain, and other goods), and shifting consumer demand.³⁰⁵

Notably, demand for imported tangible goods such as entertainment devices, furniture, and home improvement items increased during the pandemic because U.S. consumers spent more time at home as a result of lockdowns and other safety measures.³⁰⁶ This marked increase in domestic consumer demand and the resulting record surge in freight rates led to unprecedented profits for ocean carriers, as well as a large increase in new ship orders by these heavily consolidated shipping firms. Historically high freight rates from mid-2020 through the first half of 2022 also exacerbated global inflation³⁰⁷ and led to greater U.S. government scrutiny of the mostly foreign-based global shipping industry and the introduction of a new maritime container shipping law in the United States.³⁰⁸

Market Conditions

In 2021, the United States posted a trade deficit of \$49.7 billion in maritime freight transportation services, up sharply from a deficit of \$28.4 billion in 2020 (figure 4.1). This increase reflected a growing deficit in merchandise trade and largely resulted from a sharp rise in sea freight imports while exports

³⁰⁴ For the purposes of this investigation, maritime freight transport services do not include port services or passenger transport. For a discussion on port services, see the Ports section of this chapter. USDOC, BEA, *U.S. International Economic Accounts: Concepts and Methods*, June 2022.

³⁰⁵ Related to crew health and safety concerns, in 2022, governments, seafarers, and shipowners agreed to amendments to the International Labour Organization Maritime Labour Convention that aim to improve ship health and safety policies and improve seafarer access to medical care on land and to communication lines with loved ones. UNCTAD, *Review of Maritime Transport: 2022*, November 2022.

³⁰⁶ OECD, International Trade during the COVID-19 Pandemic, March 10, 2022.

³⁰⁷ A study by the IMF found that increased freight rates affect the cost of goods and add to global inflationary pressures. The United Nations Conference on Trade and Development (UNCTAD) estimated that higher dry bulk freight rates and global grain prices contributed to a 1.2 percent increase in consumer food prices worldwide. Carrière-Swallow et al., "Shipping Costs and Inflation," March 2022; UNCTAD, *Review of Maritime Transport: 2022*, November 2022.

³⁰⁸ Ocean Shipping and Reform Act of 2022, Pub. L. No. 117-146, 136 Stat. 1272 (2022) (codified at 46 U.S.C. § 101 et seq.).

remained relatively flat.³⁰⁹ Notably, maritime freight services imports peaked at nearly \$20 billion in the second quarter of 2022, compared to a pre-pandemic high of \$8 billion in the fourth quarter of 2018.



Figure 4.1 U.S. exports and imports of maritime freight services, quarterly, 2017–22

Source: USDOC, BEA, "Table 3.1 U.S. International Trade in Services," April 17, 2022.

The top five U.S. export markets for maritime freight services in 2021 were China (accounting for 10 percent of U.S. exports), followed by Japan (6 percent), Mexico (6 percent), Turkey (5 percent), and India (5 percent).³¹⁰ The top five sources of U.S. imports were Denmark (14 percent), Switzerland (12 percent), Taiwan (12 percent), Japan (12 percent), and China (9 percent).³¹¹

The majority of shipping firms are foreign owned, and the world's top 10 ocean shipping companies are headquartered outside the United States (table 4.1). U.S. imports by source country correspond

³⁰⁹ USDOC, BEA, table 2.2, "U.S. Trade in Services, by Type of Service and Country of Affiliation," January 1, 2023. Trade in maritime services stems from merchandise trade. In general, U.S. imports of freight transport services occur when foreign ocean carriers transport merchandise imports to the United States. Exports of maritime freight transport services occur when U.S. ocean carriers (which are consistently smaller than imports because U.S. firms represent a small portion of the global industry) transport U.S. merchandise exports to foreign countries. For more information on the relationship between maritime freight services and merchandise trade volumes, see box 4.3 in the 2019 USITC Recent Trends report. United States International Trade Commission, *Recent Trends in U.S. Services Trade: 2019 Annual Report*, September 2019.

³¹⁰ Separately, in 2020, sales by U.S.-owned foreign affiliates in water transportation fell to \$6.8 billion, down from \$7.8 billion in 2019, and purchases of services from U.S. affiliates of foreign firms fell from \$2.9 billion to \$2.8 billion. These data include sales and purchases by entities that provide both passenger and freight transportation. USDOC, BEA, table 4.1, "Services Supplied to Foreign Persons by U.S. MNEs through Their MOFAs, by Industry of Affiliate and by Country of Affiliate," and table 5.1, "Services Supplied to U.S. Persons by Foreign MNEs Through Their MOUSAs, by Industry of Affiliate and by Country of UBO."

³¹¹ USDOC, BEA, table 2.2, "U.S. Trade in Services, by Type of Service and Country of Affiliation," January 1, 2023.

approximately to the countries where the leading global ocean carriers are headquartered.³¹² Among this group, MSC (Switzerland), Maersk (Denmark), CMA CGM Group (France), COSCO Group (China), and Hapag-Lloyd (Germany) were the largest firms, measured by their share of global container ship capacity.³¹³ Of the top 30 shipping companies by container volume, the only one headquartered in the United States is Matson, which operates 66,000 20-foot equivalent units (TEUs)³¹⁴ of global containers (or 0.3 percent market share). Matson has historically derived the majority of its revenues from shipping to or from Hawaii and Alaska and shipping to or from the continental United States, with these routes being subject to the Jones Act.³¹⁵ The U.S. trade deficit in maritime freight transportation services reflects the relatively small size of the U.S. maritime freight industry and the way in which maritime freight statistics are reported depending on the country of the firm operating the vessel.

Global		Headquarters			
ranking	Operator	location	Capacity (TEUs)	Market share (%) [*]	
1 st	MSC	Switzerland	4,609,905	17.6	
2 nd	Maersk	Denmark	4,220,012	16.1	
3 rd	CMA CGM Group	France	3,402,212	13.0	
4 th	COSCO Group	China	2,869,477	10.9	
5 th	Hapag-Lloyd	Germany	1,796,163	6.8	
6 th	Evergreen Line	Taiwan	1,661,865	6.3	
7 th	ONE (Ocean Network Express)	Singapore	1,528,921	5.8	
8 th	HMM Co Ltd	South Korea	816,365	3.1	
9 th	Yang Ming Marine Transport Co.	Taiwan	705,614	2.7	
10 th	ZIM	Israel	533,823	2.0	

Table 4.1 Top 10 operators with the largest shipping container fleets
Canacity is the number of containerized 20-foot equivalent units (TELIs); market share is in percentage

Source: Alphaliner, "Alphaliner Top 100," accessed January 15, 2023.

Note: * = percentage of market share is based on the number of TEUs.

The global shipping industry has been consolidating since the mid-2010s.³¹⁶ The U.S. Federal Maritime Commission (FMC) reports that "the number of major carriers in the U.S. Atlantic and transpacific trade decreased from 20 in 2015 to 11 in 2022, due to ocean carrier mergers and the bankruptcy of one major

³¹² The two largest ocean carrier operators by fleet size, MSC and Maersk, are headquartered in Switzerland and Denmark, the top two sources of U.S. maritime freight imports. Taiwan, the third largest source of U.S. maritime freight imports, is the headquarters for two of the top ten ocean carrier operators by fleet size, Evergreen Line and Yang Ming Marine Transport Co. USDOC, BEA, table 2.2, "U.S. Trade in Services, by Type of Service and Country of Affiliation," January 1, 2023; Alphaliner, "Alphaliner Top 100," January 15, 2023.

³¹³ Mediterranean Shipping Company (MSC) was the world's largest shipping container company in 2022, with 4.6 million TEUs (or 17.6 percent of the global total), surpassing Maersk, which had held the distinction for more than 25 years. Quartz, "Maersk Is No Longer the World's Largest Shipping Line," January 6, 2022.

³¹⁴ The industry standard container size is equal to the volume of a 20-foot-long intermodal container, known as a 20-foot equivalent unit (TEU).

³¹⁵ 46 U.S.C. § 55102. The "Jones Act" refers to section 27 of the Merchant Marine Act of 1920, Pub. L. No. 66-261, §27, 41 Stat. 988, 999 (1920). The U.S. share of the world's cargo fleet fell from 16 percent in 1960 to 0.2 percent in 2019. The Jones Act requires that all vessels transporting cargo between covered U.S. ports must, subject to limited exceptions, be built in the United States, registered under the U.S. flag, be manned predominantly by U.S. crews, and owned and operated by U.S.-organized companies that are controlled and 75 percent owned by U.S. citizens. Premack, "How America Quietly Lost 2,700 Ships," June 18, 2021; Matson, *2021 Annual Report*, February 25, 2022; Alphaliner, "Alphaliner Top 100," accessed January 15, 2023.

³¹⁶ USITC, Recent Trends in U.S. Services Trade: 2019 Annual Report, September 2019, 78–79.

carrier."³¹⁷ As of December 2022, the world's top five shipping container companies operated roughly 65 percent of active global TEUs and the top 10 operated nearly 85 percent.³¹⁸

Nine of the largest ocean shipping companies are currently part of three major alliance—the 2M alliance, the alliance, and the Ocean Alliance—that share capacity on large ships, also known as megaships.³¹⁹ These alliances enable liner firms to achieve economies of scale by sharing the costs of operating ships and port terminals, without either pooling revenues or sharing profits among alliance members.³²⁰ These three alliances account for roughly 80 percent of the global container shipping market and 95 percent of the total ship capacity on East-West trade lanes.³²¹ The 2M alliance between MSC and Maersk, the two largest firms that account for a combined two-fifths share of all seaborne freight, will formally end in 2025.³²²

Freight Rates

The shipping industry was relatively unprofitable following the 2008 recession because weak consumer demand and falling freight rates led to heavy debts and tight cashflows.³²³ In 2020, following the onset of the COVID-19 pandemic, the surge in consumer demand for goods overwhelmed existing vessel container capacity, with port congestion exacerbating the limited supply of available container space. The combination of limited freight container supply and heightened demand for shipped goods drove container shipping freight rates to historic highs in 2021 and 2022.³²⁴

Freight rates as measured by the Drewry World Container Composite Index, which tracks the cost of 40foot containers via eight major routes,³²⁵ increased eightfold from \$1,262 per 40-foot container in September 2019 to \$10,361 per 40-foot container in September 2021.³²⁶ Rates for freight transport from Shanghai to Los Angeles—the busiest ports in Asia and North America, respectively, during this period—increased from \$1,404 per 40-foot container in September 2019 to \$12,172 per 40-foot container in September 2021 (figure 4.2).³²⁷ Freight rates, however, decreased as pandemic-related

³¹⁷ Federal Maritime Commission, *Effects of the Covid-19 Pandemic on the U.S. International Ocean Supply Chain*, May 2022.

³¹⁸ Alphaliner, "Alphaliner Top 100," accessed January 15, 2023.

³¹⁹ The largest megaships in 2022 have a maximum capacity of 24,000 TEUs. By contrast, the largest container ship in 1990 could transport roughly 4,800 TEUs. Premack, "Giant Container Ships Are Ruining Everything," May 19, 2022; Allyn International, "Largest Container Ships by Year," accessed January 18, 2023; Murray, "Container Lines Are Set to Smash Year-Old Profit Record by 73%," August 9, 2022; USITC, *Recent Trends in U.S. Services Trade: 2019 Annual Report*, September 2019, 78.

³²⁰ For a more comprehensive discussion on ocean carrier alliances, see United States International Trade Commission, *Recent Trends in U.S. Services Trade: 2019 Annual Report*, September 2019, 78–79.

³²¹ International Transport Forum, "The Impact of Alliances in Container Shipping," 2018.

³²² Maersk, "Maersk and MSC to Discontinue 2M Alliance in 2025," January 25, 2023; Alphaliner, "Alphaliner Top 100," accessed January 15, 2023.

³²³ de Ricqlès, "Shipping: If There Had Been No Pandemic . . . ," February 8, 2022.

³²⁴ UNCTAD, *Container Shipping in Times of Covid-19*, June 21, 2021; Statista, "Container Freight Rate Index from Shanghai to Los Angeles 2019-2022," accessed January 4, 2023.

³²⁵ Including spot rates and short-term contracts.

³²⁶ The index value is the weighted composite price per 40-foot container (2 TEUs) of the eight tracked routes. MacroMicro, "Drewry World Container Index," accessed April 13, 2023.

³²⁷ MacroMicro, "Drewry World Container Index," accessed April 13, 2023; Lloyd's List, *One Hundred Ports 2022*, 2022.

restrictions eased and consumer demand shifted back toward services. Rates for the composite index stood at \$1,717 as of March 30, 2023, and the Shanghai to Los Angeles route fell to \$1,775.³²⁸



Figure 4.2 Container freight rate index for transport from Shanghai to Los Angeles (2019–23)

In dollars per 40-foot container. Underlying data for this figure can be found in appendix B, <u>table B.32</u>.

Source: Statista, "Container Freight Rate Index from Shanghai to Los Angeles 2019-2023," accessed April 17, 2023.

Profits

As a result of a period of historically high freight rates during 2020 through the first half of 2022, ocean freight carrier profits reached a record \$110 billion in 2021, despite only a modest increase in overall freight volume.³²⁹ By comparison, combined 2010–20 operating profits for ocean freight carriers totaled \$37.5 billion, about one-third of the 2021 total.³³⁰ Profits continued to rise in 2022, totaling \$123 billion in the first two quarters of the year.³³¹ Drewry forecast in 2022 that global ocean freight carrier profits for the years 2021–23 will equal the total of all profits recorded from 1950 through 2020.³³² Although freight rates began to return to 2019 levels in early 2023, container shipping industry profits remain high

³²⁸ MacroMicro, "Drewry World Container Index," accessed April 13, 2023.

³²⁹ Profits reflect earnings before interest and taxes (EBIT), also commonly referred to as operating earnings, operating profit, and profit before interest and taxes. The quantity of minor bulks, containerized trade, and residual general cargo in international maritime trade increased from 4.5 million metric tons in 2020 to 4.8 metric tons in 2021, or roughly 5 percent. UNCTAD, *Review of Maritime Transport: 2022*, November 2022.
³³⁰ Port Technology International, "Container Carriers Enjoy Eye-Watering \$110 Billion in 2021 Operating Profit," March 25, 2022.

 ³³¹ McCown, "Mind-Altering \$63.7 Billion Profit In 2Q22 For Container Shipping | LinkedIn," September 4, 2022.
 ³³² Container ships were first manufactured in the 1950s. Marine Insight, "What Are Container Ships - History, Types And Design," June 12, 2022; Milne, "Hard Landing Threat Hangs over Booming Container Shipping Industry," September 8, 2022; MacroMicro, "Drewry World Container Index," accessed April 13, 2023.

because the most recent annual contracts locked in peak pandemic rates. The industry expects weaker profits in 2023, as new contacts are negotiated.³³³

Record profits have led to an increase in new ship orders. The order book for new container ships stood at 6.6 million TEUs in November 2022, equal in size to 27 percent of the existing global container shipping fleet.³³⁴ This is the order book's highest level since 2008, when orders for new container ships exceeded 42 percent of the then-existing global fleet. The global fleet capacity is expected to grow by 8.5 percent in 2023 alone.³³⁵

The return of freight rates to pre-COVID-19 pandemic levels, declines in shipping volumes (see the section on ports in this chapter), and a wave of new ship orders have led to fears that the maritime shipping industry may be entering the latter part of a "boom and bust" cycle.³³⁶ Weakening consumer import demand in the United States and abroad³³⁷—particularly for goods from major net exporters such as China³³⁸—along with a shift in demand from goods toward services may lead to further decreases in shipping rates, just as an influx of new vessels sets sail.³³⁹

In response to these headwinds, shipping conglomerates have begun using blank sailing strategies, in which they idle ships in an effort to limit supply and minimize freight rate declines due to overcapacity.³⁴⁰ Firms have deferred new ship deliveries and begun decommissioning and demolishing older vessels.³⁴¹ Ocean carrier companies are also investing heavily in logistics and port services to mitigate expected decreases in their core freight shipping profits by expanding their portfolios.³⁴² MSC, for example, has announced a \$6 billion joint venture with Ho Chi Minh City to build Vietnam's largest port.³⁴³ Maersk has completed the purchase of LF Logistics—a Hong Kong-based logistics firm that owns 223 warehouses across Asia—as well as the purchase of North American logistics firm Pilot Freight Services. Maersk has more than doubled its global warehouse footprint since 2021.³⁴⁴

³³³ Miller, "Container Shipping's 'Big Unwind': Spot Rates near Pre-COVID Levels," December 22, 2022.

³³⁴ Cello Square, "Capacity management will stabilize rates despite growing orderbook," November 7, 2022.

³³⁵ Cello Square, "Capacity management will stabilize rates despite growing orderbook," November 7, 2022.

³³⁶ Milne, "Hard Landing Threat Hangs over Booming Container Shipping Industry," September 8, 2022.

³³⁷ Bloomberg News, "Chinese Exports Hit by Weak Global Demand and Covid Disruptions," December 7, 2022.

³³⁸ Miller, "Plunge in US Imports Accelerates; Volumes near Pre-COVID Levels," December 12, 2022.

³³⁹ Large commercial container vessels take roughly three years to build, including planning and design. Payne and Chokshi, "How Giant Ships Are Built," June 17, 2020; Maersk, "A.P. Moller - Maersk Continues Green Transformation with Six Additional Large Container Vessels," October 5, 2022.

³⁴⁰ Lewis, "Container Lines Get Creative to Keep Idle Fleet 'Artificially' Low," December 30, 2022.

³⁴¹ Boonzaier, "Container Ship Demolition Derby Begins with Feeder Trio Set to Hit the Recycling Beaches," December 12, 2022.

³⁴² For more information on ports, see the Ports section in this chapter. For more information on logistics, see the Logistics section in chapter 3.

³⁴³ *Economist*, "Investments in Ports Foretell the Future of Global Commerce," January 14, 2023.

³⁴⁴ A. P. Moller - Maersk, "Maersk Annual Report 2022," February 8, 2023, 50.

U.S. Regulatory Response to Record Freight Rates and Logistical Issues for U.S. Exporters

Historically high freight rates and record profits for ocean freight carriers resulted in greater scrutiny of ocean shipping firms by U.S. and foreign governments.³⁴⁵ This scrutiny was further prompted by substantial decreases in schedule reliability and the role of increased shipping rates in exacerbating global inflation.³⁴⁶ U.S. exporters were often unable to find container ships willing to carry their goods overseas, and U.S. trucking firms argued that they were unfairly charged demurrage and detention (D&D) fees (box 4.1).³⁴⁷ In the United States, this led to the passage of legislation aimed at strengthening the enforcement of maritime freight transport rules and protecting U.S. exporters from unfair late fees and retaliatory measures by ocean carriers, notably the Ocean Shipping Reform Act of 2022 (OSRA 22).³⁴⁸

³⁴⁵ The European Commission, for example, is set to review the EU's Consortia Block Exemption Regulation (CBER). The CBER, which is set to expire in 2024, provides carriers exemptions from antitrust regulations in some circumstances so they can enter into cooperation agreements to provide joint cargo transportation services. Separately, France's national assembly approved a tax on windfall profits targeting energy and transport companies, proposed partly in response to ocean carrier profits. *Maritime Executive*, "EC to Review Carriers' Antitrust Exemption After Shippers Complain," August 10, 2022; Reuters, "French Lawmakers Back Special Tax on Dividends from Windfall Profits," October 13, 2022.

³⁴⁶ In January 2020, 68.5 percent of container ships reached their destinations on time; in January 2022, only 30.4 percent arrived on time. Statista data provided by Sea Intelligence, "Schedule Reliability in the Shipping Industry 2022," accessed January 18, 2023; Sea-Intelligence, "Schedule Reliability Declined Slightly in September 2022," October 28, 2022; Carrière-Swallow et al., "Shipping Costs and Inflation," March 2022.

³⁴⁷ gCaptain, "FMC Ruling Could Prove Crucial for 'Unfair' Detention and Demurrage Fee Complaints," January 3, 2023.

³⁴⁸ Ocean Shipping and Reform Act of 2022, Pub. L. No. 117-146, 136 Stat. 1272 (2022) (codified at 46 U.S.C. § 101 et seq.).

Box 4.1 Demurrage and Detention Charges and Collections Increased in the Wake of the COVID-19 Pandemic

As part of their maritime freight shipping contracts, shipping companies provide their customers with the containers used to transport their goods. Customers are provided "free time periods" outside the port terminal to load or unload their merchandise into or from the container and in the port terminal to load or unload the container onto or off a ship. Shipping companies either own or lease these containers, so they have an incentive to turnaround the containers as quickly as possible by charging demurrage and detention (D&D) fees to discourage customers from exceeding their free time periods.^a Demurrage refers to the charge that the customer pays for the use of the container within the port terminal beyond the free time period. Detention refers to the charge that the customer pays for the use of the container pays for the use of the contai

D&D fees imposed by shipping companies on their customers increased considerably in the United States in 2021 and 2022. According to a Federal Maritime Commission (FMC) audit of nine ocean carriers, the total amount of D&D charges billed in the United States increased about ninefold. Demurrage fees alone increased about 10-fold between the second quarter of 2020 and first quarter of 2022.^c The nine carriers audited collected about \$10.1 billion in D&D charges between April 2020 and September 2022.^d

U.S. transportation firms—particularly trucking companies—assert that ocean carriers charged unfair D&D fees in 2021 and 2022. U.S. firms contend that shipping companies were collecting D&D fees on late returns of containers despite heavy port congestion, levying daily holding charges despite port closures, and providing inadequate time periods for container movements.^e U.S. operators and shippers that transported goods over short distances also raised concerns regarding last-minute notices of changes of terminals that were accepting empty containers, as well as uncertainty regarding where to return the containers.^f

U.S. exporters—notably agricultural exporters—have claimed that ocean carriers have refused to load their cargo at seaports, instead sending empty containers to Asia to accommodate higher-paying imports. The Federal Maritime Commission (FMC) reported that the average rate of a 20-foot dry container moving from Shanghai to the U.S. West Coast reached \$8,130 in January 2022. The rate for the backhaul, or return trip, was only \$1,220.³⁴⁹ Given the relatively high fees that firms were willing to pay to ship their goods from Asia to the United States, along with the costs and port delays associated with fulfilling backhaul shipments, ocean carriers reportedly found that it was often more efficient and lucrative to ship goods from Asia to the United States and then return empty containers to Asia, rather than load them with U.S. goods for export.³⁵⁰ For example, one study found that the volume of U.S.

^a UNCTAD, "Demurrage and Detention Charges in Container Shipping," December 12, 2018.

^b UNCTAD, "Demurrage and Detention Charges in Container Shipping," December 12, 2018.

^c These nine carriers are CMA CGM, COSCO, Evergreen, Hapag-Lloyd, Hyundai Merchant Marine, Maersk, Mediterranean Shipping Company,

ONE, and Yang Ming. Federal Maritime Commission, "Detention and Demurrage," accessed January 18, 2023.

^d Federal Maritime Commission, "Detention and Demurrage," accessed January 18, 2023.

^e gCaptain, "FMC Ruling Could Prove Crucial for 'Unfair' Detention and Demurrage Fee Complaints," January 3, 2023.

^f Federal Maritime Commission, "Fact Finding Investigation 29 Final Report," May 31, 2022.

³⁴⁹ Buxbaum, "OSRA 22 Rulemaking Seen as Not Protecting Ag Exporters' Interests," December 21, 2022.

³⁵⁰ A survey by the Agriculture Transportation Coalition, which represents exporters, found about 22 percent of agricultural exports were not delivered as a result of "unreasonable shipping practices." NPPC, "NPPC Supports Ocean Shipping Reform Act of 2022," June 16, 2022.

containerized agricultural exports was 22 percent less than the expected counterfactual level from May 2021 to January 2022, due in part to exporters' difficulty obtaining empty shipping containers and amounting to an estimated \$10 billion in export losses.³⁵¹ As a result, Congress passed OSRA 22, which, among other changes, provided the FMC with guidance that ocean carrier companies cannot "unreasonably" refuse to book space on ships for U.S. agricultural exports.³⁵²

OSRA 22 also authorized the FMC to investigate complaints about charges—such as D&D charges assessed by "common carriers," including shipping firms, and order refunds or penalties for charges that do not comply with the law.³⁵³ OSRA 22 includes antiretaliatory measures aimed at protecting complainants from discrimination or retaliation and also places the burden of proof for the reasonableness of a D&D charge on the shipping company.³⁵⁴

Since the enactment of OSRA 22 in June 2022, the FMC has received more than 200 "charge complaint" filings to challenge carrier fees, with more than 70 meeting the FMC's threshold requirements to be referred to investigators. The FMC also estimates that more than \$700,000 has been refunded by carriers as a result of the charge complaint process.³⁵⁵

To address the conditions that contributed to high shipping rates and other challenges during the pandemic, the U.S. Department of Justice (USDOJ) and the FMC signed an interagency memorandum of understanding (MOU) in July 2021. The MOU established a framework for the USDOJ's Antitrust Division and the FMC to continue regular discussions and review law enforcement and regulatory matters affecting competition in the maritime industry.³⁵⁶ This partnership was strengthened in February 2022 with the announcement of a knowledge-sharing agreement between the two agencies. The USDOJ will provide the FMC with the support of attorneys and economists from its Antitrust Division for enforcement of violations of the Shipping Act and related laws. The FMC will provide the USDOJ's Antitrust Division with support and maritime industry expertise for enforcement actions.³⁵⁷

Outlook

The pandemic period was historically profitable for the maritime shipping industry. Industry analysts forecast tepid growth and a return to relative normalcy in 2023 and 2024 as freight rates return to their pre-pandemic levels and growth in containerized shipping trade volume remains minimal.³⁵⁸ In the near

³⁵⁴ Bruno, "FMC to Assess Shippers' Anti-Retaliation Compliance," December 22, 2022; Ocean Shipping and Reform Act of 2022, Pub. L. No. 117-146, §§ 5 (prohibition on retaliation) & 10 (carrier bears burden of establishing reasonableness), 136 Stat. 1272 (2022) (amending 46 U.S.C. § 411102 and adding 46 U.S.C. § 41310)}.

³⁵¹ Carter et al., "Global Shipping Container Disruptions and U.S. Agricultural Exports," April 2022.

³⁵² Domestically, agricultural exporters have raised concerns about the definition of "unreasonable vessel accommodation." Buxbaum, "OSRA 22 Rulemaking Seen as Not Protecting Ag Exporters' Interests," December 21, 2022; Ocean Shipping and Reform Act of 2022, Pub. L. No. 117-146, 136 Stat. 1272 (2022) (codified at 46 U.S.C. § 101 et seq.).

³⁵³ FMC, "Guidance on Charge Complaint Interim Procedure," accessed February 9, 2023.

 ³⁵⁵ FMC, "FMC to Seek Additional Comments on Unreasonable Refusal to Deal Rulemaking," January 25, 2023.
 ³⁵⁶ USDOJ, "Justice Department and Federal Maritime Commission Sign Memorandum of Understanding to Support Interagency Collaboration," July 12, 2021.

³⁵⁷ USDOJ, "Justice Department and Federal Maritime Commission Reaffirm and Strengthen Partnership to Promote Fair Competition in the Shipping Industry," February 25, 2022.

³⁵⁸ UNCTAD, *Review of Maritime Transport: 2022*, November 2022.

term, ocean carriers will be responsible for meeting new decarbonization regulations developed by the United Nations International Maritime Organization (IMO) (which came into effect in January 2023) as well as the compliance costs associated with OSRA 22.³⁵⁹ Ocean carriers are also expected to continue expanding their core portfolios by investing their pandemic-era profits in logistics and warehousing services.

Ports: Congestion, Expansion, and Labor Issues

Ports are facilities where ships load and unload cargo.³⁶⁰ These include coastal seaports close to oceans, inland ports on rivers or canals, and dry ports that connect to road or rail systems.³⁶¹ Most ports are governed by local public port authorities that manage construction and navigation. Port authorities can have several functions. For example, the Port of New York and New Jersey acts as a landlord, building and maintaining infrastructure but not working in operations,³⁶² while the Port of Houston directly operates some terminals.³⁶³ The U.S. Army Corps of Engineers plays a role in planning and managing port improvement projects.³⁶⁴ The United States has consistently run a trade surplus in both cross-border port services and foreign affiliate sales of water transportation services. Globally, the pandemic was associated with port congestion, while increased investment and the adoption of new technologies have improved port infrastructure.

Market Conditions

The BEA reports data on cross-border exports and imports of port services, including both intra-firm trade and trade among unaffiliated parties, between U.S. residents and foreign residents.³⁶⁵ U.S. cross-

³⁵⁹ These new rules require that ships of 400 gross tonnage (GT) and above calculate their Energy Ship Index and implement technical means of improving their energy efficiency, as well as requiring ships 5,000 GT and above to calculate their operational carbon intensity using indicators that link GHG emissions to their carrying capacity. In 2024, ships will be rated, and those with the lowest ratings for three consecutive years will have to submit a corrective action plan. UNCTAD, "Assessing Possible Impacts on States of Future Shipping Decarbonization," June 20, 2022. 2021 Amendments to the International Convention for the Prevention of Pollution from Ships (MARPOL), June, 2021, Regulations 20–31.

³⁶⁰ USDOT, BTS, "Definition of Ports and Methods Used to Identify the Top 25 Ports by Total Tonnage, Twenty-Foot Equivalent Unit, and Dry Bulk Tonnage," January 26, 2017.

³⁶¹ Airports are usually separable from ports because they provide high-value goods instead of bulk commodities, though some integration does exist. Rodrigue, "Integration Between Port and Airport Terminals," accessed February 24, 2023.

³⁶² A public self-supporting organization established in 1921 that offers trade and transportation within a 25 mile radius of the Statue of Liberty. See Port Authority NY NJ, "The Largest U.S. East Coast Container Port," accessed March 30, 2023.

³⁶³ USDOT, BTS, "Definition of Ports and Methods Used to Identify the Top 25 Ports by Total Tonnage, Twenty-Foot Equivalent Unit, and Dry Bulk Tonnage," January 26, 2017. The Port of Houston is a 25-mile complex with public and private terminals. See Texas Comptroller of Public Accounts, "Port of Entry: Houston," 2016.

³⁶⁴ USDOT, BTS, "Definition of Ports and Methods Used to Identify the Top 25 Ports by Total Tonnage, Twenty-Foot Equivalent Unit, and Dry Bulk Tonnage," January 26, 2017.

³⁶⁵ The BEA's annual survey covers port services like pilotage, towing and tugboat services, harbor fees, and berth fees. USDOC, BEA, "A Guide to BEA's Services Surveys," August 2018, 10.

border exports of port services (i.e., the provision of port services to foreign firms shipping goods to the United States) totaled \$15.4 billion in 2021, an increase from \$13.7 billion in 2016.³⁶⁶ Denmark and Switzerland were the largest markets for these exports in 2021 (at \$2.3 billion and \$2.0 billion, respectively), likely because the world's two largest container shipping firms—Maersk Line and MSC— are headquartered in these countries (see the section on maritime shipping in this chapter).³⁶⁷ U.S. cross-border imports of port services totaled \$2.0 billion in 2021, up from \$1.6 billion in 2016.³⁶⁸

The BEA also reports data on affiliate sales (i.e., services sold in international markets through direct investment) of water transportation services. Sales by foreign affiliates of U.S. water transportation services firms fell to \$6.8 billion in 2020 (the latest year available), compared to \$9.9 billion in 2015.³⁶⁹ Purchases from U.S.-located affiliates of foreign water transportation services firms fell to \$2.8 billion in 2015.³⁷⁰ The pandemic may have negatively affected such sales and purchases in 2020, but both have been declining for some time. Sales by U.S.-owned foreign affiliates of U.S. water transportation services had fallen steadily from \$9.9 billion in 2015 to \$7.9 billion in 2019. Likewise, purchases from foreign-owned U.S. affiliates of water transportation services fell to \$3.0 billion in 2019 from \$4.7 billion in 2015.

By one estimate, Shanghai, Singapore, and Ningbo-Zhoushan were the world's largest container ports in 2020 in terms of throughput, with 43.5 million TEUs, 36.9 million TEUs, and 28.7 million TEUs, respectively (table 4.2).³⁷¹ This represents growth from 2016, when volumes at these three ports were 37.1 million TEUs, 30.9 million TEUs, and 21.6 million TEUs, respectively.³⁷² The largest U.S. ports in 2020 were Los Angeles, Long Beach, and the Port of New York and New Jersey. Notably, starting in August 2022, the Port of New York and New Jersey became the busiest port in the United States, measured by containerized cargo, as firms reduced their dependency on Los Angeles and Long Beach because of congestion (see below).³⁷³ U.S. locations are distinguished by their relative volumes of imports, exports, and domestic shipments. By one estimate, Los Angeles had 77.9 percent of its TEUs in imports, 21.3 percent of its TEUs in exports, and 0.7 percent of its TEUs in domestic shipments in 2020.³⁷⁴

³⁶⁶ USDOC, BEA, table 2.2, "U.S. Trade in Services, by Type of Service and by Country or Affiliation," December 7, 2022.

³⁶⁷ By one estimate, in 2021 Maersk had 713 vessels and MSC had 587 vessels. McCarthy, "The World's Largest Container Shipping Companies," March 29, 2021. The third country is Japan at \$1.8 billion in exports.

³⁶⁸ USDOC, BEA, table 2.2, "U.S. Trade in Services, by Type of Service and by Country or Affiliation," December 7, 2022.

³⁶⁹ USDOC, BEA, table 4.1, "Services Supplied to Foreign Persons by U.S. MNEs through Their MOFAs, by Industry of Affiliate and by Country of Affiliate," December 7, 2022.

³⁷⁰ USDOC, BEA, table 5.1, "Services Supplied to U.S. Persons by Foreign MNEs though Their MOUSAs, by Industry of Affiliate and by Country of UBO," December 7, 2022.

³⁷¹ Lloyd's List, *One Hundred Ports*, 2021. This is the most recent year available as of December 2022.

³⁷² Lloyd's List, "Shanghai (China), Throughput 2016," August 2, 2017; Lloyd's List, "Singapore, Throughput 2016," August 2, 2017; Lloyd's List, "Ningbo-Zhoushan (China), Throughput 2016," August 2, 2017.

³⁷³ Berger, "California Long Ruled U.S. Shipping. Importers Are Drifting East," December 14, 2022.

³⁷⁴ USDOT, BTS, "2022 Port Performance Freight Statistics Program: Supply Chain Feature," 2022, 3. The U.S. Department of Transportation's Bureau of Transportation Statistics used another method of measuring U.S. container port TEUs in 2020. According to the U.S. Army Corps of Engineers, Waterborne Commerce Statistics Center, these 2020 statistics may not be comparable to previous years because of changes in boundaries and definitions.

	TEUs	Global		TEUs	Global
Global ports by throughput	(millions)	ranking	U.S. ports by throughput	(millions)	ranking
Shanghai (China)	43.5	1st	Los Angeles, CA	9.2	17th
Singapore	36.9	2nd	Long Beach, CA	8.1	19th
Ningbo-Zhoushan (China)	28.7	3rd	New York and New Jersey, NY and NJ	7.6	21st
Shenzhen (China)	26.6	4th	Savannah, GA	4.7	38th
Guangzhou (China)	23.5	5th	Seattle and Tacoma, WA	3.3	53rd
Qingdao (China)	22.0	6th	Houston, TX	3.0	62nd
Busan (South Korea)	21.8	7th	Virginia, VA	2.8	68th
Tianjin (China)	18.4	8th	Oakland, CA	2.5	75th
Hong Kong (China)	18.0	9th	Charleston, SC	2.3	80th
Rotterdam (The Netherlands)	14.3	10th	Miami, FL	1.1	n.a.

Table 4.2 Top global and U.S. ports, by throughput, in 2020 Throughput is based on number of 20-foot equivalent units (TEUs): TEUs in millions

Source: Lloyd's List, One Hundred Ports, 2021.

Notes: The Port of Virginia is a group of facilities comprising 4 marine terminals (including Newport News, Norfolk, and Portsmouth) as well as related intermodal and inland operations. The port of New York and New Jersey is a port district which encompasses facilities within a 25-mile radius of the Statue of Liberty. In 2020, only 9 U.S. ports were ranked among the top 100 ports by throughput. The Miami estimate is not included in the global ranking and comes from Container News, "Top 10: The Busiest Container Ports in the United States," July 18, 2021.

The World Bank's Container Port Performance Index ranks performance and efficiency according to total port hours per ship call, which include how long it takes for a ship to arrive at a port, complete its cargo exchange, and depart.³⁷⁵ The five top-ranked container ports on this index in 2021 were King Abdullah Port (Saudi Arabia), Salahah (Oman), Hamad Port (Qatar), Yangshan (China), and Khalifa Port (Abu Dhabi), highlighting their investments in infrastructure and technology.³⁷⁶ Notably, of 370 global ports, Los Angeles and Long Beach were rated as the most inefficient in 2021. Over time, inefficiency may lead to slower growth, higher costs, and less employment.³⁷⁷

Short-Term Congestion and Delays

Lockdowns and fluctuations in consumer demand stemming from the COVID-19 pandemic had a substantial impact on activity, wait times and delays, and shipping costs at U.S. and global ports. The volume and value of freight moving through ports fell in early 2020, following the onset of the pandemic, then started rising substantially in mid-2020.

³⁷⁵ World Bank and S&P Global, *The Container Port Performance Index 2021*, 2022, 29–31. See also World Bank, "Middle East Container Ports Are the Most Efficient in the World," May 25, 2022. The largest percentage of ships (44 percent) were made by "intra-regional" ships with a capacity between 1,500 and 5,000 TEUs, compared to smaller "feeder" ships with less than 1,500 TEUs (11 percent) and ultra-large ships with more than 13,500 TEUs (9 percent).

³⁷⁶ World Bank and S&P Global, *The Container Port Performance Index 2021*, 2022, 39.

³⁷⁷ World Bank and S&P Global, *The Container Port Performance Index 2021*, 2022, vi, 11. The ratings are based on index points using two approaches, administrative and statistical. The administrative approach estimates –954.1 in Los Angeles and –952.5 in Long Beach, reflecting poor port performance in call and vessel size relative to the average, compared to King Abdullah Port's index point of 217.9. Similarly, the statistical approach estimates –281.8 in Los Angeles and –348.9 in Long Beach, compared to King Abdullah Port's 93.4.

By one estimate, U.S. container import levels in 2021 logged the largest volume and fastest growth on record, increasing by 18.3 percent compared to 2020.³⁷⁸ The Port of Los Angeles alone moved 10.7 TEUs in 2021, breaking its 2018 record by 13 percent,³⁷⁹ and its operating revenue rose by 22 percent.³⁸⁰ The U.S. Department of Transportation's Bureau of Transportation Statistics shows that freight value transported by vessel in the United States increased from \$34 billion in U.S. exports and \$66 billion in U.S. imports in May 2020 to \$61 billion and \$109 billion, respectively, in October 2021.³⁸¹ The proportion of global container ships that were fully laden increased from 52 percent in 2020 to 60 percent in 2021.³⁸²

By late 2022, easing of pandemic restrictions and a rebalancing of consumer demand away from goods and toward services like travel and entertainment reversed many of these impacts on ports. U.S. container import TEUs were down in September 2022 by about 11 percent year-over-year and down 12 percent from August—a sudden decrease, especially because these months tend to be peak shipping times.³⁸³ Container shortages were followed by a surplus of containers, filling up storage at terminals.³⁸⁴

During this period, sudden changes in demand caused significant port congestion in the United States, Europe, and China.³⁸⁵ In August 2021, about 353 container ships were waiting outside ports globally, compared to less than half that number in January.³⁸⁶ By one estimate, global shipping times increased by 25 percent from the end of 2020 to the end of 2021.³⁸⁷ Port congestion can also be measured by dwell time—the amount of time that vessels spend in port actively loading or unloading cargo, which affects both port capacity and throughput performance.³⁸⁸ By one estimate, the average U.S. container vessel dwell time increased from 28.1 hours in 2020 to 32.0 hours in 2021.³⁸⁹ Still another estimate on North American and Eastern routes shows an increase in container delays from 2 days at the beginning of 2020 to 12 days at the end of 2021,³⁹⁰ and an increase in average waiting time for global dry bulk handlers from 50 hours in 2019 to 67 hours in 2022.³⁹¹

Cancellations of scheduled port calls grew quickly, with ship schedule reliability decreasing from an estimated 65 percent in early 2020 to 34 percent by the end of 2021.³⁹² Ship delays in vessel transit from China to the Port of New York and New Jersey peaked at an estimated 21 days as late as February

³⁷⁸ Berman, "Port Tracker Has 2021 Import Volumes on a Record-Setting Pace," December 8, 2021.

³⁷⁹ Port of Los Angeles, "Facts and Figures," accessed February 27, 2023; White House, "A Record Year for America's Ports and a Look to the Year Ahead," January 20, 2022.

³⁸⁰ CNBC, "Why Ports Are Some of the Least Efficient in the World," February 17, 2022.

³⁸¹ USDOT, BTS, "Supply-Chain Challenges," accessed November 3, 2022.

³⁸² UNCTAD, *Review of Maritime Transport: 2022*, November 2022, 83.

³⁸³ Berger and Page, "Freight Operators' Peak Shipping Season Is Crumbling," October 18, 2022.

³⁸⁴ Tan, "The Global Shipping Industry Is Facing a New Problem: Too Many Containers," November 10, 2022.

³⁸⁵ During the COVID-19 pandemic, U.S. consumers increased purchases of home office furniture and exercise equipment, leading to record volumes of goods imports from Asian factories. Goodman, "'No Jobs Available,'" October 28, 2022.

³⁸⁶ Plimmer and Dempsey, "Ports Face Biggest Crisis Since Start of Container Shipping," August 10, 2021.

³⁸⁷ Komaromi, Cerdeiro, and Liu, *Supply Chains and Port Congestion Around the World*, March 2022.

³⁸⁸ USDOC, BTS, "Port Performance Freight Statistics Program: Glossary," February 2018; USDOT, BTS, "Container Vessel Dwell Times," accessed January 26, 2023.

³⁸⁹ USDOT, BTS, "Container Vessel Dwell Times," accessed January 26, 2023.

³⁹⁰ UNCTAD, *Review of Maritime Transport: 2022*, November 2022, xix.

³⁹¹ UNCTAD, *Review of Maritime Transport: 2022*, November 2022, 86.

³⁹² International Transport Forum, "Performance of Maritime Logistics: Case-Specific Policy Analysis," 2022, 7.

2022.³⁹³ Also in February 2022, the Port of Los Angeles had a backlog of more than 90 container ships and about 69,000 empty containers at the terminal and off-dock depots.³⁹⁴ In addition to changes in demand, another factor impacting these trends is that about 10 percent of dockworkers in Los Angeles and Long Beach were unavailable for work in January 2022 because of COVID-19 pandemic-related reasons.³⁹⁵ Also, in 2021, the number of port arrivals in Panama rose by 22 percent, largely for container ships avoiding U.S. West Coast congestion by moving through the Panama Canal.³⁹⁶

These delays raised prices for transport significantly.³⁹⁷ At the end of 2020, spot freight rates (i.e., onetime prices of moving shipments at current market rates) were an estimated 264 percent higher for transport from Asia to North Europe compared to 2019.³⁹⁸ Additionally, from March to December 2020, freight rates from China to the United States and Europe increased 300 percent and spot rates were up from \$1,200 to \$6,000 per container.³⁹⁹ From 2019 to 2022, the largest cost increases in shipments to major U.S. ports were estimated to be from Shanghai and Ho Chi Minh City, Vietnam (though shipments from the Port of Durban, South Africa, to Houston had rare cost decreases).⁴⁰⁰ The rise in prices, along with congestion, motivated retailers like Home Depot, Walmart, and Amazon to start chartering their own ships.⁴⁰¹

Ports have reacted to congestion and higher shipping costs in different ways, often by changing container policies. For example, the Port of New York and New Jersey created temporary storage for empty and import containers on more than 12 acres in Port Newark and the Elizabeth-Port Authority Marine Terminal.⁴⁰² In August 2022, the Port of New York and New Jersey also announced new D&D fees against ocean carriers in an attempt to reduce growing port congestion.⁴⁰³ By one estimate, these ports now have the highest charges in the world for the late arrival of containers, with an average D&D charge of \$3,182 in July 2022, compared to \$1,349 in Taiwan.⁴⁰⁴ As mentioned earlier, the Federal Maritime

³⁹³ LaRocco, "Port of New York and New Jersey Adds Fees for Ocean Carriers as Shipping Containers Pile Up," August 2, 2022.

³⁹⁴ CNBC, "Why Ports Are Some of the Least Efficient in the World," February 17, 2022.

³⁹⁵ CNBC, "Why Ports Are Some of the Least Efficient in the World," February 17, 2022.

³⁹⁶ UNCTAD, *Review of Maritime Transport: 2022*, November 2022, 83. Factors other than the COVID-19 pandemic have also contributed to port congestion in recent years. For example, the six-day blockade of the Suez Canal by the Ever Given, a container ship, in March 2021 temporarily accelerated congestion and Vancouver's port temporarily stopped because of flooding rain in 2021. These events had global consequences like late arrivals and rising prices. See Shimada and Kumon, "Ever Given's Suez Canal Blockage Still Disrupting Global Shipping," May 2, 2021. For the history of closing the Suez Canal, see Debre, "Before the Ever Given: A Look at the Crises That Closed Suez," March 28, 2021.

³⁹⁷ For global container price estimates, see Freightos, "Freightos Baltic Index: Global Container Freight Index," accessed December 22, 2022.

³⁹⁸ Tan, "An 'Aggressive' Fight Over Containers Is Causing Shipping Costs to Rocket by 300%," January 24, 2021.

³⁹⁹ Tan, "An 'Aggressive' Fight Over Containers Is Causing Shipping Costs to Rocket by 300%," January 24, 2021.

⁴⁰⁰ Rubinton and Isaacson, "Do Congested Ports Cause Higher Shipping Costs?," April 19, 2022.

⁴⁰¹ CNBC, "Why Ports Are Some of the Least Efficient in the World," February 17, 2022.

⁴⁰² LaRocco, "Port of New York and New Jersey Adds Fees for Ocean Carriers as Shipping Containers Pile Up," August 2, 2022.

⁴⁰³ LaRocco, "Port of New York and New Jersey Adds Fees for Ocean Carriers as Shipping Containers Pile Up," August 2, 2022.

⁴⁰⁴ LaRocco, "Shipping Container Fees Are Falling Around the World, But Not in the U.S.," August 12, 2022.

Commission has investigated the application of such charges when congestion requires container storage.⁴⁰⁵

Long-Term Expansion and Technology

Recent years have seen several large investments in port infrastructure. For example, in 2022 the Port of Baltimore announced a joint investment with Terminal Investment Limited to create a new 165-acre terminal and employ about 1,000 people in crane operations, yard operations, and repair and maintenance.⁴⁰⁶ Port Houston started working on a \$1 billion expansion of the Houston Ship Channel with the U.S. Army Corps of Engineers in June 2022, on schedule for completion in 2025.⁴⁰⁷ Internationally, Singapore's Maritime Port Authority is currently building the Tuas Port, which is expected to be the biggest port in the world by 2040 with a capacity of 60 million TEUs.⁴⁰⁸ Singapore recently invested an estimated \$1.8 billion in the first stage of the new port.⁴⁰⁹ Port infrastructure investment is also on the rise in Vietnam and the Philippines, which had double-digit annual growth in their port arrivals of 18.6 percent and 12.3 percent, respectively, in 2021.⁴¹⁰

The expansion of port infrastructure is often associated with developments in technology. Innovations like digitization, pre-arrival processing, electronic payments, and special procedures for imported medical supplies are reducing waiting and clearance times.⁴¹¹ For example, Singapore's Maritime Port Authority is paperless and uses digital technology that shortens the turnaround time of vessels.⁴¹² Sweden's Hutchinson Ports recently established a new container port terminal with automation and remote operations.⁴¹³ The Port of Antwerp (Belgium) started using an autonomous drone in 2021 to provide surveillance and air traffic management.⁴¹⁴ Other technologies employed by ports include simulated training for port personnel; the "Internet of Vehicles," which can improve port traffic safety;⁴¹⁵ and augmented reality providing visual support that monitors port security.⁴¹⁶ One estimate is

- ⁴¹⁰ UNCTAD, *Review of Maritime Transport: 2022*, November 2022, 82–83.
- ⁴¹¹ UNCTAD, *Review of Maritime Transport: 2022*, November 2022, xxii.

⁴⁰⁵ For more information see box 4.1 in the maritime shipping section earlier in this chapter. LaRocco, "Shipping Container Fees Are Falling Around the World, But Not in the U.S.," August 12, 2022.

⁴⁰⁶ Mirabella, "Massive New Container Terminal Announced for Tradepoint Atlantic in Baltimore County's Sparrows Point," October 25, 2022.

⁴⁰⁷ Donnelly, "Port Houston Starts Work on \$1 Billion Channel Expansion Project," June 6, 2022.

⁴⁰⁸ Brewer, "Tuas Megaport in Singapore," accessed December 12, 2022.

⁴⁰⁹ *Economist,* "Investments in Ports Foretell the Future of Global Commerce," January 14, 2023.

⁴¹² Brewer, "Tuas Megaport in Singapore," accessed December 12, 2022.

⁴¹³ MI News Network, "Watch: Automation and Remote Crane Operations Prime New Swedish Container Terminal for the Future," October 19, 2022.

⁴¹⁴ Antunes, "The Port of Antwerp Is Working Toward the Deployment of Autonomous Drones to Improve Operations," April 5, 2021.

⁴¹⁵ Specifically, the "Internet of Vehicles" is a network that uses software, sensors, and other technologies to connect some vehicles to other vehicles (e.g., pedestrians or parking lots) and exchange data. WIPRO, "Internet of Vehicles: Revolutionizing Transportation of Tomorrow Riding on 5G and Edge AI," March 2022.

⁴¹⁶ ST Engineering Antycip, "Top Five Emerging Port Technologies," January 11, 2021. Notably, the International Longshore and Warehouse Union (ILWU) accepted machine automation at ports in its 2008 labor agreement but has been concerned that such technologies (like the Port of Los Angeles's Trans-Pacific Container Service Corporation and the Long Beach Container Terminal) are "job killers" for dockworkers. Ostrow, "U.S. Dock Workers Say 'No' to Port Automation," September 1, 2022.

that a successfully automated port could increase productivity by up to 35 percent and reduce operating expenses by up to 55 percent.⁴¹⁷

Investment has benefited ports, but aging and inadequate infrastructure reportedly remain issues. One 2020 study of "gigantism" in container shipping found that the number and size of ocean transportation ships have increased significantly but growth in inland terminal capacity has not kept pace.⁴¹⁸ Another study predicts a funding gap of about \$12 billion during the next 10 years in U.S. waterside infrastructure and estimates that only 9 percent of the pavement that connects ports to other modes of transportation is in good or very good condition.⁴¹⁹

Labor Relations

Labor issues have impacted port operations in the United States and around the world in recent years. Nearly all U.S. dockworkers are unionized.⁴²⁰ In July 2014, a labor agreement covering most U.S. West Coast port dockworkers—represented by the International Longshore and Warehouse Union and the Pacific Maritime Association—expired and was not renewed until February 2015. Because no agreement was in place, some industry groups moved shipments to alternative ports in response to increasing transportation costs, storage costs, and late fees, as well as declining revenue due to discounted sales and lost customers.⁴²¹ Specifically, some firms reportedly started shipping to Savannah, Georgia, to avoid the possibility of strikes and other disruptions.⁴²²

Similarly, since July 2022, West Coast port labor unions (representing about 22,000 dockworkers) have again been operating without a contract.⁴²³ The impact of this has been unclear: one report suggests that slowdown tactics may be reducing productivity at these ports,⁴²⁴ but an analysis found no significant cargo-handling issues.⁴²⁵ Notably, U.S. dockworkers are protected by unions, but dray operators (who move containers on the ground in ports) are mostly independent contractors. Dray

⁴²⁰ Cole, "Dockworkers in America," August 22, 2017.

⁴¹⁷ Chu et al., "The Future of Automated Ports," December 4, 2018.

⁴¹⁸ Behdani et al., "Port-hinterland Transport and Logistics: Emerging Trends and Frontier Research," 2020, 22. ⁴¹⁹ ASCE, *2021 Report Card for America's Infrastructure: Ports*, 2021. This study also finds that smaller and inland ports have a hard time competing for federal grants. Overall, ports are given a B– in 2021, an increase from C+ in 2017. ASCE has defined its grading scale for infrastructure as ranging from A, exceptional, to F, failing. ASCE, "News Release: NCS Gives DC's Infrastructure a 'C' Grade for 2021," June 15, 2021.

⁴²¹ GAO, *West Coast Ports: Better Supply Chain Information Could Improve DOT's Freight Efforts*, October 2016, 29. For example, one auto industry representative said that they used additional manpower resources to work around the disruption.

⁴²² Goodman, "'No Jobs Available,'" October 28, 2022.

⁴²³ Monteiro, "U.S. Dockworker Union Deal Will Take Months Says Seroka," October 25, 2022. As of January 2023, there is no contract.

⁴²⁴ Mongelluzzo, *Oakland, Seattle-Tacoma Hit by ILWU Job Slowdowns as Deal Remains Elusive*, September 26, 2022.

⁴²⁵ LaRocco, "Tensions Rise in West Coast Port Labor Battles, with Unions and Management Trading Accusations," September 28, 2022.

operators have experienced some reductions in income, which have been attributed to port congestion (because they are paid by the load and not by the hour)⁴²⁶ as well as a lack of demand in imports.⁴²⁷

Labor relations in the port services sector also have a gender component. Women's participation rates in the U.S. port workforce are low at about 17 percent on average and are especially low in the port operations (6 percent) and cargo handling (8 percent) segments.⁴²⁸ In some cases, work in ports can be physically demanding, which may account for the lower share of women working in the sector; however, work has become less physically demanding with automation.⁴²⁹ In the United States, one estimate found that the percentage of female dockworkers has grown from 5.6 percent in 2019 to 7.1 percent in 2021.⁴³⁰ Discrimination against female dock workers has also been reported.⁴³¹ A 2021 interview suggests that some European ports have been trying to reduce gender disparity through efforts to improve compliance and equity.⁴³² Costa Rica, whose terminal employees are now about 20 percent female, received a Gender Equality Seal granted by the Instituto Nacional de las Mujeres in 2020.⁴³³

Environmental Impacts

Ports provide essential and innovative cargo delivery, but they can also have negative environmental impacts on surrounding communities. Examples include noise and dust, as well as water pollution stemming from oil spills and the discharge of ballast water.⁴³⁴ Dredging, which is necessary to maintain ports, can yield polluting sediments. Additionally, shipping is responsible for about 30 percent of worldwide nitrogen oxides (NOx) emissions, which can be linked to thousands of premature deaths in coastal areas.⁴³⁵ The UN's International Maritime Organization (IMO) regulates maritime pollution, including through a 2001 convention that requires large ships to maintain insurance or other financial securities that cover registered owners' liability in cases where damage is caused by spills of oil carried in ships' bunkers.⁴³⁶ In January 2020, the IMO started limiting sulfur content in marine fuel from 3.5 percent to 0.5 percent mass-by-mass, which should reduce noxious emissions from thick bunker fuel

⁴³² Barreiro-Gen et al., "Gender Equality for Sustainability in Ports: Developing a Framework," September 2021.

⁴³⁴ OECD, The Competitiveness of Global Port Cities: Synthesis Report, 2014, 7, 33–34.

⁴²⁶ Garcia-Hodges, "Poor Conditions and Low Pay for Truckers Helped Fuel Supply Chain Crisis," November 22, 2021. California's Assembly Bill 5, which became law in September 2019, reclassified many dray operators from independent contractors to employees. Many truckers oppose this and seek an exemption from the court ruling. Roche, "California Truckers Protest AB5–ILWU Respect Picket Lines," July 20, 2022. See also the Truck and Rail section of this report.

⁴²⁷ Goodman, "'No Jobs Available,'" October 28, 2022.

⁴²⁸ UNCTAD, *Review of Maritime Transport: 2022*, November 2022, 95.

⁴²⁹ Andiappan and Dufour, "Gender Inequality is Still Rampant in the Maritime Longshore Profession," November 17, 2022.

⁴³⁰ Zippia, "Dock Worker Demographics in the US," accessed May 3, 2023.

⁴³¹ Levine, "U.S. Women Dockworkers Accuse Shippers, Union of Discrimination," March 29, 2018.

⁴³³ Mihajic, "Gender Equality Grows in the Maritime and Port World," October 7, 2020.

⁴³⁵ OECD, "Ocean Shipping and Shipbuilding: Decarbonizing Maritime Transport," accessed February 14, 2023.

⁴³⁶ IMO, "International Convention on Civil Liability for Bunker Oil Pollution Damage (BUNKER)," accessed March 3, 2023. The United States was not a signatory to the Bunker Convention; however, bunker spills from most ships are covered in the U.S. Oil Pollution Act of 1990. Gard, "Entry Into Force of Bunker Convention," August 1, 2008.

(though low-sulfur alternatives like liquefied natural gas can be more expensive).⁴³⁷ One study of routine shipping operations on ports suggested that ports should continue to monitor oil residues and develop strategies to improve the environmental impacts of ship operators.⁴³⁸

California's port-side communities have had especially high rates of air pollution and related illnesses, though pollutants have fallen during the past 30 years partly because of the Clean Air Action Plan adopted by the Ports of Los Angeles and Long Beach in 2006 and updated in 2010 and 2017.⁴³⁹ In October 2021, California's South Coast Air Basin compared container ship emissions to pre-pandemic levels and estimated that emissions had increased by 20 tons per day of NOx and 0.5 tons per day of particulate matter.⁴⁴⁰ In an effort to reduce this, California now has financial incentives for ships with newer engines and ships that reduce speed when entering the San Pedro Bay ports of Los Angeles and Long Beach.⁴⁴¹Increasing storms and heat waves can also affect port maintenance and operations. Ports in low-lying locations are especially vulnerable, as ports in the Pacific Islands, Caribbean Sea, and Indian Ocean may be at risk of coastal flooding over time.⁴⁴²

The recent increase in maritime transportation volumes led to an estimated 4.7 percent increase in carbon dioxide emissions by the world fleet from 2020 to 2021, mostly from container ships, dry bulk, and general cargo vessels.⁴⁴³ Port-related carbon intensity fell during the past decade, though. From 2012 to 2022, the carbon intensity of container ships fell by 21 percent and that of bulk and general cargo vessels by 18 percent. This is partly due to increasing container ship size as well as reducing the speed of cargo ships, which saves fuel.⁴⁴⁴

Outlook

One analysis predicts slower growth in U.S. ports over the next few years compared to recent years. From 2022 to 2027, annual growth in port revenue is expected to be 1.4 percent (compared to 6.0 percent in 2017–22), port employment growth is expected to be 2.5 percent (compared to 9.5 percent),

⁴³⁷ IMO, "IMO 2020 Fuel Oil Sulphur Limit: Cleaner Air, Healthier Planet," January 28, 2021; Gallucci, "At Last, the Shipping Industry Begins Cleaning Up Its Dirty Fuels," June 28, 2018; Safe Harbor Pollution Insurance, "Sulphur 2020 Regulations: One Year Later," February 10, 2021. Bunker fuel is made from petroleum refining restudies which can include waste byproducts. Installing exhaust scrubber systems can also help shipping companies meet the new sulfur requirements. Some public health experts predicted that this reduction could prevent about 7.6 million childhood asthma cases and 150,000 premature deaths annually.

⁴³⁸ Ng and Song, "The Environmental Impacts of Pollutants Generated by Routine Shipping Operations on Ports,"2010, 309.

⁴³⁹ Port of Long Beach and Port of Los Angeles, "San Pedro Bay Ports Clean Air Action Plan," November 2, 2017; CNBC, "Why Ports Are Some of the Least Efficient in the World," February 17, 2022; EPA, "Case Study of the San Pedro Bay Ports' Clean Air Action Plan 2006–2018," March 2021.

⁴⁴⁰ The increase in NOx emissions was equivalent to the emissions from 5.8 million passenger cars in the South Coast, and the increased diesel particulate matter emissions were equivalent to the emissions from about 100,000 Class 8 diesel trucks. California Air Resources Board, *Emissions Impact of Ships Anchored at Ports of Los Angeles and Long Beach*, November 9, 2021.

⁴⁴¹ Port of Los Angeles, "Environmental Ship Index Program," accessed April 11, 2023; CNBC, "Why Ports Are Some of the Least Efficient in the World," February 17, 2022.

⁴⁴² Izaguirre et al., "Climate Change Risk to Global Port Operations," 2021.

⁴⁴³ UNCTAD, *Review of Maritime Transport: 2022*, November 2022, 107.

⁴⁴⁴ UNCTAD, *Review of Maritime Transport: 2022*, November 2022, 107–8.

and wage growth is expected to be 2.3 percent (compared to 11.9 percent).⁴⁴⁵ These factors are partly due to the anticipation of faster growth in the competing ports of Canada and Mexico.⁴⁴⁶ Another analysis expects ports in Indonesia, Malaysia, Singapore, the Philippines, and Thailand to grow quickly in trade volume from 2022 to 2027.⁴⁴⁷

The U.S. government has recently invested in ports. The U.S. Infrastructure Investment and Jobs Act, signed into law on November 2021,⁴⁴⁸ applies \$17 billion to reduce congestion and emissions in U.S. port infrastructure and waterways.⁴⁴⁹ In December 2021, the U.S. Transportation Secretary announced \$241 million in grants through the Maritime Administration's Port Infrastructure Development Program.⁴⁵⁰ Examples of projects underway in FY 2022 include \$68.7 million to reconfigure and realign the shoreline by general cargo terminals at the Port of Alaska, \$47.3 million to install solar panels that will improve the reliability of port operations and other activities at the container terminal in Honolulu, and \$30.1 million to install software that streamlines cargo handling at the terminal in Long Beach.⁴⁵¹

Truck and Rail: Leading Modes of Freight Transport

Truck and rail are the primary modes of freight transportation, both within the United States and among North American countries, and play essential roles in facilitating international trade more broadly by connecting producers and consumers through global supply chains. According to specially tabulated data by the Bureau of Transportation Statistics, in 2020, the two modes together accounted for 73.6

⁴⁴⁵ Burns, Port and Harbor Operations in the U.S., June 2022, 6.

⁴⁴⁶ Burns, Port and Harbor Operations in the U.S., June 2022, 8.

⁴⁴⁷ *Economist,* "Investments in Ports Foretell the Future of Global Commerce," January 14, 2023.

⁴⁴⁸ H.R. 3684, 117th Cong. (2021).

⁴⁴⁹ White House, "Fact Sheet: The Bipartisan Infrastructure Deal," November 6, 2021.

⁴⁵⁰ USDOT, Maritime Administration, "U.S. Transportation Secretary Pete Buttigieg Announces Over \$241 Million in Grants for America's Ports," December 23, 2021.

⁴⁵¹ USDOT, Maritime Administration, *2022 PIDP Grant Awardees*, 2022. In 2020, the port of Alaska had an estimated 382,000 container TEUs and the port of Honolulu had an estimated 785,000 container TEUs. USDOT, BTS, "2022 Port Performance Freight Statistics Program: Supply Chain Feature," 2022, 4.

percent of total U.S. freight by ton-miles, a metric corresponding to volume and distance shipped.⁴⁵² As shown in figure 4.3, trucks accounted for a higher share of this total (46.2 percent or 2.4 trillion tonmiles) than rail (27.4 percent or 1.4 trillion ton-miles). Air, water, and pipeline accounted for the remainder. By value of commodities shipped, trucks alone transported more than 70 percent of all U.S. freight shipments in 2020.453





Source: USDOT, BTS, "National Transportation Statistics, U.S. Ton-Miles of Freight," accessed December 5, 2022. Notes: The data shown include domestic transport flows as well as flows to or from the United States and Mexico and the United States and Canada. Airfreight ranged between 12.5 billion ton-miles (in 2010) and 18.7 billion ton-miles (in 2020). Data for certain years, including each year shown above (with the exception of 2017 and 2018) appear to be revised.

⁴⁵² USDOT, BTS, "National Transportation Statistics (NTS), U.S. Ton-Miles of Freight," December 5, 2022. "Ton-miles is the primary physical measure of freight transportation output. A ton-mile is defined as one ton of freight shipped one mile, and therefore, reflects both the volume shipped (tons) and the distance shipped (miles)." See, USDOT, BTS, "Domestic Freight Ton-Miles," September 10, 2012. The data shown in figure 4.3 include domestic transport flows as well as flows to or from the United States and Mexico and the United States and Canada. The BTS Freight Analysis Framework (FAF) data can be differentiated between domestic and total (including import and export flows) flows: single-mode truck and rail accounted for 63.2 percent of total flows and 62.9 percent of domestic flows in 2020. Unlike the FAF data, which include a separate category for "multiple modes and mail," the data shown in figure 4.3 account for multimodal activity within each mode. Because the rail total for 2020 shown in the figure (1.44 trillion ton-miles) accounts for multimodal activity, it is higher than reported by the FAF (.96 trillion ton-miles-total flows) for the same year. Notably, the difference is not as great for trucking (2.4 trillion tonmiles shown in the figure and 2.34 trillion ton-miles-total flows reported by FAF) as for rail, which demonstrates the importance of multimode shipments in overall rail activity. USDOT representative, email message to Commission staff, February 1, 2023; USDOT, BTS, "Freight Analysis Framework Version 5 (FA5F)," December 22, 2022; USDOT, BTS, "Freight Analysis Framework Frequently Asked Questions," March 4, 2021. The Association of American Railroads estimates that 40 percent of U.S. freight is transported by rail, see Association of American Railroads, "Freight Rail Facts & Figures," November 2022.

⁴⁵³ USDOT, BTS, "Freight Analysis Framework Version 5 (FA5F)," December 22, 2022. Data refer to total flows, including import and export flows.

Because hundreds of trucks are needed to carry the freight of one train, large quantities of goods can be transported more efficiently (in terms of scale, cost, and fuel efficiency) by rail.⁴⁵⁴ This efficiency is particularly relevant for facilitating international trade and connecting producers and consumers with global supply chains, which require coordinated intermodal transport (which entails using more than one mode of transport during a single journey) via ships, trains, and trucks between ports and the country's interior.⁴⁵⁵ Approximately half of U.S. intermodal freight volumes contain imports and exports, and rail is estimated to transport one-third of U.S. goods exports.⁴⁵⁶

Among North American countries, international trade in goods depends on truck and rail transport. The latest available monthly U.S. transborder freight data show that, in October 2022, trucks moved 62.3 percent and rail moved 12.8 percent of total freight by value between the United States and Canada, and between the United States and Mexico.⁴⁵⁷ It is important to differentiate the value of annual freight flows among the United States, Canada, and Mexico (estimated at \$1.3 trillion in 2021) and U.S. international services trade statistics, which capture the revenues of truck, rail, or other carriers for transportation services provided.⁴⁵⁸ In 2021, total U.S. road and other transport services exports were valued at \$3.9 billion and imports were valued \$3.7 billion, as shown in chapter 2.⁴⁵⁹ In the U.S. trucking industry, Mexico-domiciled carriers are prohibited from providing point-to-point transportation services within the United States for goods other than international cargo.⁴⁶⁰

Market Conditions

Deregulation has had a substantial impact on the U.S. truck and rail industries. The Staggers Rail Act of 1980 enabled rail transport providers to set rates and shut down unprofitable routes, among other

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⁴⁵⁴ Association of American Railroads, *The Economic Impact of a Railroad Shutdown*, September 2022, 5.

⁴⁵⁵ Goodman, "How a Rail Strike Could Wreak Havoc on the American Supply Chain," September 14, 2022; Association of American Railroads, *The Economic Impact of a Railroad Shutdown*, September 2022, 4, 6. Rail intermodal transport refers to "the long-haul movement of shipping containers and truck trailers by rail, combined with a truck or water movement at one or both ends." See Association of American Railroads, "What Railroads Haul: Intermodal," October 2022, 1–2.

⁴⁵⁶ Association of American Railroads, "Freight Rail Facts & Figures," November 2022; Association of American Railroads, "What Railroads Haul: Intermodal," October 2022.

⁴⁵⁷ USDOT, BTS, "October 2022 Transborder Tables," January 5, 2023, table 2. Trucks moved 53.7 percent and rail moved 14.1 percent of total freight between the United States and Canada; trucks moved 70.5 percent and rail moved 11.6 percent of total freight between the United States and Mexico (see tables 3 and 4). Annual percentages for 2021 North American truck transport are also reported by the American Trucking Associations. See American Trucking Associations, "Economics and Industry Data," November 28, 2022.

⁴⁵⁸ USDOC, BEA, "U.S. International Economic Accounts: Concepts and Methods," June 2022, 99.

⁴⁵⁹ USDOC, BEA, table 2.1, "U.S. Trade in Services, by Type of Service," July 7, 2022; BEA representative, email message to Commission staff, January 30–31, 2023. The "road and other transport" category includes service types other than truck and rail freight, e.g., space freight. Within the category, truck freight exports and imports, as well as rail freight imports, only include transactions between the United States and Canada. Rail freight exports include transactions between several countries, including Canada and Mexico.

⁴⁶⁰ 49 C.F.R. §§ 365.101T(h), 365.501(b); USDOT, Federal Motor Carrier Safety Administration, "Application to Register Mexican Carriers for Motor Carrier Authority to Operate Beyond U.S. Municipalities and Commercial Zones on the U.S.- Mexico Border FORM OP-1(MX)," accessed February 2, 2023. For information on truckingrelated provisions in the U.S.-Mexico-Canada Trade Agreement, see USITC, *U.S.-Mexico-Canada Trade Agreement*, April 2019, 162–66.

things.⁴⁶¹ As a result, U.S. rail networks were reduced by about 40 percent from 1980 to 2008 and employment in the U.S. industry declined by about 73 percent from 1980 to 2019.⁴⁶² Deregulation also facilitated industry consolidation toward the composition of the U.S. freight rail network, which through mid-April 2023 consisted of seven Class I railroads (defined as those having a minimum revenue threshold of \$900 million in 2021) and 630 Class II and III (or shorter line) railroads.⁴⁶³ The seven Class I railroads, listed in table 4.3, generated an estimated \$66.1 billion in revenue in 2020 (latest available year reported) and represent 94 percent of U.S. freight rail industry revenue.⁴⁶⁴ Revenue for these carriers declined on average by 11.1 percent from 2019 to 2020 as a result of effects from the COVID-19 pandemic.⁴⁶⁵ Class I railroads also accounted for 88 percent of total employment in the industry (estimated at 119,120 workers in 2021).⁴⁶⁶

Table 4.3 U	J.S. Class	I freight	railroad	companies,	2021
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Revenue in billions of dollars.	
Company	2021 Revenue
BNSF Railway Co.	23.3
Union Pacific Railroad Co.	21.8
CSX Transportation	12.5
Canadian National Railway (Grand Trunk Corporation)	11.3
Norfolk Southern Combined Railroad Subsidiaries	11.1
Canadian Pacific (Soo Line Corporation)	6.1
Kansas City Southern Railway Co.	3.0

Source: USDOT, Federal Railroad Administration, "Freight Rail Overview," July 8, 2020; Statista, "Revenue of North American Railroad Companies," May 2022.

Note: Effective on April 14, 2023, the Surface Transportation Board approved the merger of Kansas City Southern and Canadian Pacific, see Surface Transportation Board, "STB Approves CP/KCS Merger With Conditions and Extended Oversight Period," March 15, 2023.

⁴⁶¹ Staggers Rail Act of 1980, Pub. L. No. 96-448, 94 Stat. 1895 (1980) (codified in scattered sections of 11, 45, and 49 U.S.C.); Buck, "How America's Supply Chains Got Railroaded," February 4, 2022. For more information on the Staggers Act and other reforms affecting the rail industry, see Eakin et al., "Railroad Performance Under the Staggers Act," Winter 2010–11.

⁴⁶² Buck, "How America's Supply Chains Got Railroaded," February 4, 2022. The article estimates 135,000 employees in 2019 and 500,000 at the time of the Staggers Act. For more information on network reductions relate to size (as measured by miles of road) and trackage, see Eakin et al., "Railroad Performance Under the Staggers Act," Winter 2010–11, 35.

⁴⁶³ Association of American Railroads, "Freight Rail Facts & Figures," November 2022; Association of American Railroads, "Understanding Intercity Passenger, Commuter & Freight Railroads," November 28, 2022. Effective on April 14, 2023, the Surface Transportation Board approved the merger of Kansas City Southern and Canadian Pacific, see Surface Transportation Board, "STB Approves CP/KCS Merger With Conditions and Extended Oversight Period," March 15, 2023.

⁴⁶⁴ USDOT, BTS, "National Transportation Statistics, Total Operating Revenues," accessed December 6, 2023; Statista, "Operating Revenues of U.S. Class I Rail," February 2022; Association of American Railroads, "Freight Rail Facts & Figures," November 2022. The share of Class I railroad revenue is reported by the Association of American Railroads.

⁴⁶⁵ Statista, "Operating Revenues of U.S. Class I Rail," February 2022.

⁴⁶⁶ Association of American Railroads, "Railroad 101," May 2022; Association of American Railroads, "Freight Rail Facts & Figures," November 2022; USDOL, BLS, "Occupational Employment and Wage Statistics, May 2021 National Occupational Employment and Wage Estimates," March 31, 2022. Employment data refer to (SOC) series "53-4000 Rail Transportation Workers." See Executive Office of the President, Office of Management and Budget, "Standard Occupational Classification Manual," 2018.

The trucking industry also experienced deregulation beginning in the 1980s.⁴⁶⁷ These regulatory changes are associated with declining unionization, increasing competition, the rise of independent contracting, and lower wages in the industry, as discussed more fully below.⁴⁶⁸ The U.S. trucking industry generated \$875.5 billion in annual freight revenue in 2021, and the industry employs an estimated 1.9 million drivers of heavy and tractor-trailer trucks.⁴⁶⁹ Top trucking firms include FedEx Freight, Old Dominion Freight Line, and Yellow Corp, as shown in table 4.4. The table categorizes firms by market segment according to load quantity (truckload (TL) or less-than-truckload (LTL)).⁴⁷⁰ The total revenues of the top 25 TL firms and the top 25 LTL firms declined between 2019 and 2020 because of lowered freight volumes associated with the early phase of the COVID-19 pandemic.⁴⁷¹ Between 2020 and 2021, however, the total revenues of the top 25 TL firms grew by 20.6 percent and the total revenues of the top 25 LTL firms grew by 15.3 percent.⁴⁷²

Table 4.4 Top U.S. tr	rucking firms,	by revenue,	2021
Revenue in billions of do	llars.		

Company	2021 Revenue	Primary carrier type
FedEx Freight	8.6	Less-than-truckload
Old Dominion Freight Line	5.2	Less-than-truckload
Yellow Corp	5.1	Less-than-truckload
XPO Logistics	4.2	Less-than-truckload
Knight-Swift Transportation	4.1	Truckload

Source: Schulz, "Top 50 Trucking Carriers 2022," April 1, 2022.

⁴⁶⁷ USDOT, BTS, "Section 2: Trucking Industry Background and Structure," September 6, 2012.

⁴⁶⁸ Semuels, "The Great American Trucker Shortage Isn't Real," November 12, 2021; Premack, "Washington Lawmakers Still Believe There's a Truck Driver Shortage," November 8, 2022; Viscelli, "How One of America's Steadiest Jobs Turned Into One of Its Most Grueling," May 10, 2016.

⁴⁶⁹ American Trucking Associations, "Economics and Industry Data," November 28, 2022; USDOL, BLS, "Occupational Employment and Wage Statistics, May 2021 National Occupational Employment and Wage Estimates," March 31, 2022. Employment data refer to Standard Occupational Classification (SOC) series "53-3032 Heavy and Tractor-Trailer Truck Drivers," a subcategory of "53-3030 Driver/Sales Workers and Truck Drivers." For more information, see Executive Office of the President, Office of Management and Budget, "Standard Occupational Classification Manual," 2018.

⁴⁷⁰ Schulz, "Top 50 Trucking Carriers 2022," April 1, 2022; USDOT, BTS, "Section 2: Trucking Industry Background and Structure," September 6, 2012. The industry includes the "for-hire" and "in-house" segments—in the former, the industry is composed of (1) TL carriers characterized by large shipments (weighing 10,000 pounds or more) over long distances and (2) LTL carriers transporting consolidated shipments weighing less than 10,000 pounds. The industry can also be segmented by freight type (general or specialized). In 2021, the TL total market size was estimated at \$212.2 billion but the LTL total market size was estimated at \$86 billion. See Statista, *Trucking Industry in the United States*, 2021, 12–13.

⁴⁷¹ Schulz, "Top 50 Trucking Companies," March 30, 2021.

⁴⁷² Schulz, "Top 50 Trucking Carriers 2022," April 1, 2022.

Recent Labor-Related Issues for Truck and Rail Industries

Rail

In fall 2022, the threat of a strike by railroad workers highlighted the economic importance of rail transport.⁴⁷³ A report by the Association of American Railroads estimated that a labor strike in the rail industry would lead to a \$2 billion per day loss in economic output.⁴⁷⁴ Some observers emphasized that a rail strike could result in consumer price increases due to shortages of inputs (such as fertilizers for crops) and scarcity of essential commodities such as oil, grain, or chlorine used in wastewater treatment plants.⁴⁷⁵ Switching all current rail traffic to trucks would be costlier and less efficient and may not be possible given the current capacity of long-haul trucks and highway infrastructure, as well as driver availability.⁴⁷⁶

The potential strike also spotlighted issues with business operations, service delivery, and working conditions in the rail freight industry. The changes associated with deregulation (discussed above) reportedly led to two decades during which railroad rates and costs decreased in real terms and rail volumes increased. More recently, however, rates and carrier profitability have risen and costs and volumes of shipments have steadied.⁴⁷⁷ To cut costs, Class I carriers have reduced staff and implemented measures such as running trains at maximum capacity and using longer trains, which require less labor.⁴⁷⁸ These changes led to increased work, arduous schedules, and strict attendance requirements for workers.⁴⁷⁹ Although these measures have boosted profits for rail carriers, they have

⁴⁷³ Goodman, "How a Rail Strike Could Wreak Havoc on the American Supply Chain," September 14, 2022.

⁴⁷⁴ Association of American Railroads, *The Economic Impact of a Railroad Shutdown*, September 2022.

⁴⁷⁵ Philbrick, "A Strike, Averted," December 4, 2022; Lai, "Congress Moved to Avert a Rail Strike. Here's How and Why," December 2, 2022; Levitz, "Why America's Railroads Refuse to Give Their Workers Paid Leave," November 30, 2022. See also Neuman, "A Deal to Avert a Rail Strike Is on Track, but It Won't Fix U.S. Supply Chain Issues," September 16, 2022.

 ⁴⁷⁶ Association of American Railroads, *The Economic Impact of a Railroad Shutdown*, September 2022; Garland,
 "Amid Strike Fears, Cargo Diversion a Key Fixture in 2022's Supply Chain Playbook," November 16, 2022.
 ⁴⁷⁷ Buck, "How America's Supply Chains Got Railroaded," February 4, 2022; Moore, "U.S. Freight Customers
 Increasingly Taxed by Higher Rail Rates," June 24, 2019; Levitz, "Why America's Railroads Refuse to Give Their
 Workers Paid Leave," November 30, 2022.

⁴⁷⁸ Surface Transportation Board, "STB Issues Hearing Notice for Urgent Issues in Freight Rail Service," April 7, 2022; GAO, "Freight Rail," December 13, 2022 (from 2011 to 2021, Class I carriers have reduced staff by 28 percent); Levitz, "Why America's Railroads Refuse to Give Their Workers Paid Leave," November 30, 2022. Longer freight trains were reportedly among the factors that will be considered in the investigation(s) of the February 3, 2023 freight train derailment in East Palestine, Ohio; see Snyder, "'The Longer the Train, the Heavier the Train'— Ohio Disaster Calls Attention to Freight's Growing Bulk," February 16, 2023. Recently proposed legislation related to the derailment and rail safety includes a bill in the U.S. Senate "to enhance safety requirements for trains transporting hazardous materials, and for other purposes," as well as a bill in the U.S. House of Representatives that would amend the definition of "high-hazard flammable train" and enhance reporting requirements of train accidents involving toxic material. S. 576, 118th Cong. (2023); see also H.R. 1674, 118th Cong. (2023); Lai, "Lawmakers Propose Legislation to Tighten Rail Safety Regulations," February 28, 2023; Lai, "Senate Republicans

and Democrats Propose Rail Safety Bill," March 1, 2023.

⁴⁷⁹ Philbrick, "A Strike, Averted," December 4, 2022; Lai, "Congress Moved to Avert a Rail Strike. Here's How and Why," December 2, 2022.

constrained the ability to meet heightened demand for rail freight and to flexibly manage business operations or supply chain disruptions (as was the case for all carriers in early 2021). They also have discouraged carriers from granting concessions to workers demanding paid sick leave.⁴⁸⁰ Predating the pandemic and continuing through 2022, complaints regarding rail service delays, interruptions, higher rates, and other challenges have been voiced by the chemistry, grain, and other industries, as well as by shippers, some of which prefer the reliability of truck transportation.⁴⁸¹ Railroads have reportedly been losing market share to trucks since before the pandemic. This is reflected in the declining relative shares of rail ton-mile output as shown in figure 4.3, above.⁴⁸²

Since 2020, unions representing freight rail workers have been working on a new labor contract in which paid sick leave became a key worker demand.⁴⁸³ Until recently, rail carriers had not provided paid sick leave in line with their "precision-scheduled railroading" (PSR) business model. PSR aims to transport more freight with fewer workers but lacks flexibility to adjust when workers need time off, especially when demand for rail services has been high.⁴⁸⁴ In 2022, the Biden administration helped negotiate an agreement that included a pay raise, along with other benefits. Although the agreement prevented a potential strike, it did not include paid sick leave, which contributed to several unions' rejection of the deal.⁴⁸⁵ Ultimately, Congress and the President imposed a labor agreement on workers in the rail industry, which was signed into law on December 2, 2022, but nonetheless provided that the parties could reach mutual agreements in future under different terms.⁴⁸⁶ Subsequently, agreements that provide paid sick leave benefits to railroad workers have been reached between some unions and Class I railroads.⁴⁸⁷

⁴⁸⁰ Buck, "How America's Supply Chains Got Railroaded," February 4, 2022; Philbrick, "A Strike, Averted," December 4, 2022; Levitz, "Why America's Railroads Refuse to Give Their Workers Paid Leave," November 30, 2022; Scheiber and Chokshi, "Workers Say Railroads' Efficiency Push Became Too Much," September 15, 2022. For links to reports that estimate increases in rail service rates and profits (30 percent and 186 percent, respectively, from 2000 to 2017), see Buck, "How America's Supply Chains Got Railroaded," February 4, 2022.

⁴⁸¹ Buck, "How America's Supply Chains Got Railroaded," February 4, 2022; Lopez, "GAO Begins to Study PSR's Effect on Reliability, Fees for Shippers," May 14, 2021; Semuels, "America's Railroads Are in Trouble–With or Without a Strike," September 15, 2022.

⁴⁸² USDOT, BTS, "National Transportation Statistics (NTS), U.S. Ton-Miles of Freight," accessed December 5, 2022. In 1980, trucks and rail accounted for 30.9 percent and 22.2 percent of U.S. ton-miles of freight (not shown in the figure). By 2000, those shares had increased to 39.3 percent and 28.7 percent, respectively. Although trucks' share continued to grow to 46.2 percent, rail had fallen to 27.4 percent by 2020.

 ⁴⁸³ Scheiber, "Some Rail Workers, Seeking Sick Days, Say Biden Betrayed Them," November 30, 2022.
 ⁴⁸⁴ Levitz, "Why America's Railroads Refuse to Give Their Workers Paid Leave," November 30, 2022.
 ⁴⁸⁵ Philbrick, "A Strike, Averted," December 4, 2022.

⁴⁸⁶ Pub. L. No. 117-216, §§ 1–2, 136 Stat. 2267, 2268 (2022). For more information on the U.S. government's role in this labor dispute (including a separate measure to add paid sick time to the contract) and the Railway Labor Act generally, see Lai, "Congress Moved to Avert a Rail Strike. Here's How and Why," December 2, 2022.

⁴⁸⁷ For an overview of such agreements reached since February 2023, see Luczak, "UP," March 23, 2023. For more information on some of these agreements, see Marsh, "CSX Reaches Sick Leave Agreements with Mechanical and Repair Workers," February 8, 2023; Marsh, "CSX Reaches Sick Leave Agreements with More Union Groups," February 14, 2023; Marsh, "Union Pacific Reaches Sick Leave Agreements with 2 Unions," February 20, 2023; Marsh, "Norfolk Southern, Maintenance-of-Way Workers Reach Deal on Sick Leave," February 23, 2023.

Trucking

In the trucking industry, the apparent shortage and persistent high turnover rates of drivers—and the related economic consequences—have been key issues. The shortage of truck drivers has been reported by the American Trucking Associations (ATA) since 2005.⁴⁸⁸ The ATA estimated a shortage of 78,000 drivers in 2022 (close to the historic high reported in 2021). Assuming that current trends continue, the ATA expects the shortage to double by 2030.⁴⁸⁹ The ATA indicates the shortage is most prevalent within the long-haul segment of the industry and is related to multiple factors, including driver demographics (e.g., older workers and retirements and low levels of female drivers relative to overall workforce) and challenges with infrastructure.⁴⁹⁰ Since before the pandemic, the trucker shortage, coupled with increased demand for movement of goods, resulted in higher shipping costs as well as higher retail and consumer prices.⁴⁹¹ More recently, the relative lack of drivers has compounded supply chain issues such as congestion at ports and shipping delays.⁴⁹²

The existence of a labor shortage has been questioned, however. Some observers suggest that the issue is instead very high driver turnover and cite retention issues and poor working conditions in the trucking industry after deregulation in the 1980s.⁴⁹³ The trucking industry has experienced persistently high turnover (as high as 92 percent in recent years, which appears concentrated in the TL segment (characterized by larger shipments over long distances) as turnover in the LTL segment was reported to be 14 percent over the same period).⁴⁹⁴ A U.S. Bureau of Labor Statistics analysis, which does not find evidence of a shortage in the labor market for truck drivers, states that high turnover is an indicator of the "unattractive" nature of such jobs.⁴⁹⁵ Though estimates vary, inflation-adjusted driver compensation is reported to be as low as half what it was in the late 1970s, despite increased productivity with rising volumes of freight.⁴⁹⁶ Notably, driver indebtedness to trucking companies has been reported—for example, to repay training costs or truck leases as part of their contracting agreement—and such driver-

⁴⁸⁸ Burs and Monaco, "Is the U.S. Labor Market for Truck Drivers Broken?," March 2019.

⁴⁸⁹ American Trucking Associations, "Driver Shortage Update 2022," October 25, 2022.

⁴⁹⁰ American Trucking Associations, "Driver Shortage Update 2021," October 25, 2021; American Trucking Associations, "Driver Shortage Update 2022," October 25, 2022. See also American Trucking Associations, "3 Ways to Help Lighten the Load on Truckers," July 29, 2021.

⁴⁹¹ Edmondson, "'What Does a Trucker Look Like?," July 28, 2018; Long, "The U.S. Doesn't Have Enough Truckers, and It's Starting to Cause Prices of about Everything to Rise," November 24, 2021.

⁴⁹² Ngo and Swanson, "The Biggest Kink in America's Supply Chain," November 9, 2021.

⁴⁹³ Goodman and Etheredge, "The Real Reason America Doesn't Have Enough Truck Drivers," February 9, 2022. See also Rivero, "There Is No Shortage of US Truck Drivers," November 10, 2021.

⁴⁹⁴ Semuels, "The Great American Trucker Shortage Isn't Real," November 12, 2021. For more information on turnover, see also American Trucking Associations, "The Truth about Trucking Turnover," March 25, 2022; Burs and Monaco, "Is the U.S. Labor Market for Truck Drivers Broken?," March 2019. The Bureau of Labor Statistics (BLS) cites ATA survey data that present similar trends dating back to 1995: the turnover rates for drivers in the large and small carrier truckload segment averaged 94 and 79.2 percent, respectively, between 1995 and 2017 and the less-than-truckload segment averaged 11.7 percent between 2000 and 2017.

⁴⁹⁵ Burs and Monaco, "Is the U.S. Labor Market for Truck Drivers Broken?," March 2019.

⁴⁹⁶ Semuels, "The Great American Trucker Shortage Isn't Real," November 12, 2021; Premack, "Washington Lawmakers Still Believe There's a Truck Driver Shortage," November 8, 2022; Premack, "Truck Drivers' Salaries Are Experiencing an 'unprecedented' Jump, but It's Not Enough to End the Driver Shortage That's Making Everything More Expensive," August 4, 2018.

related costs have repeatedly been cited as the top challenge in a survey of truckers.⁴⁹⁷ Additionally, drivers often work long hours away from home, yet are paid per mile driven and not compensated for overtime or other work (e.g., long waits for loading or unloading).⁴⁹⁸ Poor working conditions, such as lack of bathroom access and inadequate truck parking, have led to inefficiency and safety issues because drivers do not have a reliable place to sleep and rest.⁴⁹⁹ Such conditions disproportionately impact female drivers, who have made up a growing share of the industry's workforce in recent years.⁵⁰⁰ The Infrastructure Investment and Jobs Act, which includes funding for infrastructure projects such as roads, bridges, and highways, has been considered beneficial for freight transportation by the trucking industry.⁵⁰¹ It also includes a pilot program for drivers under 21 years of age, aimed at expanding the pool of drivers, as well as a "Women of Trucking Advisory Board," aimed at fostering entry of women in the trucking industry.⁵⁰² Furthermore, state projects to expand truck parking have been granted discretionary funds under the law.⁵⁰³

Outlook

With projections of higher volumes of freight transport associated with economic growth and recovery from the pandemic, demand for truck and rail freight services and growth in both industries is expected over the next five years.⁵⁰⁴ Anticipated economic recovery domestically and within U.S. trade partners Mexico and Canada—alongside increases of international trade volumes—will likely heighten demand

⁴⁹⁷ Semuels, "The Great American Trucker Shortage Isn't Real," November 12, 2021; Viscelli, "How One of America's Steadiest Jobs Turned Into One of Its Most Grueling," May 10, 2016; *Inbound Logistics*, "Truckers: What Are Your Greatest Challenges?," September 2022. See also Rosalsky, "Is There Really A Truck Driver Shortage?," May 25, 2021.

⁴⁹⁸ Semuels, "The Great American Trucker Shortage Isn't Real," November 12, 2021; Premack, "Washington Lawmakers Still Believe There's a Truck Driver Shortage," November 8, 2022; Viscelli, "How One of America's Steadiest Jobs Turned Into One of Its Most Grueling," May 10, 2016. Legislation with changes to truck driver overtime rules was introduced in both the House of Representatives and Senate in 2022. See H.R. 7517, 117th Cong. (2022); S. 4823, 117th Cong. (2022); see also *Roll Call*, "Truckers Hope Bill Brings Long-Sought Overtime Pay to Their Field," April 26, 2022; U.S. Senate, Office of Senator Ed Markey, "Senators Markey, Padilla Introduce Bill to Ensure Truckers Are Fairly Paid for Overtime Work," September 12, 2022; U.S. Department of Transportation, *Supply Chain Assessment of the Transportation Industrial Base: Freight and Logistics*, February 2022, 85.

⁵⁰⁰ Estimated growth from 14 percent in September 2016 to 18 percent in September 2022. Cheng, "Women Are Entering US Truck-Driving Jobs in Record Numbers," December 5, 2022. On working conditions, see, for example Towey and Kay, "Truckers Say They're Denied Bathrooms on the Job, Forcing Female Drivers to Take Creative Measures to Relieve Themselves," February 7, 2022. In Congress, a bill proposed in 2022 would guarantee bathroom access for truck drivers. H.R. 9592, 117th Cong. (2022). See also Gallagher, "New Legislation Provides Bathroom Access for Truck Drivers," December 15, 2022.

⁵⁰¹ Infrastructure Investment and Jobs Act, Pub. L. No. 117-58, 135 Stat. 429 (2021). Cullen, "Infrastructure Bill Delivers Much for Trucking," November 8, 2021.

⁵⁰² Pub. L. No. 117-58, § 23022, 135 Stat. 429, 778 (2021) (codified at 49 U.S.C. § 31315 note) (creating apprenticeship pilot program); Pub. L. No. 117-58, § 23007, 135 Stat. 429, 761 (2021) (promoting women in the trucking workforce). Cullen, "Infrastructure Bill Delivers Much for Trucking," November 8, 2021. See also Edmondson, "What Does a Trucker Look Like?," July 28, 2018.

⁵⁰³ American Trucking Associations, "The Bipartisan Infrastructure Law Is Delivering for Truck Parking," September 22, 2022.

⁵⁰⁴ O'Malley, Industry Report 48211: Rail Transportation in the US, June 2022; Rose, Industry Report 48412: Long-Distance Freight Trucking in the US, July 2022.

for truck transport among these North American countries.⁵⁰⁵ Trucking is likely to continue as the leading mode of freight transportation with anticipated adoption of electric trucks and automation contributing to growth.⁵⁰⁶ Demand for long-distance and fuel-efficient rail services will continue, and rail operators are expected to deepen links with other modes of transport (including truck freight) to facilitate integrated transport services. Projected expansions in infrastructure expenditure (e.g., in fuel-efficient cars), among other factors, may hamper rail operators' profitability.⁵⁰⁷ Finally, new regulations are expected in the rail industry, for example regulatory changes related to safety, as discussed above.⁵⁰⁸

Air Cargo: Capacity Changes and New Entrants

Demand for goods transport via airfreight rose substantially at the onset of the COVID-19 pandemic in 2020, with volumes peaking in 2021. As a result of this increased demand, airfreight rates also hit record levels during 2021 and U.S. exports of air cargo services grew. However, rates largely fell back to their pre-pandemic levels by 2022. This was due to an increase in the availability of belly cargo (carried in passenger aircraft) and a more generalized slowdown in demand for merchandise imports (as consumers shifted their purchasing patterns back toward services for travel and entertainment and as high inflation reduced consumer spending). Against this backdrop, firms in both the e-commerce and maritime shipping sectors have recently established or significantly expanded their domestic and international air cargo operations, driven by a desire to increase efficiency and offer integrated transport and logistics solutions to customers.

Market Conditions

Airfreight (or air cargo) is primarily used to transport goods that are either time sensitive (such as vaccines) or high value (such as semiconductors) because the cost of airfreight is relatively high compared to sea, road, and rail freight.⁵⁰⁹ Globally, air cargo accounts for about 35 percent of world goods trade by value,⁵¹⁰ (though a much smaller amount by volume). In 2021, 20.2 billion ton-miles of airfreight was transported domestically in the United States and 4.8 billion ton-miles was transported internationally with the United States as a point of origin or destination.⁵¹¹ This international air transport of goods translated into a total \$21.5 billion in U.S. exports and \$13.6 billion in U.S. imports of

⁵⁰⁷ O'Malley, *Industry Report 48211: Rail Transportation in the US*, June 2022.

⁵⁰⁵ Rose, Industry Report 48412: Long-Distance Freight Trucking in the US, July 2022.

⁵⁰⁶ Rose, *Industry Report 48412: Long-Distance Freight Trucking in the US*, July 2022; USDOT, BTS, "National Transportation Statistics (NTS), U.S. Ton-Miles of Freight," December 5, 2022.

⁵⁰⁸ Marsh, "Buttigieg," February 20, 2023.

⁵⁰⁹ IATA, "What Types of Cargo Are Transported by Air?," September 7, 2022.

⁵¹⁰ IATA, "Value of Air Cargo," accessed January 12, 2023.

⁵¹¹ A cargo ton-mile is one ton of revenue cargo (freight or mail) carried for one mile. Similarly, a cargo tonkilometer is one ton of revenue cargo carried for one kilometer. Both are standard measures of volume and capacity in the freight transportation sector. USDOT, BTS, "Air Cargo Summary Data (All) October 2002 -September 2022," accessed January 12, 2023; Eurostat, "Glossary," accessed January 12, 2023.

airfreight services in 2021.⁵¹² Quarterly trade data indicate that both U.S. cross-border exports and imports of airfreight services by value were rising slowly before the onset of the pandemic in March 2020 and accelerated through the end of 2021. Preliminary data show both U.S. exports and imports of airfreight services by value fell in the latter half of 2022, though remaining above their 2019 levels (figure 4.4).⁵¹³ This decrease in the value of U.S. exports and imports of airfreight services occurred in large part because of a decline in airfreight rates; the value of U.S. imports fell more than U.S. exports largely due to lower freight rates on routes from Asia to North America where foreign carriers transported much of the volume.⁵¹⁴





Source: USDOC, BEA, "Table 3.1. U.S. International Trade in Services," March 23, 2023.

Firms in the air cargo sector can generally be divided into three types: express delivery, passenger airlines, and dedicated cargo airlines. Express delivery firms like FedEx and United Parcel Service (UPS) own large fleets of cargo aircraft and provide ground transportation and last-mile delivery. Many passenger airlines such as Qatar Airways have subsidiaries that specialize in air cargo shipments using either dedicated freighters or (more often) the belly cargo capacity of their passenger planes. Dedicated cargo airlines like Atlas Air (United States) and SF Airlines (China) transport goods on their own freighters, lease cargo aircraft to other firms, and provide Aircraft, Crew, Maintenance, and Insurance

⁵¹² U.S. airfreight exports represent the revenue generated by U.S. carriers for transporting goods from the United States abroad or transporting goods between foreign points. U.S. airfreight imports represent the revenue generated by foreign carriers for transporting goods from abroad to the United States, or within the United States. Payments by U.S. firms to U.S. carriers, as well as payments by foreign firms to foreign carriers, are not recorded as international trade. U.S. exports and imports of airfreight services do not correspond exactly to the movement of goods by air to and from the United States. USDOC, BEA, "Table 3.1. U.S. International Trade in Services," March 23, 2023; USDOC, BEA, *U.S. International Economic Accounts: Concepts and Methods*, 2022.

⁵¹³ USDOC, BEA, "Table 3.1. U.S. International Trade in Services," March 23, 2023.

⁵¹⁴ Statista, "Air Freight Rate Changes since the Beginning of Coronavirus Outbreak 2019-2022," accessed January 12, 2023; Lennane, "Airfreight Rates out of Asia Take a Dive as Demand from the West Is 'Subdued,'" July 22, 2022.

(ACMI) services (which entail leasing aircraft and suppling pilots, as well as providing related maintenance services for clients). Firms may choose to purchase different combinations of these services, depending on their needs or business model. All these firms, in turn, interact with third-party logistics providers (3PLs) that consolidate packages and purchase space (often for resale) from the various types of air cargo providers.⁵¹⁵

FedEx and UPS are the world's top airfreight carriers (figure 4.5). This is due, in part, to the large amount of cargo flown domestically by these two firms. Cabotage rules in many markets require that any cargo (or passengers) transported domestically be carried by firms based in that market. For example, U.S. law prohibits "the transportation of persons, property, or mail for compensation or hire between points of the U.S. in a foreign civil aircraft."⁵¹⁶ For international freight, FedEx ranks second and UPS ranks seventh. Several passenger airlines from the Middle East (including passenger airline Qatar Airways at number one) and several Chinese carriers also hold top spots in the international market. Cargo charter and leasing services firms, such as Air Transport International, are major providers in the domestic U.S. market.⁵¹⁷



In millions of ton-kilometers. Underlying data for this figure can be found in appendix B, table B.35.

Figure 4.5 Top 10 global cargo airlines by ton-kilometers (millions), 2021

Source: IATA, World Air Transport Stats 2021, 2021, 24.

Both demand and supply in the air cargo sector have been volatile in recent years. With the onset of the pandemic in early 2020, global demand for air cargo rose because of increased demand for certain merchandise imports (especially for products like personal protective equipment and electronics).⁵¹⁸ At

⁵¹⁵ MarketLine, *Global Air Freight*, March 2021; IBISWorld, *Global Cargo Airlines*, December 2020.

⁵¹⁶ Rules of this type are often referred to as cabotage policies, which also exist in maritime shipping and trucking, and prohibit the transport of goods or passengers between two points in the same country. 19 C.F.R. § 122.165 (explaining air cabotage law at 49 U.S.C. § 41703). Some exceptions are made in certain situations. 49 U.S.C. § 41703(c).

⁵¹⁷ MarketLine, *Global Air Freight*, March 2021; IBISWorld, *Global Cargo Airlines*, December 2020; IATA, *World Air Transport Stats 2021*, 2021. See chapter 3 for more information on 3PLs.

⁵¹⁸ See the special topic section in chapter 2 for more information on the impact of the COVID-19 pandemic on goods trade. McKinsey, "COVID-19's Impact on the Global Aviation Sector," March 31, 2022; USITC, *Shifts in U.S. Merchandise Trade, 2020: The Impact of the COVID-19 Pandemic in Freight Transportation Services and U.S. Merchandise Imports*, November 2021; industry representatives, interview by USITC staff, January 11, 2023.

the same time, available cargo capacity decreased significantly with the loss of "belly cargo" (cargo carried in the holds of passenger aircraft) because of canceled flights.⁵¹⁹ Increased demand for air cargo persisted through 2021 because consumers shifted their spending from certain services to goods and ocean freight remained constrained.⁵²⁰ As a result, cargo load factors (the amount of cargo carried relative to capacity) increased across all regions beginning in March 2020 and remained elevated through the end of 2022 (figure 4.6). Both these phenomena led to a pronounced increase in airfreight rates, especially in late 2021 and early 2022, and in particular for routes from Asia to Europe and North America.⁵²¹

By 2022, airfreight volumes had largely returned to their pre-pandemic levels and capacity rebounded with the return of most intercontinental passenger travel.⁵²² This return to a more stable equilibrium can also be seen in the disappearance of the "preighter" phenomenon, where idle passenger aircraft were hastily converted into makeshift freighters to meet demand for air cargo services.⁵²³

Figure 4.6 Airfreight rates for selected international routes, monthly, January 2020–March 2023



Rates in dollars per kilogram. Underlying data for this figure can be found in appendix B, table B.36.

Source: Statista, "Air Freight Rate Changes since the Beginning of Coronavirus Outbreak 2019–2022," accessed January 12, 2023; Air Cargo News, "Airfreight Rates – Baltic Exchange Airfreight Index," accessed April 5, 2023.

⁵¹⁹ Belly cargo capacity in April 2020 was 75 percent lower than in April 2019. David, "Air Cargo Market Analysis," April 2020.

⁵²⁰ Industry representatives, interview by USITC staff, January 11, 2023.

⁵²¹ Statista, "Air Freight Rate Changes since the Beginning of Coronavirus Outbreak 2019–2022," accessed January 12, 2023.

⁵²² Vanolli, "Air Cargo Market Analysis," October 2022.

⁵²³ Curran, "Is the Preighter Era Ending?," June 13, 2022; IATA, "IATA Economics' Chart of the Week: The Importance of 'Preighters' Seems to Start to Diminish," April 15, 2022; Semanik, "Preighters: How Airlines Pivoted Operations in the Face of a Global Pandemic," 2021.

New Entrants in Airfreight Challenge Established Firms

Increased demand for air cargo services in recent years has led firms in related industries to enter the market. Several firms, including e-commerce firm Amazon and several maritime shipping conglomerates, have recently established or significantly expanded their domestic and international air cargo operations. A key factor driving this trend is firms' desire to increase efficiency and offer integrated transport and logistics solutions to customers.

Amazon has built a large air cargo operation in only a few years. The firm began building its air cargo fleet (called Amazon Air) in 2015, reportedly after encountering difficulties in delivering products during the busy holiday season.⁵²⁴ By the end of 2022, it was running more than 200 flights per day from 71 airports in the United States and several European countries.⁵²⁵ Its fleet consists of 11 cargo aircraft owned by Amazon as well as more than 100 planes leased through seven carriers.⁵²⁶ In early 2023, Amazon also announced its expansion into the Indian market, serving four cities in India.⁵²⁷

A key enabling factor in Amazon Air's rapid expansion has been its reliance on ACMI service providers, which are also used by other firms in the air cargo industry. These ACMI firms hold the aircraft's operating certificates; provide pilots, maintenance, and insurance services; and, in many cases, own the aircraft itself.⁵²⁸ Even for aircraft that it owns, Amazon Air still relies on ACMI firms for crew, maintenance, and insurance.⁵²⁹ Reliance on ACMI firms has allowed Amazon Air to increase its number of cargo flights without making large investments in aircraft or hiring full-time pilots. For example, much of Amazon Air's freighter fleet in Europe is contracted only part time, providing flexibility to its dedicated fleet. Similarly, its partnership with QuickJet in India allowed it to scale up the number of

 ⁵²⁴ Amazon also provides other services in addition to e-commerce, including cloud computing, video streaming, and online advertising. For more on Amazon's role as an e-commerce platform, see chapter 3 of this report.
 ⁵²⁵ Amazon Air's European operations include France, Germany, Italy, Poland, Spain, and the UK. Brett, "Amazon Rapidly Expands European Freighter Operations," March 16, 2022; Harrington, "Inside Amazon Air's Quest to Seize the Skies," December 1, 2022.

 ⁵²⁶ These contract carriers include Atlas Air; ASL Airlines Ireland; Silver Airlines; and Air Transport Services Group (ATSG), a holding company for a variety of cargo airlines. In some cases, Amazon owns the aircraft but still contracts for crew, maintenance, and insurance. Harrington, "Inside Amazon Air's Quest to Seize the Skies,"
 December 1, 2022; Schwieterman, Craig, and Mader, "Takeoff in Northern Kentucky," September 20, 2022.
 ⁵²⁷ Shah and Mandayam, "Amazon Launches Dedicated Air Cargo Service in India as Online Sales Soar," January 23, 2023.

⁵²⁸ Aircraft leases are classified into two types: dry leases and wet leases. For wet leases, the lessor provides the crew and therefore has operational control of aircraft. In a dry lease, the lessee provides the crew (including the pilot) and has operational control. The firm maintaining operational control is required to ensure compliance with Federal Aviation Administration rules; outsourcing the crew also shifts the compliance burden to the ACMI servicer. Schwieterman, Craig, and Mader, "Takeoff in Northern Kentucky," September 20, 2022. ⁵²⁹ Harrington, "Inside Amazon Air's Quest to Seize the Skies," December 1, 2022.

freighters it uses.⁵³⁰ In the United States, Amazon spent \$131 million to take a minority stake in one of its ACMI partners, Air Transport Services Group, to bolster its domestic U.S. air cargo operations.⁵³¹

Increased flexibility has been cited as a key reason for Amazon's entry into the air cargo industry, allowing Amazon to build flight schedules around its delivery commitments (especially its two-day Prime deliveries) rather than the other way around.⁵³² Before 2015, Amazon had almost exclusively relied on UPS and FedEx for express delivery of its packages in the United States.⁵³³ Amazon ended its contract with FedEx in 2019, and the volume of Amazon packages delivered by UPS has decreased. Amazon Air is reportedly considering transporting third-party shipments in the future. It has recently signed an agreement with the U.S. Postal Service (USPS) to use some of its spare capacity to transport USPS packages.⁵³⁴

Although Amazon's focus on flexibility and efficiency has led to the build-out of its air cargo operations, it has also attracted criticism from unions representing contracted pilots. In one instance, this led to walk-offs and the threat of a strike by unionized ACMI pilots over scheduling and safety issues.⁵³⁵

Several maritime shipping firms have also established or expanded their air cargo operations, often using ACMI firms in a manner similar to Amazon Air.⁵³⁶ Maersk, a Danish shipping firm, launched an air cargo service from the United States to South Korea in 2022, using ACMI partner Amerijet International. Maersk also opened a new airfreight facility in Chicago, adding to its existing air cargo network in Europe.⁵³⁷ Maersk reportedly expanded its air cargo offerings as part of its transformation into a one-stop logistics service provider.⁵³⁸

Swiss-based shipping firm MSC began weekly around-the-world air cargo service (including a stop in Indianapolis) and announced additional service beginning in 2023 with partner Atlas Air.⁵³⁹ MSC has stated that its move into air cargo was part of an effort to provide complementary services to ocean freight and better serve key trade routes.⁵⁴⁰ French shipping firm CMA CGM also cited customer demand

⁵³⁰ Schwieterman, Craig, and Mader, "Takeoff in Northern Kentucky," September 20, 2022; Harrington, "Inside Amazon Air's Quest to Seize the Skies," December 1, 2022; Shah and Mandayam, "Amazon Launches Dedicated Air Cargo Service in India as Online Sales Soar," January 23, 2023.

 ⁵³¹ Palmer, "Amazon Spends \$131 Million to Take Minority Stake in Air Cargo Contractor ATSG," March 8, 2021.
 ⁵³² Harrington, "Inside Amazon Air's Quest to Seize the Skies," December 1, 2022.

⁵³³ Harrington, "Inside Amazon Air's Quest to Seize the Skies," December 1, 2022.

 ⁵³⁴ Amazon has also built out its own logistics network. Harrington, "Inside Amazon Air's Quest to Seize the Skies," December 1, 2022; Kulisch, "Amazon Air Paves Way for Third-Party Delivery," February 16, 2021; "Amazon Looks to Sell Excess Air Cargo Space as Demand Cools," December 23, 2022; Haselton and Pound, "FedEx Is Ending Ground-Delivery Contract with Amazon," August 7, 2019; Solomon, "Amazon and UPS," October 6, 2022.
 ⁵³⁵ Harrington, "Inside Amazon Air's Quest to Seize the Skies," December 1, 2022; Bhattarai, Williams, "The Amazon Air Pilots Who Deliver Your Parcels Are Prepared to Strike," August 19, 2019.

 ⁵³⁶ For more information on maritime shipping, see the Maritime Shipping section earlier in this chapter.
 ⁵³⁷ Kjærgaard-Winther, "A.P. Moller - Maersk Launches U.S.-Korea Air Freight Service and Strengthens Its Integrated Air Cargo Operation," October 28, 2022.

 ⁵³⁸ Kulisch, "Maersk Air Cargo Opens US Bases with South Korea Service Set to Debut," October 13, 2022.
 ⁵³⁹ Kulisch, "MSC Air Cargo Moves up Start Date for Global Freighter Service," November 18, 2022; CH Aviation, "MSC Air Cargo Launches Liège Hub," August 12, 2022; Kunzler, "US Cargo Carrier Atlas Air Receives Boeing 777 Freighter," December 8, 2022.

 ⁵³⁹ Kunzler, "US Cargo Carrier Atlas Air Receives Boeing 777 Freighter," December 8, 2022.
 ⁵⁴⁰ Salgado, "MSC to Launch Air Cargo Service," accessed January 12, 2023; MSC, "Air Cargo Solution (Company Website)," accessed January 12, 2023.

for better logistics solutions as the reason behind its launch of air cargo service in 2021 between the United States, Europe, and Asia. In a turn of events, CMA CGM suspended its recently introduced air cargo and freight forwarding service in the United States in December 2022, choosing instead to lease its own cargo planes to DHL and Qatar Airways in a move to increase profitability faster. As of late 2022, it still maintains its European air cargo operations.⁵⁴¹

Before the pandemic, shipping firms had already been investing more in ports and logistics operations.⁵⁴² One analyst noted that supply chain disruptions due to the pandemic created more demand for air transport of goods, generating record profits for maritime shipping firms.⁵⁴³ This provided an opportunity for them to move into the air cargo market. For example, the record profits earned by shipping firms since 2020 reportedly enabled Maersk to finance purchases of additional cargo aircraft for its fleet.⁵⁴⁴ The profits Amazon generated during the pandemic also likely helped it to expand its own ground transportation and logistics network as well as its air cargo operations, although the company recently announced layoffs in other divisions.⁵⁴⁵

Outlook

Despite rapid expansion in recent years, the outlook for air cargo is mixed. Inflation and the threat of recession in many major markets have put downward pressure on demand for air cargo services. Air cargo rates have fallen from their peak in late 2021, and firms have responded by reducing services. FedEx is reportedly cutting its global flight hours. Amazon Air is slowing its growth by adding fewer flights than in previous years and reducing existing ACMI aircraft leases in some markets.⁵⁴⁶ Jet fuel spot prices in December 2022 were more than 50 percent higher than in the same month in 2021, which increased the cost of operating aircraft.⁵⁴⁷ Several industry representatives stated that the volume of e-commerce shipments transported via air cargo from 2020 to 2022 was equal to an entire decade's worth of industry expectations.⁵⁴⁸ Growth in e-commerce sales, however, slowed in late 2022 compared to

 ⁵⁴¹ The Maritime Executive, "MSC Follows Maersk and CMA CGM in Launching Air Cargo," September 27, 2022;
 Todd, "Paris-Hong Kong Freighter Flies Five Times a Week as CMA CGM Air Cargo Takes off - The Loadstar,"
 September 26, 2022; Kulisch, "CMA CGM Air Cargo 'Temporarily' Suspends US Operations," December 16, 2022.
 ⁵⁴² Tan and Torsoli, "CMA CGM Nears Deal for New York, New Jersey Container Terminals," December 6, 2022;
 Berger, Page, "Maersk Expects Logistics Revenues to Exceed Shipping in Coming Years," November 2, 2022.
 ⁵⁴³ For more information on maritime shipping, see the Maritime Shipping section earlier in this chapter. Handley, "Awash with Cash," accessed January 12, 2023.

 ⁵⁴⁴ Brett, "Maersk Air Cargo Starts Regulatory Process for US Flights," September 15, 2022; Bryant, "Shipping's
 \$500 Billion Profit Can Take on Amazon," May 23, 2022.

⁵⁴⁵ Palmer, "Amazon to Lay Off 9,000," March 20, 2023.

⁵⁴⁶ Josephs, "Air Cargo Rates Slump but Some Companies See Long-Term Strength," accessed January 12, 2023;
Day, "Amazon Air Cargo Flights Grow at Slowest Pace Since Early Pandemic," September 20, 2022; Kulisch,
"Amazon Dials Back Air Cargo Expansion as E-Commerce Sales Slow," September 20, 2022; Josephs and Palmer,
"Amazon Scales Back Cargo Flying as Demand Cools, Contractor Says," February 6, 2023.

⁵⁴⁷ Kulisch, "Amazon Dials Back Air Cargo Expansion as E-Commerce Sales Slow," September 20, 2022; USDOT, BTS, "Airline Fuel Cost and Consumption (U.S. Carriers - Scheduled) January 2000 - November 2022," accessed January 12, 2023; USDOE, "U.S. Gulf Coast Kerosene-Type Jet Fuel Spot Price FOB (Dollars per Gallon)," accessed March 7, 2023.

⁵⁴⁸ Industry representatives, interview by USITC staff, January 11, 2023.

previous years because consumers returned to brick-and-mortar stores and inflation increased.⁵⁴⁹ Several industry representatives also noted that U.S. customs documentation was becoming more burdensome for express delivery firms, particularly with regard to the types of data required for ecommerce shipments.⁵⁵⁰

Consumers are increasingly conscious of the environmental impact of their purchases,⁵⁵¹ which may affect demand for shipping via air cargo. Airfreight is faster than ground or sea freight, but it is also much more carbon intensive.⁵⁵² At the same time, policies that encourage the use of "sustainable aviation fuel" have been included in recent U.S. legislation that may reduce the carbon footprint of air cargo.⁵⁵³

Express Delivery: Drones

Market Conditions

The delivery of goods via unmanned aerial vehicle—or drone—is a relatively recent development. Plans and early efforts to provide drone delivery services emerged in the mid-2010s.⁵⁵⁴ Since that time, the drone delivery market has developed more slowly than industry participants predicted. To date, drone delivery has been largely limited to small and pilot projects with narrow product offerings in a few U.S. and overseas locations.⁵⁵⁵ Furthermore, one source estimates that delivery and logistics composed a very small share of the overall commercial drone industry in 2020, trailing other commercial applications—including energy, entertainment and other media, construction and real estate, security, and agriculture—by a wide margin.⁵⁵⁶

Estimates of the current and projected size of the global drone delivery market vary widely and are not comparable. Each of these disparate estimates suggests that—despite its small size—the global market for drone delivery will grow rapidly during the next five years. Statista has published estimates indicating that the global market for drone delivery will more than triple between 2021 and 2027, growing from

⁵⁴⁹ See the e-commerce section in chapter 3. U.S. Census Bureau, "Quarterly E-Commerce Sales 3rd Quarter 2022," November 18, 2022; NPR, "Online Retailers Are Feeling the Pain as Pandemic-Driven e-Commerce Slows," July 15, 2022.

⁵⁵⁰ One industry representative noted that they were required to provide the URL of the e-commerce provider, as well as other data elements beyond what is normally needed for standard customs forms. Industry representative, interview by USITC staff, January 11, 2023.

⁵⁵¹ Emmert, "The Rise of the Eco-Friendly Consumer," accessed January 12, 2023.

⁵⁵² Greene, "Freight Transportation, MIT Climate Portal," September 4, 2020; Siegle, "How Ethical Is Shipping Goods by Sea?," November 2, 2014.

⁵⁵³ The White House, "Fact Sheet," March 15, 2022; Ghatala, "Sustainable Aviation Fuel Policy in the United States: A Pragmatic Way Forward," April 2020, 15–20; Pub. L. No. 117-169, § 13203, 136 Stat. 1818 (2022) (creating 26 U.S.C. § 40B).

⁵⁵⁴ Mathews, "Drone Dreams Delayed," December 2021, 53–54.

⁵⁵⁵ Nanalyze, "Contactless Drone Delivery Companies Close to Scaling," October 19, 2020; Ovide, "Where Are the Delivery Drones?" June 16, 2022; Wolf, "It's Not Economics Diminishing Drone Delivery," June 17, 2022; Mathews, "Drone Dreams Delayed," December 2021.

⁵⁵⁶ Grand View Research, "Commercial Drone Market Size," 2022. For more information on the use of drones in the construction industry, see Powell, "<u>Drone Services in Construction," January 2021</u>.
\$13 billion to \$4.4 billion.⁵⁵⁷ McKinsey also projects rapid growth for this market, estimating that the number of global drone deliveries will increase from 482,000 in 2021 to more than 1.4 million in 2022.⁵⁵⁸ Statista published 2021 estimates indicating that, in 2023, the Asia Pacific region would account for the largest share of the drone delivery market (with \$654 million or 39 percent), followed by North America (with \$503 million or 30 percent).⁵⁵⁹ McKinsey estimates that the Asia Pacific region and Africa accounted for the largest shares of the market in 2022.⁵⁶⁰

U.S. firms are among the top providers of drone delivery services. Market research firm Drone Industry Insights identifies Zipline, Wing (an Alphabet, Inc. subsidiary), and Matternet—all based in the United States—as the world's leading drone delivery firms.⁵⁶¹ Other U.S. firms that have been identified as important players in this industry include Amazon Prime Air, Skydrop, and UPS.⁵⁶² Top foreign providers of drone delivery services include Ireland-based Manna and Israel-based Flytrex—ranked fourth and fifth, respectively, by Drone Industry Insights—and German firm Wingcopter, among others.⁵⁶³

Drones are currently used for retail, intracompany, and other nonretail deliveries, transporting, for example, medical supplies, food, and small packages. To illustrate, in October 2016, U.S. firm Zipline began transporting blood supplies via drone to medical clinics in Rwanda. Since then, the firm has expanded to provide drone delivery in Ghana, Japan, Nigeria, Rwanda, and the United States of a large number of health-related items, as well as products from retailers.⁵⁶⁴ Irish firm Manna delivers food and other retail products in a few communities in Ireland and plans to expand its operations to other locations in Ireland, Europe, and the United States.⁵⁶⁵ Other examples include drone deliveries of prepared food, groceries, personal care products, and other items in the United States, Finland, and

⁵⁵⁷ Statista, "Projected global drone delivery market size in selected years from 2021 to 2026 (in billion U.S. dollars)," March 23, 2023.

⁵⁵⁸ Carter et al., "Drone Delivery: More Lift than You Think," March 15, 2022.

⁵⁵⁹ Statista, "Projected global drone delivery market size in 2023, by region (in million U.S. dollars)," December 2021.

⁵⁶⁰ Carter et al., "Drone Delivery: More Lift than You Think," March 15, 2022.

⁵⁶¹ Zanelli, "Best Companies for Drone Services in 2022," November 10, 2022; Singh, "Ranked: Top Drone Companies for Remote Sensing, Package Delivery in 2022," November 15, 2022.

⁵⁶² UAV Coach, *The Top 100 Drone Companies to Watch in 2022*, 2022; Expert Market Research, "Top 10 Companies in the Global Drone Package Delivery Market, Leading with Technological Advancement," November 12, 2022.

⁵⁶³ Zanelli, "Best Companies for Drone Services in 2022," November 10, 2022; Expert Market Research, "Top 10 Companies in the Global Drone Package Delivery Market, Leading with Technological Advancement," November 12, 2022.

 ⁵⁶⁴ "Zipline Press Kit," 2022; Team Zipline, "Zipline Turns Five: A Look Back, and Ahead," October 28, 2021.
⁵⁶⁵ McNabb, "Manna Drone Delivery Expands: New Delivery Sites, New Manufacturing," August 12, 2022;
McCullagh, "Deliveries in Balbriggan Arrive like Manna from Drone Heaven," August 18, 2022; Stonor, "Manna Aero: Balbriggan Drone Delivery Starts This Week," November 11, 2021; Manna, "Manna Drone Delivery," November 16, 2022.

Australia by Alphabet/Wing; COVID-19 vaccines in Winston-Salem, North Carolina, by UPS Flight Forward;⁵⁶⁶ and packages in Lockeford, California, and College Station, Texas, by Amazon Prime Air.⁵⁶⁷

Factors Affecting Drone Adoption

Drone delivery reportedly has several advantages compared to the well-established truck delivery system. Specifically, observers indicate that drones can deliver goods more quickly than trucks and can transport critical items to areas that may be difficult to access by road because of distance, traffic, or other adverse conditions. Drones emit less carbon dioxide, use less energy,⁵⁶⁸ and may be less noisy than trucks.⁵⁶⁹ Some observers also note that drones have certain cost advantages over road vehicles. One source suggests that meal delivery via drone has a 90 percent cost advantage over car delivery;⁵⁷⁰ another source indicates that drones are less expensive to produce, operate, and service as compared to other vehicles.⁵⁷¹

At the same time, a number of drawbacks may slow the adoption of drone delivery. For example, drone delivery entails the collection of customer data and the use of GPS and cameras, raising privacy issues.⁵⁷² Drone crashes and the potential for increased air traffic have led to safety concerns,⁵⁷³ and drones may negatively affect birds and other wildlife.⁵⁷⁴ Short battery life and the inability to fly in wind and rain may hamper the reliability of drone delivery.⁵⁷⁵ Additionally, some observers indicate that drones—which can be costly and carry only one item at a time—are not currently as efficient or cost effective for package delivery as trucks—which can carry a large number of items and travel on a well-established road system.⁵⁷⁶ A recent McKinsey paper suggests that the cost of drone delivery could

⁵⁶⁶ UPS Flight Forward—in partnership with Gavi and Zipline—also delivered COVID-19 vaccines via drone in Ghana. UPS, "UPS Operates First Ever U.S. Drone COVID-19 Vaccine Delivery," August 23, 2021.

⁵⁶⁷ X (Google LLC), "Wing: Transforming the Way Goods Are Transported," accessed December 6, 2022; Tonkin, "Australia Leads the World in Drone Delivery," September 2, 2021; Amazon Staff, "Amazon's Drone Delivery Is Coming to Texas," July 15, 2022; UPS, "UPS Operates First Ever U.S. Drone COVID-19 Vaccine Delivery," August 23, 2021; Bangeman, "Amazon Begins Drone Deliveries," December 28, 2022.

⁵⁶⁸ Mathews, "Drone Dreams Delayed," December 2021; Harris, "What Is Drone Delivery?," August 31, 2021; Soocial, "23 Fascinating Drone Delivery Statistics You Must Check Out," accessed November 16, 2022; Biba, "Is Drone Delivery on the Horizon?," September 30, 2022. A recent McKinsey paper estimates that the carbon dioxide (CO₂) emissions associated with the delivery of a single package via drone are significantly less that the emissions associated with single-package delivery via car or van. However, per-package emission intensity is less for cars and vans carrying multiple packages in a single trip than for drones (which can only carry a single package). Cornell et al., "Drones Take to the Sky," January 3, 2023.

⁵⁶⁹ Biba, "Is Drone Delivery on the Horizon?," September 30, 2022.

⁵⁷⁰ Koestier, "Drone Delivery Is Live Today," August 18, 2021.

⁵⁷¹ Soocial, "23 Fascinating Drone Delivery Statistics You Must Check Out," accessed November 16, 2022.

⁵⁷² Harris, "What Is Drone Delivery?," August 31, 2021; Biba, "Is Drone Delivery on the Horizon?," September 30, 2022; Nath, "How Drones Are Changing the Business World," January 16, 2022.

⁵⁷³ Mathews, "Drone Dreams Delayed," December 2021; Teale, "As Companies Expand Drone Deliveries," July 19, 2022.

⁵⁷⁴ Biba, "Is Drone Delivery on the Horizon?," September 30, 2022; Nath, "How Drones Are Changing the Business World," January 16, 2022.

⁵⁷⁵ Harris, "What Is Drone Delivery?," August 31, 2021; Crumley, "UPS Unlikely to Revise Use of Drones," January 12, 2022; Biba, "Is Drone Delivery on the Horizon?," September 30, 2022.

⁵⁷⁶ Harris, "What Is Drone Delivery?," August 31, 2021; Biba, "Is Drone Delivery on the Horizon?," September 30, 2022.

become comparable to the costs of delivery via electric car, electric van, or traditional gas-powered vans if regulations were liberalized to allow a single individual to monitor multiple drone flights.⁵⁷⁷

Regulations also impact the feasibility of drone delivery, and regulatory issues-such as uncertainty and limitations on certain types of operations—have been proposed as possible reasons for the slow adoption of drone delivery services in the United States.⁵⁷⁸ Drone operators in the United States must navigate federal regulations as well as multiple state and local regulations, which may increase compliance and permitting costs for drone operators and limit certain drone operations.⁵⁷⁹ For example, drones cannot fly in certain airspace without a waiver and flights over private property may face legal obstacles.⁵⁸⁰ Drones must be controlled by a pilot (i.e., autonomous drone flights are not permitted) and pilots must obtain a waiver to fly more than one drone simultaneously, limiting the potential efficiency of drone delivery.⁵⁸¹ Restrictions on flights beyond a pilot's visual line of sight (BVLOS)—which can limit the geographic scope of operations—reportedly have a particularly large impact on providers of drone delivery services.⁵⁸² In 2022, Manna announced plans to begin drone delivery in the United States. The firm indicated, however, that its U.S. operations will be relatively small because foreign firms are not eligible for Part 135 certification, which is needed to conduct BVLOS drone delivery flights (box 4.2).⁵⁸³ On March 10, 2022, the FAA's Unmanned Aircraft Systems Beyond Visual Line-of-Sight Operations Aviation Rulemaking Committee (or UAS BLVOS ARC) issued a report that included several recommendations aimed at broadening operators' ability to conduct BVLOS flights in the United States.⁵⁸⁴ As of January 2023, the FAA had not implemented regulations to such effect.

⁵⁷⁷ Many U.S. and overseas jurisdictions require visual monitoring of drone flights and do not allow observers to monitor more than one flight simultaneously. McKinsey estimates the cost of drone delivery for a single package at \$13.50 (if observers are unable to monitor multiple flights at the same time) and at \$1.80 (if a single observer is monitoring 20 flights simultaneously). By comparison, per package delivery costs were estimated at \$1.60 for electric cars carrying 5 packages simultaneously, \$1.80 for electric vans carrying 100 packages, and \$1.90 for gaspowered vans carrying 100 packages. The estimated cost of single-package road deliveries ranged between \$9.40 and \$11.60—significantly higher than the cost of multi-package road trips but less that the cost of drone deliveries with a dedicated observer. Cornell et al., "Drones Take to the Sky," January 3, 2023.

⁵⁷⁸ Skorup, "How Do Regulations Affect Delivery Drones?," October 25, 2022; Magill, "Manna Plans Slow Rollout," April 25, 2022; Wolf, "It's Not Economics Diminishing Drone Delivery," June 17, 2022.

⁵⁷⁹ Rupprecht, "The Truth About Drone Delivery," February 4, 2021.

⁵⁸⁰ Skorup, "How Do Regulations Affect Delivery Drones?," October 25, 2022; Rupprecht, "The Truth About Drone Delivery," February 4, 2021.

⁵⁸¹ Rupprecht, "The Truth About Drone Delivery," February 4, 2021; Small Unmanned Aircraft Systems, Pub. L. No. 14 C.F.R. Part 107, 14 C.F.R. Part 107, (June 28, 2016), 107, accessed January 5, 2023; Carter et al., "Drone Delivery: More Lift than You Think," March 15, 2022.

⁵⁸² O'Toole, "How Relaxing Regulations Will Expand Drone Delivery in Last-Mile," March 2, 2022; Kulisch, "New FAA Rules Put Drone Delivery Closer to Reality," December 30, 2020; Mathews, "Drone Dreams Delayed," December 2021; Rupprecht, "The Truth About Drone Delivery," February 4, 2021.

⁵⁸³ Magill, "Manna Plans Slow Rollout," April 25, 2022.

⁵⁸⁴ Unmanned Aircraft Systems (UAS) Beyond Visual Line-of-Sight (BVLOS) Operations Aviation Rulemaking Committee (ARC) UAS BLVOS ARC, *Final Report*, March 10, 2022; Turner, Baxenberg, and Bouboulis, "FAA Committee," March 14, 2022.

Box 4.2 Federal Aviation Administration Certification for Drone Operations

In the United States, firms can provide drone services by obtaining Federal Aviation Administration (FAA) certification under one of two FAA regulations: 14 C.F.R. Part 107 (or Part 107) and 14 C.F.R. Part 135 (or Part 135). While some very limited drone delivery operations are conducted under Part 107; drone delivery operations that extend beyond a pilot's visual line of sight (BVLOS) require Part 135 certification.

Adopted in 2016, Part 107 establishes rules for commercial drone operations. Among other things, these regulations limit the height and speed at which commercial drones may fly, require drone registration, establish the process through which pilots can be certified to fly small commercial drones, and limit or bans certain types of operations (such as flights in certain locations or from moving vehicles).^a Part 107 was revised in 2021 to allow night flights and flights over people, activities that were previously permitted only with an FAA waiver. However, BVLOS flights currently remain restricted under Part 107. Operators can obtain waivers for some commercial BVLOS flights, but the FAA cannot issue waivers for BVLOS flights that transport third-party property for compensation.^b Therefore, firms cannot conduct BVLOS drone delivery operations under Part 107 in most cases.^c

Part 135 establishes rules for on-demand and commuter flights and applies generally to any air carrier that provides these services.^d Although this regulation is not specific to drones, the FAA states that, "Part 135 certification is the only path for small drones to carry the property of another for compensation beyond visual line of sight" and has modified Part 135 certification to accommodate drone flights—exempting drone operators from certain rules.^e Under Part 135, the FAA offers several types of certification based on factors such as the type and location of operations and the number of pilots, with each certification carrying specific limitations and responsibilities.^f In April 2019, Wing became the first drone operator to receive Part 135 certification. Since that time, the FAA has also granted Part 135 certification to UPS Flight Forward, Inc., Amazon, and Zipline.^g

^a FAA, "Small Unmanned Aircraft Systems (UAS) Regulations (Part 107)" October 6, 2020; National Interagency Fire Center, "FAA Part 107 Fact Sheet," accessed January 11, 2023.

^b Small Aircraft Systems, 14 C.F.R. § 107. In March 2022, an FAA aviation rulemaking committee issued a report recommending the establishment of new rules (Part 108) that would support BVLOS flights, but these recommendations have not yet been implemented. Unmanned Aircraft Systems (UAS) Beyond Visual Line-of-Sight (BVLOS) Operations Aviation Rulemaking Committee (ARC) UAS BLVOS ARC, Final Report, March 10, 2022; Daleo, "Expanded Drone Delivery Taxis," March 17, 2022; McNabb, "FAA Releases," March 11, 2022; Turner, Baxenberg, and Bouboulis, "FAA Committee," March 14, 2022.

^c In a very small number of instances, the FAA has allowed limited BVLOS drone deliveries of medical supplies under Part 107. For example, in May 2020, the FAA granted Novant Health (which was working with Zipline) emergency approval for the BVLOS delivery of Personal Protective Equipment (PPE) between two Novant-owned facilities in North Carolina under Part 107. Similarly, beginning in 2019, UPS and Matternet partnered to conduct drone deliveries under Part 107 for health services provider WakeMed in Raleigh, North Carolina. Additionally, in 2020, CVS and UPS announced that they would begin prescription deliveries to a retirement village in Florida via Matternet drones. This service, also conducted under Part 107, was set to begin with very short-distance flights that transported the medicines to a single nearby location, with deliveries completed via ground. Ackerman, "Zipline Launches," May 20, 2020; Rupprecht, "The Truth About Drone Delivery," February 4, 2021; UPS, "UPS Flight Forward, CVS," April 27, 2020.

^d Operating Requirements: Commuter and on Demand Operations and Rules Governing Persons on Board Such Aircraft, 14 C.F.R. § 135; Federal Aviation Administration, "Charter-Type Services," accessed January 11, 2023.

^e For example, the FAA does not require onboard flight manuals for drones. Federal Aviation Administration, "Package Delivery by Drone (Part 135)," June 21, 2022.

^f Federal Aviation Administration, "Package Delivery by Drone (Part 135)," June 21, 2022; FAA, "General Information," accessed January 11, 2023.

^g Federal Aviation Administration, "Package Delivery by Drone (Part 135)," June 21, 2022.

Experiences in other countries illustrate the close connection between regulation or government cooperation and the viability of drone delivery. For example, Zipline initiated its drone program in Rwanda under an agreement with the Rwandan government, which provided land and cooperation from

key government agencies.⁵⁸⁵ In 2018, Rwanda introduced performance-based drone rules that would facilitate drone approvals and allow drone programs to expand operations. In 2022, Zipline and the Rwandan government concluded a new contract that will expand the current program to food, postal deliveries, and other items.⁵⁸⁶ Manna indicates that well-defined and cohesive EU drone regulations have enabled the company to raise funds, and the ability to conduct autonomous drone flights in the EU provides the opportunity to scale operations.⁵⁸⁷ The liberalization of Japan's rules for autonomous BVLOS flights in 2022 was quickly followed by an announcement that Japan Post will begin delivering parcels by drone in 2023.⁵⁸⁸ India recently eased its license and registration requirements for drone firms by reducing paperwork, exempting companies that fly nano- and micro-drones for research and development purposes from licensing requirements, and removing restrictions on foreign-owned drone firms.⁵⁸⁹ India has authorized consortiums headed by U.S.-based ANRA Technologies to conduct trial BVLOS drone deliveries of medical items and food. ⁵⁹⁰ Additionally, the Indian state of Telangana and the World Economic Forum have partnered to initiate a drone delivery program for medicine and vaccines, and a few firms have been granted emergency permission from the Directorate General of Civil Aviation for the project.⁵⁹¹ Observers suggest that these steps toward BVLOS delivery may build a framework for and expand India's drone services market.⁵⁹²

Outlook

Like other technologies, drones may have a transformative impact on the labor market for delivery services.⁵⁹³ Drones may reduce the demand for drivers but increase demand for workers that manufacture, operate, and service drones.⁵⁹⁴ Additionally, drones could complement the work of delivery drivers.⁵⁹⁵ For example, UPS has experimented with dispatching drones from delivery trucks, enabling a truck to continue traveling to its next destination while the drone transports an item to a nearby drop-off point. The drone then flies back to the truck further down the road. UPS estimates that even small reductions in drivers' travel could result in significant cost savings.⁵⁹⁶

⁵⁸⁵ These government of Rwanda agencies include the Civil Aviation Authority as well as the Ministries of Defense and Health. Bright, "Rwanda's Tech Initiatives," October 16, 2016; sUAS News, "Rwanda: Agreement Signed," February 10, 2016.

⁵⁸⁶ Whittaker, "Zipline Spearheads Drone Performance Regulations," January 24, 2018; Shankland, "Rwanda Orders 2 Million," December 15, 2022.

⁵⁸⁷ Crumley, "Healy Interview II," October 18, 2022; Magill, "Manna Plans Slow Rollout," April 25, 2022.

⁵⁸⁸ Crumley, "Japan Posts," December 7, 2022.

⁵⁸⁹ Bandyopadhyay, "From Vaccines to Food," July 23, 2021.

⁵⁹⁰ McNabb, "Drones in India," June 8, 2020; ANRA Technologies Private Limited, "First End-to-End BVLOS Drone Delivery," June 16, 2021.

⁵⁹¹ Bandyopadhyay, "From Vaccines to Food," July 23, 2021.

⁵⁹² McNabb, "Drones in India," June 8, 2020; Bandyopadhyay, "From Vaccines to Food," July 23, 2021.

⁵⁹³ Poljak, "Will Drones Take Away Jobs?," accessed December 9, 2022; McNabb, "Drones, Robots, and More," November 11, 2021.

⁵⁹⁴ Soocial, "23 Fascinating Drone Delivery Statistics You Must Check Out," accessed November 16, 2022; Nath, "How Drones Are Changing the Business World," January 16, 2022; Poljak, "Will Drones Take Away Jobs?," accessed December 9, 2022.

⁵⁹⁵ Austin, "Amazon Drone Delivery," November 2, 2021.

⁵⁹⁶ Stewart, "A Drone-Slinging UPS Van," February 21, 2017; Berard, "Will Drones Help Trucks?," September 1, 2019.

The development of drone delivery projects has accelerated in recent years, but future prospects remain unclear. Some observers cite factors such as the recent regulatory changes facilitating drone operations and continuing interest by major firms as positive indications of the industry's potential.⁵⁹⁷ Others suggest that issues such as the efficiency of current road delivery systems, continuing regulatory obstacles, and the challenges of operating drones in heavily populated areas may limit drone delivery to less densely populated areas or time-sensitive applications (e.g., transporting medical supplies) in the near future.⁵⁹⁸ According to McKinsey, "Regulations, customer acceptance, and cost will all determine whether the industry reaches its potential to disrupt global logistics or remains limited to isolated applications."⁵⁹⁹

⁵⁹⁷ Austin, "Amazon Drone Delivery," November 2, 2021; Wolf, "It's Not Economics Diminishing Drone Delivery," June 17, 2022.

⁵⁹⁸ Roberts, "Drone Delivery," October 27, 2022; Ovide, "Where Are the Delivery Drones?," June 16, 2022; Biba, "Is Drone Delivery on the Horizon?," September 30, 2022.

⁵⁹⁹ Carter et al., "Drone Delivery: More Lift than You Think," March 15, 2022.

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Chapter 5 Services Roundtable Summary

Each year, the Commission hosts a roundtable to encourage dialogue among individuals from government, industry, and academia on issues that impact services trade. The 16th Annual Services Roundtable was held on Wednesday, November 2, 2022. This year's roundtable focused on two themes: (1) the impact of recent global economic and political instability on services trade and (2) opportunities and challenges faced by providers of distribution services. Following introductory remarks by Chairman David S. Johanson, Commissioner Randolph J. Stayin moderated the first half of the discussion and Commissioner Jason E. Kearns moderated the second half.

Global Economic and Political Instability

The first half of the discussion focused on the impacts of recent global economic and political shocks, including the COVID-19 pandemic, economic disruption and humanitarian crises caused by the Russian invasion of Ukraine, and trade policy uncertainty, among others.

The COVID-19 Pandemic Accelerated Preexisting Trends

Several participants noted the large effect of the COVID-19 pandemic on services trade, particularly in those industries that rely on face-to-face interactions. Participants said that industries such as hospitality, transport, and tourism were the most affected by the pandemic and have yet to fully recover. A representative from an international organization indicated that these industries have a disproportionate number of workers from underserved communities and that these workers were less able to adapt by teleworking.

Several participants mentioned that the pandemic continued and accelerated the trend toward the increased digitalization of trade. A representative from academia stated the pandemic-related acceleration of growth in e-commerce is likely to persist. A couple of participants spoke about the impact of digitalization on small and medium-sized enterprises (SMEs). One focused on the importance of digital trade and e-commerce to SMEs. This participant indicated that digital advertising has made it easier for SMEs to effectively target their customers and digital payment systems and customs fulfillment have allowed SMEs to access more markets.⁶⁰⁰ A representative from an international nonprofit remarked that digital skills gaps among SMEs may hinder their ability to maintain and grow their e-commerce operations. This participant said that digital skills gaps are more prevalent outside urban centers and in underserved communities. This participant also stated that SMEs that lack the skills or capacity to navigate the regulatory complexities of trade face a significant barrier to entry.

⁶⁰⁰ This speaker also cited a recent U.S. Chamber of Commerce paper entitled "The Digital Trade Revolution." U.S. Chamber of Commerce, "The Digital Trade Revolution," February 9, 2022.

A representative from academia noted that the pandemic accelerated a trend toward more trade in intellectual property and that this trend is likely to persist. This individual mentioned that consumers tended to maintain subscriptions to streaming services, like Netflix or Disney+, after lockdown rules were lifted. This participant also said that work-from-home was adopted in many global markets and, because of a shift in corporate culture, managers now have more trust in their employees' productivity, even when they are working outside the office.

Geopolitical Shocks

Recent developments in geopolitics, including China's trade policies and Russia's invasion of Ukraine, led the United States to enact policies that affected services trade. One representative from the distribution services industry noted that section 301 tariffs were particularly disruptive because their application to both raw materials and finished goods required the relocation of entire production chains.⁶⁰¹ A business journalist added that moving supply chains may involve a number of challenges related to factors such as production capacity, port capacity, and landside trucking capacity⁶⁰² in certain markets.⁶⁰³ A representative from the distribution services industry added that difficulties in moving supply chains include finding vendors and manufacturers in another country that meet a company's qualifications as well as U.S. regulatory requirements related to product safety or health and safety standards. Another participant agreed that the tariffs remain disruptive, have added costs, and have accelerated shifts in trade flows in some cases. Multiple participants mentioned that, despite discussions of near-shoring and friend-shoring, these activities were not yet visible in the data. A representative of an international organization discussed the impact that China's zero-COVID policy had on supply chains. This participant noted that, when a COVID-19 outbreak closed a port, the new chokepoint led to disruptions along the supply chain.

Russia's invasion of Ukraine has caused a humanitarian crisis and led the United States to enact controls on exports to Russia. In October, the Biden administration enacted additional controls on exports to China.⁶⁰⁴ One representative from a trade association added that the export controls enacted by the Biden administration have put significant pressure on U.S. companies. Another participant noted that these export controls force companies to develop a deep understanding of where their products are going and how they are being used or incorporated by an end user. One participant said that the geopolitical environment increasingly impacts the commercial world. This individual said that many logistics managers, including those in container shipping, must increasingly consider geopolitical concerns in their business decisions.

⁶⁰¹ United States Trade Representative, "President Trump Announces Strong Actions to Address China's Unfair Trade," accessed January 11, 2023.

⁶⁰² Landside trucking capacity refers to the availability of trucking services to transport goods from ports to their next destination.

⁶⁰³ This participant specifically noted that limited production, port, and landside trucking capacity were issues in Vietnam.

⁶⁰⁴ Commerce Implements New Export Controls on Advanced Computing and Semiconductor Manufacturing Items to the People's Republic of China (PRC), October 7, 2022.

Supply Chains and Trade Policy

Several participants discussed U.S. trade policy and its impact on services trade and investment. One representative from the distribution services industry mentioned that enforcing tariffs on finished products only (as opposed to raw materials) could make it easier for companies to comply with export controls and shift supply chains. Other participants noted that rules of origin requirements in the Dominican Republic-Central American Free Trade Agreement may contribute to its underutilization.

The conversation then moved to address how trade policy can incentivize companies to shift their supply chains. Several participants advocated for the renewal of the Generalized System of Preferences (GSP) and the Miscellaneous Tariff Bill, indicating that these trade preference programs incentivize U.S. companies to diversify and shift their supply chains. One representative of the retail services industry noted that, when luggage products were added to the GSP program, production shifted from China to other countries, including Thailand. When GSP expired, however, production of these goods for the U.S. market moved back to China. A representative from the distribution services industry added that programs like GSP and the African Growth and Opportunity Act (AGOA) require periodic renewal and uncertainty acts as a significant barrier to investment. A representative from a trade association stated that uncertainty also exists around the renewal of the World Trade Organization moratorium on e-commerce customs duties. One representative from the distribution services industry added that preferential trade programs—like GSP and AGOA that require continual progress toward trade liberalization and fair treatment of U.S. companies—may need to be monitored to ensure those outcomes. Several participants advocated for the resumption of trade negotiations aimed at traditional free trade agreements and market access.

Factors Affecting Digital Trade and E-Commerce

The discussion also covered the role that internet fragmentation and data privacy play in services trade.⁶⁰⁵ A representative from the information technology services industry said that some countries are increasingly implementing a three-track approach of internet censorship, sovereignty, and surveillance—an approach pioneered by China. This participant added that internet fragmentation disrupts the functionality of the internet itself and makes it harder for consumers and businesses to provide cross-border services. This effect is especially pronounced for SMEs that may not have the resources to comply with conflicting or uncoordinated internet regulations in different markets.

A representative from academia raised questions about how data are governed at the national and international levels, including whether the data themselves should be governed rather than the platforms, technology, or business practices. A representative from a trade association emphasized that discriminatory regulation and a lack of harmonized regulations and standards across countries is increasingly restricting the data-driven economy. This individual said that the General Data Protection Regulation in the European Union (EU) is an attempt to erect a wall around European data to address privacy concerns. Relatedly, a representative from an international organization added that political trends regarding the protection of data are leading toward more "data sovereignty." One participant

⁶⁰⁵ For more information, see Lewis, "Sovereignty and the Evolution of Internet Ideology," Center for Strategic & International Studies, October 2020.
noted that some policy makers in developing nations see "digital protectionism" as a tool to increase revenue from their growing digital sectors. Other participants agreed that such protectionism is on the rise. Several participants highlighted the importance of the EU-U.S. Technology and Trade Council in harmonizing digital trade regulation.

Opportunities and Challenges Faced by Providers of Distribution Services

The second half of the roundtable focused on distribution services. Participants discussed the importance of distribution services and how the industry weathered and recovered from the pandemic. They also discussed challenges related to re-shoring and supply chain resilience, as well as the opportunities that data provide in the distribution services sector.

Industry Role and Characteristics

Participants noted that distribution services are vital to the well-being of the United States and are embedded in all aspects of the economy, including agriculture, manufacturing, and energy. A representative of the distribution services industry remarked that the post-pandemic supply chain crunch fostered public awareness about the importance of distribution services. Another participant noted a growing awareness among the public, government, and senior company executives of the need to address supply chain issues.

Participants highlighted the key role of transportation and logistics in the distribution services sector and the larger economy. One representative from the retail services industry noted that the retail sector, which employs 52 million people, relies on the distribution services industry's ships, trucks, planes, warehouses, and freight forwarders to distribute its products. A representative from the distribution services industry added that U.S. manufacturing competitiveness during the last 70 years has relied on international trade and a robust transportation and logistics infrastructure. One participant suggested that the United States may be held back by lagging government spending on infrastructure but said that recent government infrastructure funding was a positive development.

Participants also discussed the challenges distribution services firms face in building resilience. One representative from the distribution services industry noted that express delivery companies have geographically distributed networks that aren't nimble, complicating supply chain adjustments. Separately, another participant discussed the complexity of the distribution services industry, mentioning port-to-port movements, logistics and warehousing elements, and final mile delivery.⁶⁰⁶ This individual added that this complexity is due to the extent to which distribution services also depend on other services such as brokerage, insurance, and finance.

⁶⁰⁶ Final mile delivery refers to the last step of the distribution process when the merchandise is delivered to its destination.

Impacts of the COVID-19 Pandemic and Other Global Shocks

Several participants discussed impacts of the COVID-19 pandemic. A representative from the distribution services industry noted that the pandemic accelerated growth in e-commerce. This individual also indicated that the industry does not anticipate e-commerce growth slowing, despite labor shortages, war, climate change, or other global disruptions. One participant added that conflicting pandemic-related measures regarding the movement of people, quarantines, and testing were very disruptive to distribution networks. Another participant mentioned the large effect the zero-COVID policies in China (together with policies in other countries like Vietnam) had in creating chokepoints in the distribution services system. This individual noted that resulting delays in transpacific shipping combined with disruptions to the productivity of longshoremen in California ultimately impacted the entire system.

A business journalist indicated that the container shipping system is only about halfway back to prepandemic levels of reliability and resilience. This participant said that it will take a long time for this system to uncoil and predicted that retailers may need to make significant changes in how they source and manage inventory from the factory to the shop floor. The participant noted, for example, that a shortage of truck chassis⁶⁰⁷ and warehousing space near some U.S. ports affects the entire system. This participant concluded by noting that the global distribution system remains vulnerable to geopolitical shocks and unanticipated changes in consumer demand.

Labor Issues

Participants indicated that labor issues in both U.S. and overseas markets have impacted the distribution services industry. One participant mentioned that past labor strikes have been disruptive to the distribution sector and that the recent surge in trade activity, combined with political and economic shocks, is happening alongside the resurfacing of these labor issues. A business journalist added that organized labor has gained leverage in the distribution services industry globally, with labor groups in some countries demanding more work-life balance and pay increases to address inflation. This participant mentioned strikes in Germany and South Africa as examples of this trend. Another participant noted that distribution services workers may be reluctant to embrace automation because they fear job losses, even if automation may eventually lead to better jobs.

Distribution Networks and Climate Change

A number of participants raised issues related to climate change. A representative from an international organization noted the push to decarbonize the shipping industry, including new standards for emissions, and that the transition to zero-carbon shipping will be slow, potentially leading to capacity issues in the future if demand for shipping surges. Furthermore, they noted a lack of agreement on the standards and technology related to decarbonizing among the membership at both the International Maritime Organization and the International Labour Organization. A representative of the retail services

⁶⁰⁷ Truck chassis are used to move containers on roads.

industry noted the potential pressure to push sustainable technologies that are not market-ready or scalable. This participant indicated that in the trucking industry, for example, significant investment in infrastructure will be needed to move toward electric trucking fleets. A representative from the banking sector commented that the financial services industry has a large role to play in global decarbonization efforts, notably in lending to clients to finance such efforts and in developing standards. This individual mentioned the Glasgow Financial Alliance as a forum where the financial sector is trying to establish principles and standards for financing decarbonization.

Issues Pertaining to Data

Several participants discussed a trend toward digitalization in distribution services. A representative of the distribution services industry stated that improved data collection and transparency along the supply chain would be a key factor in building more resilient distribution networks. This participant noted, for example, that trucking firms may be too focused on moving containers to ports without paying attention to chassis availability, warehouse capacity, or rail or trucking connections. This individual suggested that digitalization will help distribution services providers get out of a "black box" scenario and understand where capacity issues are occurring along their supply chains through connected data. Another participant added that digitalization is playing an increasingly important role in e-commerce because some companies are becoming more vertically integrated, running their own logistics, distribution, and warehousing services. Another representative of the distribution services industry noted that technologies like radio-frequency identification tracking will facilitate automation and the seamless movement of goods around the globe, potentially eliminating the need for manual processing.

One participant said that more transparency in distribution is necessary to facilitate the identification of product origins. A representative from the distribution services industry added that businesses need end-to-end visibility throughout the life cycle of their products—from the extraction of raw materials to disposal—and digital technologies would facilitate this visibility. Another participant noted that most companies—particularly those that manufacture complex products—are not vertically integrated, offering an opportunity for third-party digital services providers to support these firms' supply chains. A representative of the retail services industry mentioned that although these third-party digital services providers are in their infancy, data resulting from the digitalization of supply chains will be a critical tool for companies to track carbon emissions, identify forced labor activities, and expose money laundering operations along the supply chain. Several participants also suggested that blockchain technologies could play a role in digitalization and data collection in the distribution services industry.

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Recent Trends in U.S. Services Trade: 2023 Annual Report

Appendix A Selected Services-Related Commission Publications and Staff Research

This appendix provides summaries of and links to recent U.S. International Trade Commission publications—reports and shorter papers—that feature topics in services trade. Reports are prepared under section 332(g) of the Tariff Act of 1930 (19 U.S.C. 1332(g)) in response to a request from the U.S. Trade Representative, the U.S. House of Representative Committee on Ways and Means, or the U.S. Senate Committee on Finance. The shorter papers are the results of research by the Commission's Services Division staff, sometimes in collaboration with staff members from other divisions of the Commission. These papers include articles in the Commission's Journal of International Commerce and Economics and working papers.

The shorter papers summarized in this appendix are meant to represent solely the opinions and professional research of their authors. They are not meant to represent in any way the views of the U.S. International Trade Commission, of any of its individual Commissioners, or of the U.S. government.

332 Investigations

Distributional Effects of Trade and Trade Policy on U.S. Workers

Investigation Number: 332-587, October 2022

https://www.usitc.gov/publications/332/pub5374.pdf

Stephanie Fortune-Taylor (Office of Economics, Country and Regional Analysis Division) and Jennifer Powell (Office of Industry and Competitiveness Analysis, Services Division)

This report is the first of a two-part investigation on the distributional effects of trade and trade policy on U.S. workers. The report summarizes roundtable discussions with representatives from underserved and underrepresented communities, the proceedings of an academic symposium on this issue, and a review of the literature. Several sections of the report consider the role of services trade, in addition to goods trade.

Foreign Censorship, Part 2: Trade and Economic Effects on U.S. Businesses

Investigation Number: 332-586, July 2022

https://www.usitc.gov/publications/332/pub5334.pdf

Ravinder Ubee (Office of Economics, Research Division), George Serletis (Office of Industry and Competitiveness Analysis, Services Division), and Shova KC (Office of Analysis and Research Services)

This report is the second volume of an investigation that identifies and describes various foreign government censorship policies and practices, including examples that U.S. businesses consider impediments to trade and investment. Several sections of the report consider the role of services trade, including:

Chapter 2: Prevalence and effects of censorship on U.S. businesses providing media and digital services in China

Chapter 3: Effects of foreign censorship on social media, over-the-top communications services, and internet search

Chapter 4: Effects of foreign censorship on audiovisual content and examples of extraterritorial censorship.

Research Papers

A Firm Level Analysis of Trade Restrictions in the Retail Services Industry

https://www.usitc.gov/publications/332/working_papers/firm_level_analysis_of_trade_restrictions_in_ the_retail_services_industry_compliant.pdf

Art Chambers and George Serletis (Office of Industry and Competitiveness Analysis, Services Division), November 2022

This paper examines competition in the retail services industry using data from the OECD's Services Trade Restrictiveness Index (STRI) and Bureau van Dijk's Orbis database. It is part of an ongoing series in the Services Division of the Office of Industry and Competitive Analysis examining firm profitability and barriers to entry in the services sector. The paper begins with an overview of the retail services industry, and describes industry structure, regulation, and competitiveness and the profitability of firms that provide retail services. The paper provides a quantitative analysis of the relationship between these factors using the OECD STRI indicators for distribution services as a proxy for retail services and Orbis generated firm level financial data for retail firms. The analysis suggests that certain types of restrictions in the retail services firms, while other types of restrictions are associated with lower profitability. Recent Trends in U.S. Services Trade: 2023 Annual Report

Appendix B Data Tables for Figures

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Table B.1 Real value-added by U.S. industry, 2017–21 Value in billions of dollars, corresponds to <u>figure.1.1</u>.

Type of industry	2017	2018	2019	2020	2021
Private goods-producing	3,435	3,553	3,627	3,488	3,596
industries					
Private services-producing	12,400	12,789	13,128	12,737	13,700
industries					

Source: USDOC, BEA, "Real Value Added by Industry," September 29, 2022.

Notes: Estimates are chained 2012 dollars. Private goods-producing industries include agriculture, forestry, fishing, and hunting; mining; construction; and manufacturing. Private service-producing industries include utilities; wholesale trade; retail trade; transportation and warehousing; information; finance, insurance, real estate, rental, and leasing; professional and business services; educational services, health care, and social assistance; arts, entertainment, recreation, accommodation, and food services; and other services, except government.

Table B.2 Global services: Cross-border exports of commercial services, by country, 2021

Value in billions of dollars (billion \$), shares in percentage (%), corresponds to figure 1.2.

Country	Billion \$	Share of total (%)
United States	772	12.9
United Kingdom	415	6.9
China	391	6.5
Germany	371	6.2
Ireland	337	5.6
France	302	5.0
Netherlands	245	4.1
India	240	4.0
Singapore	230	3.8
Japan	164	2.7
All other countries	2,527	42.2
Total	5,994	100.0

Source: WTO, Statistics Database, Time Series on International Trade, "Trade in Commercial Services," July 2022.

Notes: Exports of commercial services exclude public-sector transitions. Because of difficulty measuring and reporting services trade data, total services exports do not equal total services imports. Because of rounding, figures may not add to 100 percent.

Table B.3 Global services: Cross-border imports of commercial services, by country, 2021

Value in billions of dollars (billion \$), shares in percentage (%), corresponds to figure 1.3.

Country	Billion \$	Share of total (%)
United States	525	9.5
China	438	7.9
Germany	379	6.8
Ireland	341	6.2
France	258	4.7
United Kingdom	239	4.3
Netherlands	236	4.3
Singapore	223	4.0
Japan	205	3.7
India	195	3.5
All other countries	2,498	45.1
Total	5,539	100.0

Source: WTO, Statistics Database, Time Series on International Trade, "Trade in Commercial Services," July 2022.

Notes: Imports of commercial services exclude public-sector transactions. Because of difficulty measuring and reporting services trade data, total services exports do not equal total services imports. Because of rounding, figures may not add to 100 percent.

Table B.4 U.S. services: Cross-border exports and imports, 2017–21 (million \$) Millions of dollars, corresponds to figure 1.4.

	U.S. cross-border exports of	U.S. cross-border imports of
Year	private services	private services
2017	817,550	526,428
2018	843,418	542,420
2019	868,642	569,594
2020	704,430	441,984
2021	771,879	524,878

Source: USDOC, BEA, table 2.1, "U.S. Trade in Services, by Type of Service," July 7, 2022.

Table B.5 U.S. services: Cross-border exports, by category, 2021

Value in millions of dollars (million \$), shares in percentage, corresponds to figure 1.5.

Type of industry	Million \$	Share of total (%)
Professional services	282,594	36.6
Financial services	194,481	25.2
Digital and electronic services	116,942	15.2
Travel services	82,973	10.7
Distribution services	55,030	7.1
Charges for intellectual property	27,267	3.5
All other services	12,592	1.6
Total	771,879	100.0

Source: USDOC, BEA, table 2.1, "U.S. Trade in Services, by Type of Service," July 7, 2022. Note: Because of rounding, figures may not add to 100 percent.

Table B.6 U.S. services: Cross-border imports, by category, 2021

Value in millions of dollars (million \$), shares in percentage, corresponds to figure 1.6.

Type of industry	Million \$	Share of total (%)
Professional services	156,071	29.7
Financial services	108,906	20.7
Distribution services	91,192	17.4
Digital and electronic services	82,144	15.7
Travel services	73,485	14.0
Charges for intellectual property	5,915	1.1
All other services	7,165	1.4
Total	524,878	100.0

Source: USDOC, BEA, table 2.1, "U.S. Trade in Services, by Type of Service," July 7, 2022. Note: Because of rounding, figures may not add to 100 percent.

Table B.7 U.S. services	Cross-border expor	ts, by country, 2021
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Value in millions of dollars (million \$), shares in percentage (%), corresponds to figure 1.7.

Country	Million \$	Share of total (%)
Ireland	74,797	9.7
United Kingdom	67,761	8.8
UK Islands, Caribbean	57,327	7.4
Canada	56,136	7.3
Switzerland	47,114	6.1
China	39,498	5.1
Japan	36,892	4.8
Germany	32,037	4.2
Mexico	30,488	3.9
All other countries	329,829	42.7
Total	771,879	100.0

Source: USDOC, BEA, table 2.2, "U.S. Trade in Services, by Type of Service and by Country or Affiliation," July 7, 2022.

Notes: The BEA category "United Kingdom Islands (Caribbean)" includes the following U.K. overseas territories: the British Virgin Islands, the Cayman Islands, Montserrat, and the Turks and Caicos Islands. Because of rounding, figures may not add to 100 percent.

Table B.8 U.S. services: Cross-border imports, by country, 2021

Value in millions of dollars (million \$), shares in percentage (%), corresponds to figure 1.8.

Country	Million \$	Share of total (%)
United Kingdom	61,072	11.6
Germany	34,749	6.6
Canada	33,094	6.3
Japan	31,121	5.9
Bermuda	30,770	5.9
India	28,831	5.5
Switzerland	28,086	5.4
Mexico	27,801	5.3
China	21,469	4.1
Ireland	21,265	4.1
All other countries	206,620	39.4
Total	524,878	100.0

Source: USDOC, BEA, table 2.2, "U.S. Trade in Services, by Type of Service and by Country or Affiliation," July 7, 2022. Note: Because of rounding, figures may not add to 100 percent.

Table B.9 U.S. services: Affiliate sales and purchases, 2016–20 Value in millions of dollars, corresponds to figure 1.9.

	Sales by U.Sowned foreign	Purchases from foreign-owned U.S.
Year	affiliates	affiliates
2016	1,476,980	999,362
2017	1,549,858	1,123,825
2018	1,679,254	1,192,047
2019	1,731,363	1,236,728
2020	1,649,677	1,179,335

Source: USDOC, BEA, table 4.1, "Services Supplied to Foreign Persons by U.S. MNEs through Their MOFAs, by industry and Affiliate and by Country of Affiliate," October 19, 2022; and table 5.1, "Services Supplied to U.S. Persons by Foreign MNEs through Their MOUSA, by Industry of Affiliate and by Country of UBO," October 19, 2022.

Table B.10 U.S. services: Affiliate sales by U.S.-owned foreign affiliates by industry, 2020 Value in billions of dollars (billion \$), shares in percentage (%), corresponds to figure 1.10.

Type of industry	Billion \$	Share of total (%)	
Distribution services	451.4	27.4	
Financial services	320.9	19.5	
Digital and electronic services	272.5	16.5	
Professional services	165.0	10.0	
Manufacturing	29.2	1.8	
All other	410.7	24.9	
Total	1,649.7	100.0	

Source: USDOC, BEA, table 4.1, "Services Supplied to Foreign Persons by U.S. MNEs through Their MOFAs, by Industry of Affiliate and by Country of Affiliate," October 19, 2022.

Notes: "Manufacturing" includes ancillary services provided by goods manufacturers. Other services include goods and services supplied by majority-owned foreign affiliates of U.S. parent firms. MNEs = multinational enterprises; MOFAs = majority-owned foreign affiliates; MOUSAs = majority-owned U.S. affiliates; UBO = ultimate beneficial owner. Because of rounding, figures may not add to 100 percent.

Table B.11 U.S. services: Purchases from foreign-owned U.S. affiliates, 2020 Value in billions of dollars (billion \$), shares in percentage (%), corresponds to figure 1.11.

value in billions of donars (billion \$7, shares in percentage (70), corresponds to <u>ligure 1.11</u> .			
Type of industry	Billion \$	Share of total (%)	
Distribution services	347.9	29.5	
Financial services	224.2	19.0	
Digital and electronic services	152.9	13.0	
Professional services	131.5	11.2	
Manufacturing	93.1	7.9	
All other services	229.6	19.5	
Total	1,179.3	100.0	

Source: USDOC, BEA, table 5.1, "Services Supplied to U.S. Persons by Foreign MNEs though Their MOUSAs, by Industry of Affiliate and by Country of UBO," October 19, 2022.

Notes: "Manufacturing" includes ancillary services provided by goods manufacturers. "Other" includes ancillary services provided in the mining, agriculture, and other sectors, as well as suppressed data. Beginning with the 2018 Recent Trends in U.S. Services Trade report, software publishing was reallocated from "Other Services" to "Digital and electronic services" to better reflect the industry composition. Therefore, Digital and electronic services data in this report and the 2018 report cannot be directly compared with such data in USITC reports published before 2018. Because of rounding, figures may not add to 100 percent.

Table B.12 Distribution services: U.S. cross-border exports, by country, 2021

Value in millions of dollars (million \$), shares in percentage (\$), corresponds to figure 2.1.

Country	Million \$	Share of total (%)
Japan	4,824	8.8
South Korea	4,543	8.3
Germany	4,503	8.2
Canada	4,407	8.0
China	3,009	5.5
United Kingdom	2,817	5.1
France	2,608	4.7
Denmark	2,319	4.2
Switzerland	2,150	3.9
Taiwan	1,981	3.6
All other countries	21,869	39.7
Total	55,030	100.0

Source: USDOC, BEA, table 2.2, "U.S. Trade in Services, by Type of Service and by Country or Affiliation," July 7, 2022.

Table B.13 Distribution services: U.S. cross-border imports, by country, 2021 Value in millions of dollars (million \$) shares in percentage (%) corresponds to figure 2.2

Country	Million \$	Share of total (%)
Japan	8,724	9.6
China	8,488	9.3
Taiwan	7,941	8.7
Denmark	7,402	8.1
Switzerland	6,780	7.4
France	6,298	6.9
Germany	6,204	6.8
Canada	5,641	6.2
South Korea	4,855	5.3
Hong Kong	3,971	4.4
All other countries	24,888	27.3
Total	91,192	100.0

Source: USDOC, BEA, table 2.2, "U.S. Trade in Services, by Type of Service and by Country or Affiliation," July 7, 2022.

Table B.14 Distribution services: U.S. cross-border exports, by industry, 2021

Value in millions of dollars (million \$), shares in percentage (%), corresponds to figure 2.3.

Type of industry	Million \$	Share of total (%)
Sea transport	19,558	35.5
Air transport	28,646	52.1
Other modes of transport	4,815	8.7
Trade-related services	2,011	3.7
Total	55,030	100.0

Source: USDOC, BEA, table 2.1, "U.S. Trade in Services, by Type of Service," July 7, 2022. Note: Because of rounding, figures may not add to 100 percent.

Table B.15 Distribution services: U.S. cross-border imports, by industry, 2021

Value in millions of dollars (million \$), shares in percentage (%), corresponds to figure 2.4.

Type of industry	Million \$	Share of total (%)
Sea transport	55,904	61.3
Air transport	28,669	31.4
Other modes of transport	4,047	4.4
Trade-related services	2,572	2.8
Total	91,192	100.0

Source: USDOC, BEA, table 2.1, "U.S. Trade in Services, by Type of Service," July 7, 2022. Note: Because of rounding, figures may not add to 100 percent.

Table B.16 Distribution services: Sales by U.S.-owned foreign affiliates, by industry, 2020 Value in millions of dollars (million \$), shares in percentage (%), corresponds to figure 2.5.

Type of industry	Million \$	Share of total (%)
Wholesale trade	237,464	52.6
Retail trade	117,045	25.9
Transportation and warehousing	96,882	21.5
Total	451,391	100.0

Source: USDOC, BEA, table 4.1, "Services Supplied to Foreign Persons by U.S. Multinational Enterprises through Their Majority Owned Foreign Affiliates, by Industry of Affiliate and by Country of Affiliate," October 19, 2022.

Note: Because of rounding, figures may not add to 100 percent.

Table B.17 Distribution services: Purchases from foreign-owned U.S. affiliates, 2020
Value in millions of dollars (million \$), shares in percentage (%), corresponds to figure 2.6.

Type of industry	Μ	illion \$	Share of total (%)
Wholesale trade	1	94,146	55.8
Retail trade		87,343	25.1
Transportation and warehousing		66,451	19.1
Total	3	47,940	100.0

Source: USDOC, BEA, table 5.1, "Services Supplied to U.S. Persons by Foreign Multinational Enterprises through Their Majority Owned U.S. Affiliates, by Industry of Affiliate and by Country of Ultimate Beneficial Owner," October 19, 2022. Note: Because of rounding, figures may not add to 100 percent.

Table B.18 Sea Transport: Cross-border exports and imports, 2017–21 (million \$) Millions of dollars, corresponds to figure 2.7.

Veen		
rear	U.S. cross-border exports	U.S. cross-border imports
2017	18,211	31,362
2018	19,019	33,292
2019	18,222	32,663
2020	17,782	34,159
2021	19,558	55,904

Source: USDOC, BEA, table 2.1, "U.S. Trade in Services, by Type of Service," July 7, 2022.

Table B.19 Air transport: Cross-border exports and imports, 2017–21 (million \$)

Millions of dollars, corresponds to figur	<u>e 2.8</u> .	
Year	U.S. cross-border exports	U.S. cross-border imports
2017	26,216	20,916
2018	27,681	22,618
2019	27,964	23,581
2020	22,887	21,691
2021	28,646	28,669

Source: USDOC, BEA, table 2.1, "U.S. Trade in Services, by Type of Service," July 7, 2022.

Table B.20 Other modes of transport: Cross-border exports and imports, 2017–21 (million \$) Millions of dollars, corresponds to figure 2.9.

Year	U.S. cross-border exports	U.S. cross-border imports
2017	4,625	3,877
2018	5,146	3,853
2019	4,789	3,774
2020	4,682	3,542
2021	4,815	4,047

Source: USDOC, BEA, table 2.1, "U.S. Trade in Services, by Type of Service," July 7, 2022.

Year	U.S. cross-border exports	U.S. cross-border imports
2017	2,177	2,234
2018	2,495	2,438
2019	2,089	2,522
2020	1,531	2,333
2021	2,011	2,572

Table B.21 Trade-related services: Cross-border exports and imports,	2017-21 (million \$)
Millions of dollars, corresponds to figure 2.10.	

Source: USDOC, BEA, table 2.1, "U.S. Trade in Services, by Type of Service," July 7, 2022.

Table B.22 Wholesale trade: Affiliate sales and purchases, 2016–20 (million \$) Millions of dollars, corresponds to figure 2.11.

	Services supplied by U.S. firms' foreign	Services supplied by U.S. affiliates of
Year	affiliates	foreign firms
2016	230,797	180,487
2017	236,448	209,744
2018	250,963	204,398
2019	251,820	200,761
2020	237,464	194,146

Source: USDOC, BEA, table 4.1, "Services Supplied to Foreign Persons by U.S. MNEs through Their MOFAs, by Industry of Affiliate and by Country of Affiliate," October 19, 2022 and USDOC, BEA, table 5.1, "Services Supplied to U.S. Persons by Foreign Multinational Enterprises through Their Majority Owned U.S. Affiliates, by Industry of Affiliate and by Country of Ultimate Beneficial Owner," October 19, 2022.

Table B.23 Retail trade: Affiliate sales and purchases, 2016–20 (million \$)

·	Services supplied by U.S. firms' foreign	Services supplied by U.S. affiliates of
Year	affiliates	foreign firms
2016	108,372	63,830
2017	111,733	76,431
2018	120,621	81,143
2019	120,565	87,956
2020	117,045	87,343

Millions of dollars, corresponds to figure 2.12.

Source: USDOC, BEA, table 4.1, "Services Supplied to Foreign Persons by U.S. MNEs through Their MOFAs, by Industry of Affiliate and by Country of Affiliate," October 19, 2022 and USDOC, BEA, table 5.1, "Services Supplied to U.S. Persons by Foreign Multinational Enterprises through Their Majority Owned U.S. Affiliates, by Industry of Affiliate and by Country of Ultimate Beneficial Owner," October 19, 2022.

Table B.24 Transportation and warehousing: Af	ffiliate sales and purchases,	2016-20 (million \$)
Millions of dollars, corresponds to figure 2.13.		

	Services supplied by U.S. firms' foreign	Services supplied by U.S. affiliates
Year	affiliates	of foreign firms
2016	72,446	47,808
2017	78,614	61,869
2018	93,946	62,393
2019	99,291	68,202
2020	96,882	66,451

Source: USDOC, BEA, table 4.1, "Services Supplied to Foreign Persons by U.S. MNEs through Their MOFAs, by Industry of Affiliate and by Country of Affiliate," October 19, 2022 and USDOC, BEA, table 5.1, "Services Supplied to U.S. Persons by Foreign Multinational Enterprises through Their Majority Owned U.S. Affiliates, by Industry of Affiliate and by Country of Ultimate Beneficial Owner," October 19, 2022.

Period	Total U.S. services exports	Total U.S. goods exports
2018 Q1	218,519	412,657
2018 Q2	214,704	427,028
2018 Q3	216,192	419,714
2018 Q4	216,134	417,514
2019 Q1	218,205	419,131
2019 Q2	225,170	413,503
2019 Q3	223,618	412,182
2019 Q4	224,184	410,282
2020 Q1	203,550	400,424
2020 Q2	168,227	288,969
2020 Q3	172,092	357,652
2020 Q4	182,564	385,173
2021 Q1	187,935	410,395
2021 Q2	194,691	435,556
2021 Q3	199,688	441,893
2021 Q4	212,959	473,521
2022 Q1	217,014	486,575
2022 Q2	229,413	538,468
2022 Q3	236,745	545,943
2022 Q4	242,835	514,862

Table B.25 U.S. exports of goods and services, quarterly, seasonally adjusted, quarterly, 2018–22 In millions of dollars, corresponds to <u>figure 2.14</u>.

Source: USDOC, BEA, table 1.1, "U.S. International Transactions," September 22, 2022.

Table B.26 U.S. imports of goods and services,	quarterly, seasonally adjuste	ed, quarterly, 2018–22
In millions of dollars, corresponds to figure 2.15.		

Period	Total U.S. services imports	Total U.S. goods imports
2018 Q1	139,047	631,602
2018 Q2	140,624	633,353
2018 Q3	140,890	644,799
2018 Q4	144,834	645,909
2019 Q1	147,252	635,292
2019 Q2	149,587	637,510
2019 Q3	148,400	628,942
2019 Q4	148,354	610,614
2020 Q1	135,929	597,750
2020 Q2	101,064	511,718
2020 Q3	108,063	600,719
2020 Q4	121,482	635,915
2021 Q1	119,858	675,663
2021 Q2	130,977	702,985
2021 Q3	146,251	714,472
2021 Q4	152,939	758,540
2022 Q1	158,066	826,666
2022 Q2	172,317	847,759
2022 Q3	174,415	815,238
2022 Q4	175,500	787,213

Source: USDOC, BEA, table 1.1, "U.S. International Transactions," September 22, 2022.

Month	2004	2005	2006	2007	2008	2009	2010
January	1.55	1.55	1.47	1.49	1.49	1.57	1.39
February	1.55	1.54	1.48	1.49	1.50	1.56	1.40
March	1.54	1.54	1.49	1.47	1.49	1.57	1.37
April	1.58	1.53	1.48	1.49	1.49	1.54	1.36
May	1.55	1.54	1.51	1.47	1.47	1.50	1.38
June	1.59	1.49	1.51	1.50	1.47	1.45	1.40
July	1.58	1.44	1.50	1.50	1.48	1.43	1.41
August	1.59	1.47	1.50	1.50	1.49	1.37	1.41
September	1.56	1.48	1.50	1.49	1.51	1.41	1.41
October	1.54	1.49	1.50	1.48	1.57	1.41	1.40
November	1.55	1.49	1.50	1.47	1.62	1.40	1.38
December	1.54	1.50	1.49	1.49	1.62	1.39	1.38

 Table B.27 U.S. retailers' inventories-to-sales ratio, January 2004–August 2022

 Ratio in number of months inventory on hand, corresponds to figure 3.1.

Table continued.

Table B.28 Global business-to-consumer ("B2C") e-commerce sales, 2018–22 Trillions of dollars, corresponds to figure 3.2.

Year	B2C sales
2018	3.0
2019	3.4
2020	4.2
2021	5.2
2022*	5.7

Source: Statista, "Global Retail E-commerce Sales, 2014–2026, July 2022. Note: * = The estimated business-to-consumer sales for 2022.

Table B.29 U.S. e-commerce sales' share of total retail, 2013–22

Year	Share (%)
2013	5.8
2014	6.5
2015	7.3
2016	8.0
2017	9.0
2018	9.9
2019	11.1
2020	14.2
2021	14.2
2022	16.1

Source: Statista, U.S. E-Commerce Share of Retail Sales, 2021–2025.

Country	Share (%)
United States	24.1
China	23.6
Japan	4.9
Germany	3.4
India	2.7
France	2.5
United Kingdom	2.3
Russia	2.0
All other countries	34.5
Total	100.0

Table B.30 Logistics services: Third-party logistics revenues by country, 2020 In percentages, corresponds to figure 3.4.

Source: Armstrong and Associates, "Global 3PL Market Size Estimates," October 19, 2021.

Period	Maritime freight exports	Maritime freight imports
2017 Q1	1,046	7,308
2017 Q2	1,001	7,320
2017 Q3	1,006	7,489
2017 Q4	1,013	7,134
2018 Q1	1,049	7,480
2018 Q2	1,087	7,692
2018 Q3	1,048	7,643
2018 Q4	1,024	8,218
2019 Q1	937	7,934
2019 Q2	981	7,759
2019 Q3	949	7,786
2019 Q4	983	7,278
2020 Q1	978	7,301
2020 Q2	913	7,332
2020 Q3	939	8,157
2020 Q4	939	9,387
2021 Q1	1,039	10,318
2021 Q2	1,043	12,380
2021 Q3	1,067	14,763
2021 Q4	1,052	16,462
2022 Q1	1,154	18,840
2022 Q2	1,190	19,638
2022 Q3	1,125	18,149
2022 Q4	1,024	15,459

Source: USDOC, BEA, "Table 3.1. U.S. International Trade in Services", accessed April 17, 2023.

Month	2019	2020	2021	2022	2023
January	2,080	1,582	4,178	10,691	2,072
February	1,590	1,474	4,391	11,030	1,959
March	1,495	1,479	4,184	9,112	1,775
April	1,542	1,538	4,403	8,587	—
May	1,262	1,675	5,742	8,720	—
June	1,470	2,467	8,548	7,652	_
July	1,466	2,934	10,503	7,199	—
August	1,374	3,508	11,362	6,127	_
September	1,404	4,085	12,172	3,283	—
October	1,569	4,138	10,976	2,412	_
November	1,352	4,048	10,085	2,069	—
December	1,435	4,174	10,221	1,992	

Table B.32 Container freight rate index from Shanghai to Los Angeles, 2019–23. In dollars per 40-foot container, corresponds to figure 4.2

Source: Statista "Container freight rate index from Shanghai to Los Angeles 2019-2022" accessed April 17, 2023.

Table B.33 U.S.	ton-miles of freight by mode of transport, 2010–20
In millions of ton-n	niles corresponds to figure 4.3

in minoris of ton-miles, c	orresponds to <u>figure 4.5</u> .				
Year	Air	Truck	Railroad	Water	Pipeline
2010	12,540	1,830,761	1,691,004	605,666	955,986
2011	12,134	1,650,557	1,729,256	603,983	1,018,082
2012	12,367	1,838,648	1,712,567	577,114	856,873
2013	12,428	2,004,478	1,740,687	564,648	818,836
2014	12,845	1,956,831	1,851,229	608,918	854,632
2015	13,190	1,985,960	1,738,283	589,632	882,600
2016	13,758	2,060,878	1,585,440	580,954	869,727
2017	15,140	2,366,049	1,674,784	600,910	882,864
2018	15,969	2,341,705	1,729,638	608,756	932,523
2019	16,413	2,367,988	1,614,498	565,153	965,129
2020	18,746	2,426,766	1,439,814	539,470	926,311

Source: United States Department of Transportation, Bureau of Transportation Statistics, "National Transportation Statistics (NTS), U.S. Ton-Miles of Freight," accessed December 5, 2022.

Period	Airfreight exports	Airfreight imports
2017 Q1	3,155	1,863
2017 Q2	3,321	1,963
2017 Q3	3,501	2,015
2017 Q4	3,508	2,028
2018 Q1	3,717	2,031
2018 Q2	3,852	2,230
2018 Q3	4,009	2,307
2018 Q4	3,654	2,416
2019 Q1	3,844	2,179
2019 Q2	3,604	2,071
2019 Q3	3,534	2,147
2019 Q4	3,738	2,098
2020 Q1	3,707	2,034
2020 Q2	3,716	2,262
2020 Q3	4,039	2,395
2020 Q4	4,573	2,653
2021 Q1	5,016	2,908
2021 Q2	5,372	3,301
2021 Q3	5,378	3,495
2021 Q4	5,741	3,897
2022 Q1	6,430	3,685
2022 Q2	6,519	3,340
2022 Q3	6,119	2,991
2022 Q4	5,552	2,454

Table B.34 U.S. exports and imports of airfreight services, quarterly, 2017–22 Data in millions of dollars, corresponds to <u>figure 4.4</u>.

Source: USDOC, BEA, "Table 3.1. U.S. International Trade in Services".

Table B.35 Top 10 global cargo airlines, by ton-kilometers (millions), 2	2021
In millions of ton-kilometers, corresponds to figure 4.5.	

Airline	International	Domestic	Total
FedEx (USA)	10,266	9,390	19,656
UPS (USA)	7,017	7,354	14,371
Qatar Airways (QAT)	13,740	-	13,740
Emirates (UAE)	9,569	-	9,569
Cathay Pacific Airways (HKG)	8,137	-	8,137
Korean Air (KOR)	8,091	13	8,104
Cargolux (LUX)	7,345	-	7,345
Turkish Airlines (TUR)	6,958	19	6,977
China Southern Airlines (CHN)	5,595	996	6,591
China Airlines (CHN)	6,317	-	6,317

Source: IATA, World Air Transport Stats 2021, 2021. 24.

	Frankfurt - North	Hong Kong -	Hong Kong -
Month	America	Europe	North America
January 2020	1.91	2.83	3.14
February 2020	1.84	2.52	3.19
March 2020	2.56	3.08	4.03
April 2020	3.83	4.93	5.69
May 2020	3.71	5.88	7.73
June 2020	3.87	4.53	5.86
July 2020	3.73	3.17	4.96
August 2020	4.02	3.21	5.50
September 2020	3.39	3.37	5.26
October 2020	2.92	3.76	5.66
November 2020	4.05	5.38	7.37
December 2020	5.00	5.59	7.50
January 2021	4.45	4.28	6.43
February 2021	4.52	4.30	6.42
March 2021	4.45	4.05	5.48
April 2021	4.13	4.61	8.48
May 2021	4.41	4.73	8.70
June 2021	4.07	4.34	7.89
July 2021	4.10	4.58	7.90
August 2021	3.94	4.63	8.64
September 2021	4.21	5.57	9.74
October 2021	3.95	6.68	9.94
November 2021	4.45	7.91	11.54
December 2021	5.21	8.00	12.72
January 2022	4.62	6.61	10.90
February 2022	5.18	5.80	9.68
March 2022	4.89	5.09	8.18
April 2022	5.40	6.01	9.57
May 2022	4.23	6.35	9.69
June 2022	4.08	6.26	8.72
July 2022	3.82	6.34	8.49
August 2022	3.95	6.34	8.33
September 2022	3.87	6.09	7.94
November 2022	3.70	5.78	6.74
December 2022	4.25	5.62	6.49
January 2023	4.36	5.52	6.50
February 2023	3.45	4.96	4.93
March 2023	3.37	4.15	5.38

Table B.36 Airfreight rates for selected international routes, January 2020–March 2022Rates in dollars per kilogram, corresponds to <u>figure 4.6</u>.

Source: Statista, "Air Freight Rate Changes since the Beginning of Coronavirus Outbreak 2019–2022," accessed January 12, 2023.