



## CHAPTER 3

# Moving Goods

### Highlights

- In 2015 freight tonnage and value rose by 6.4 and 8.2 percent, respectively, over 2012 levels, fully rebounding from declines during the December 2007–June 2009 economic recession.
- The U.S. freight transportation system moved nearly 18.0 billion tons of goods valued at more than \$19.1 trillion in 2015. Expressed in per-capita terms, this means that about 56 tons of freight moved for every man, woman, and child in the United States—a 4 percent increase since 2012.
- Trucks carry 60.0 percent of the weight and 60.7 percent of the value of all goods shipped in the United States, and is the predominate mode for shipments under 750 miles. Rail leads in tons and ton-miles for shipments of 750 to 2,000 miles, while modal combinations account for the largest share of the value of shipments moved 2,000 miles or more.
- The value of total U.S.-international merchandise trade increased from more than \$2.4 trillion in 2000 to approximately \$3.3 trillion in 2016 (in 2009 dollars)—a 37.6 percent inflation-adjusted increase. U.S. trade with Canada and Mexico accounted for 29.3 percent (nearly \$1.07 trillion) of the value of U.S.-international merchandise trade in 2016.
- Trucks carried 26.8 percent of the tonnage and 65.5 percent of the value of U.S. merchandise trade with Canada and Mexico, while rail carried 18.2 percent of the tonnage and 15.5 percent of the value in 2016.
- Nearly 500 freight transportation gateways, including airports, border crossings, and seaports, handle international cargo; while the latest available data show that in 2015 the top 25 gateways handled 64.8 percent of the value of total U.S.-international merchandise trade—\$2.4 trillion in current dollars.
- Alaska, North Dakota, and Wyoming are major producers of energy commodities—oil in Alaska and North Dakota and coal in Wyoming. Alaska and North Dakota had the highest ratios of domestic export to domestic import shipments by value, while Alaska and Wyoming accounted for the highest ratios by tonnage.

The U.S. freight transportation system moved nearly 18.0 billion tons of goods valued at more than \$19.1 trillion in 2015, according to Freight Analysis Framework (FAF)<sup>1</sup> estimates

(table 3-1). This means the freight transportation system carried, on average, about 49.3 million tons of goods worth more than \$52.5 billion each day, or about 56 tons of freight annually per capita in the United States in 2015, a 4.0 percent increase from 2012. See box 3-A for information about the FAF and its foundation, the Commodity Flow Survey (CFS).

<sup>1</sup> Input sources for the FAF4 base year of 2012 are final, but each updated version of FAF incorporates continuous improvements to data quality. As a result, the latest data available online may not precisely match the data in this chapter or previous editions of this report.

**TABLE 3-1 Weight and Value of Shipments by Transportation Mode: 2012, 2015, and 2045**

Millions of tons	Weight											
	2012				2015				2045			
	Total	Domestic	Exports <sup>1</sup>	Imports <sup>1</sup>	Total	Domestic	Exports <sup>1</sup>	Imports <sup>1</sup>	Total	Domestic	Exports <sup>1</sup>	Imports <sup>1</sup>
<b>Total</b>	<b>16,896</b>	<b>14,901</b>	<b>864</b>	<b>1,130</b>	<b>17,978</b>	<b>15,983</b>	<b>920</b>	<b>1,075</b>	<b>25,346</b>	<b>20,940</b>	<b>2,202</b>	<b>2,204</b>
Truck	10,092	9,899	105	89	10,776	10,568	108	100	14,829	14,235	290	305
Rail	1,616	1,481	53	82	1,602	1,459	55	89	1,918	1,588	109	221
Water	884	502	68	313	884	544	95	246	1,100	609	190	301
Air, air & truck	10	2	4	4	10	2	4	5	37	4	16	18
Multiple modes & mail	1,311	309	596	406	1,346	324	615	407	2,962	431	1,521	1,010
Pipeline	2,942	2,672	37	233	3,326	3,056	43	226	4,468	4,058	73	338
Other & unknown	41	37	1	3	33	29	1	3	31	16	4	11

Billions of 2012 dollars	Value											
	2012				2015				2045			
	Total	Domestic	Exports <sup>1</sup>	Imports <sup>1</sup>	Total	Domestic	Exports <sup>1</sup>	Imports <sup>1</sup>	Total	Domestic	Exports <sup>1</sup>	Imports <sup>1</sup>
<b>Total</b>	<b>17,701</b>	<b>13,965</b>	<b>1,532</b>	<b>2,204</b>	<b>19,146</b>	<b>14,978</b>	<b>1,704</b>	<b>2,465</b>	<b>37,026</b>	<b>22,474</b>	<b>6,482</b>	<b>8,071</b>
Truck	10,929	10,253	365	311	11,626	10,903	381	342	18,691	16,227	1,246	1,218
Rail	578	411	61	107	623	445	63	115	1,077	646	155	276
Water	588	270	72	246	596	297	99	200	973	340	273	360
Air, air & truck	1,038	132	434	472	1,187	145	466	576	5,120	317	2,449	2,354
Multiple modes & mail	3,257	1,748	572	936	3,581	1,870	658	1,053	9,120	3,396	2,262	3,461
Pipeline	1,271	1,150	10	111	1,450	1,317	15	118	1,721	1,546	21	154
Other & unknown	40	1	17	22	83	1	21	61	325	0	76	248

<sup>1</sup> Data do not include imports and exports that pass through the United States from a foreign origin to a foreign destination by any mode.

**NOTES:** Numbers may not add to totals due to rounding. The 2015 data are provisional estimates that are based on selected modal and economic trend data. Data in this version is not comparable to similar data in previous years because of updates to the Freight Analysis Framework. All truck, rail, water, and pipeline movements that involve more than one mode, including exports and imports that change mode at international gateways, are included in multiple modes & mail to avoid double counting. As a consequence, rail and water totals in this table are less than other published sources.

**SOURCE:** U.S. Department of Transportation, Bureau of Transportation Statistics and Federal Highway Administration, Freight Analysis Framework, version 4.3.1, 2017.

Population growth and economic activity continue to be the primary factors that determine freight demand. As population increases or economic activity expands, more goods are needed and produced, resulting in additional freight movement. Between 2010 and 2016, the U.S. population increased by 4.5 percent [USDOC CENSUS American Fact Finder], and U.S. gross domestic product (GDP) grew by 12.7 percent in terms of

chained 2009 dollars [USDOC BEA 2017]. Although freight moves throughout the United States, the demand for freight transportation is driven primarily by the geographic distribution of population and economic activity. Both population and GDP have grown faster in the South and West than in the Northeast and Midwest, but the Northeast has the highest GDP per capita (table 3-2).

**TABLE 3-2 Population and Gross Domestic Product (GDP) by Region: 2010 and 2014–2016**

	2010	2014	2015	2016	Percent change, 2010 to 2016
<b>Resident Population (thousands)</b>	<b>309,348</b>	<b>318,563</b>	<b>320,897</b>	<b>323,128</b>	<b>4.5</b>
Northeast	55,318	56,117	56,185	56,210	1.6
Midwest	66,930	67,726	67,838	67,941	1.5
South	114,563	119,696	121,039	122,320	6.8
West	71,947	75,024	75,834	76,657	6.5
<b>GDP (millions of chained 2009 \$)<sup>1</sup></b>	<b>14,783,800</b>	<b>15,982,300</b>	<b>16,397,200</b>	<b>16,662,100</b>	<b>12.7</b>
Northeast	3,553,225	3,700,258	3,772,627	3,816,577	7.4
Midwest	3,000,447	3,215,098	3,257,438	3,294,998	9.8
South	4,862,984	5,268,516	5,422,600	5,490,134	12.9
West	3,211,646	3,501,251	3,636,790	3,735,446	16.3
<b>GDP per capita (chained 2009 \$)<sup>1</sup></b>	<b>47,790</b>	<b>50,170</b>	<b>51,098</b>	<b>51,565</b>	<b>7.9</b>
Northeast	64,232	65,939	67,147	67,899	5.7
Midwest	44,830	47,472	48,018	48,498	8.2
South	42,448	44,016	44,800	44,884	5.7
West	44,639	46,668	47,957	48,729	9.2

**KEY:** R = revised.

<sup>1</sup>As of October 26, 2006, the Bureau of Economic Analysis renamed the gross state product (GSP) series to gross domestic product (GDP) by state.

**NOTES:** Chained dollars are not additive, especially for periods farther away from the base year of 2009. GDP for all regions is not equal to total GDP. Numbers may not add to totals due to rounding.

**SOURCES:** **Population:** U.S. Department of Commerce, Census Bureau, Population and Housing Unit Estimates Datasets, National Population Totals Datasets, available at <https://www.census.gov/programs-surveys/popest/data.html> as of June 2017. **Gross Domestic Product:** U.S. Department of Commerce, Bureau of Economic Analysis, Regional Economic Accounts, available at [www.bea.gov/regional/](http://www.bea.gov/regional/) as of June 2017.

Economic recovery following the Great Recession through the end of 2016 was slow but steady. That same pattern was evident in transportation services where freight activities rose above the long-term growth trend. Freight activities began to rise quickly beginning in May 2009 (one month ahead of the economic acceleration following the recession) but has since slowed. Gross domestic product grew as rapidly before and after the Great Recession,

suggesting that freight transportation has recovered more slowly than the economy as a whole. In addition, changes in the composition of goods demanded and shifts in population and economic centers had an effect on what goods were moved, what modes were used to transport them, and to where they were shipped. Freight carried by the for-hire transportation industry rose as the economy rebounded from the past recession [USDOT BTS 2017c].

### **Box 3-A The Commodity Flow Survey and the Freight Analysis Framework**

The Commodity Flow Survey (CFS) is conducted every 5 years by the Bureau of Transportation Statistics (BTS) in partnership with the U.S. Census Bureau as part of the Economic Census. The CFS provides data for most of the U.S. economy on commodities shipped, their value and weight, mode of transport, and origin and destination within and between all U.S. regions. The survey covers about 75 percent of the tonnage shipped from a domestic origin to a domestic destination.

The CFS is the foundation for the Freight Analysis Framework (FAF), a freight database produced through a partnership between BTS and the Federal Highway Administration (FHWA). The FAF incorporates domestic shipments collected in the CFS (covering mining, manufacturing, wholesale, and other selected industries), and augments the CFS data with foreign trade statistics from the U.S. Census Bureau, agricultural data from the Department of Agriculture, energy commodity data from the Department of Energy, and other sources.

The fourth generation of FAF (FAF4) is based on the 2012 CFS, which includes improvements to data collection, data editing, and an expanded number of geographic areas. Improvements were also made to the non-CFS components of FAF.

FAF provides tonnage and value estimates by commodity type, mode, origin, and destination for years the CFS is conducted, provides annual estimates for years in between the CFS, and long-range (30 year) forecasts in 5-year increments. It also includes an assignment of truck flows to the highway network for the CFS year and a 30-year forecast to provide a picture of freight truck volumes.

FAF forecasts are based on long-term U.S. economic projections, including real gross domestic product growth, nonfarm business productivity, real oil prices, and the Federal budget deficit. Detailed information on CFS data and methodologies are available at [www.bts.gov/publications/commodity\\_flow\\_survey](http://www.bts.gov/publications/commodity_flow_survey). Information on FAF data and methodologies are available at [www.bts.dot.gov/archive/subject\\_areas/freight\\_transportation/faf](http://www.bts.dot.gov/archive/subject_areas/freight_transportation/faf). While the FAF is more complete in coverage of freight flows, the CFS provides greater commodity detail and additional shipment characteristics, such as hazardous materials class.

It is important to note that the input sources for the FAF4 base year of 2012 are final, but each updated version of FAF incorporates continuous improvements to data quality. As a result, the latest data available online may not precisely match the data in this chapter or previous editions of this report.



U.S. exports and imports accounted for 5.1 and 6.1 percent of the weight and 8.8 and 12.9 percent of the value of freight transported in 2015, respectively. FAF forecasts that U.S. exports and imports will account for an even greater share of freight movements in 2045, reaching 17.5 percent of the weight and 39.3 percent of the value of goods shipped throughout the country [USDOT BTS and FHWA FAF 2017].

### Domestic Freight Movement

The freight transportation industry moves goods over a network of truck routes, railroads, waterways, airports, and pipelines. The distance a shipment must travel and the cost to ship play a major part in determining what mode or mix of modes are used during any particular leg of a multimodal journey.

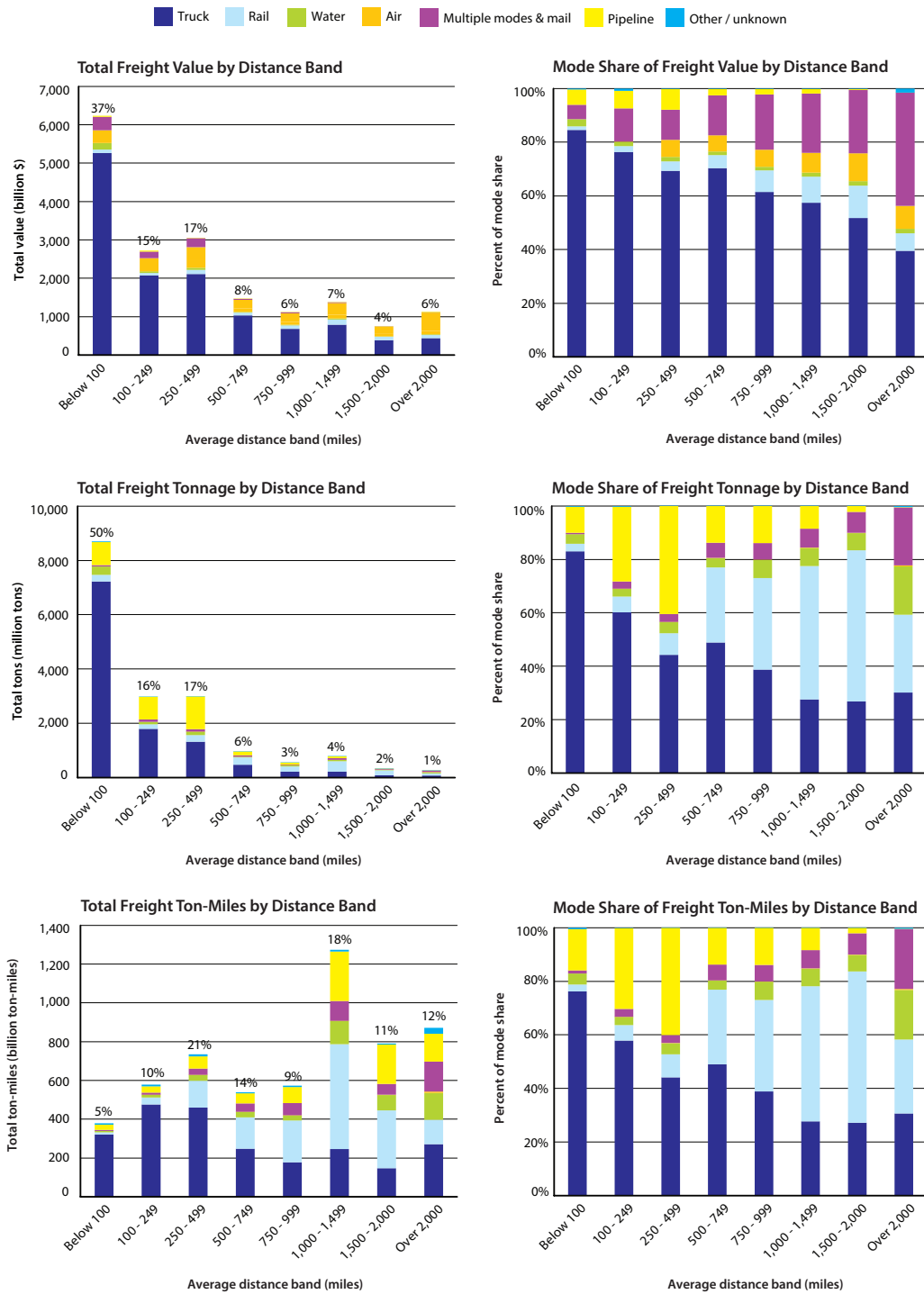
A large percentage of goods movement occurs close to home. Approximately 50.1 percent of the weight and 37.1 percent of the value of goods were moved less than 100 miles between origin and destination in 2015 (figure 3-1). By contrast, 7.6 percent of the weight and 17.1 percent of the value of goods were moved more than 1,000 miles. Distance, as used here, refers to the Great Circle Distance, which is commonly called “as-the-crow-flies.” Modal shares of freight vary considerably by distance. While trucks carry the largest shares by value, tons, and ton-miles for shipments moving 750 miles or less, rail is the dominant mode by tons and ton-miles of shipments transported between 750 to 2,000 miles; whereas air and multiple modes account for 49.8 percent of the value of shipments moving more than 2,000 miles [USDOT BTS and FHWA 2017].

Overall, trucks carry the highest percentage of the weight and value of goods in the United States, accounting for 10.8 billion tons of the weight (60.0 percent) and \$11.6 trillion of the value (60.7 percent), respectively, in 2015 (table 3-1). However, railroads and inland waterways carry large volumes and tonnages of bulk commodities over long distances. Figure 3-2 helps visualize the large volume of coal moved by rail between the Powder River Basin in Wyoming and the Midwest, in addition to the grains and energy products moved by vessel and barge along the Lower Mississippi River. Rail and water combined accounted for 13.8 percent of the total tonnage and 6.4 percent of the total value of freight moved in the United States in 2015. Air carriers almost exclusively moved high-value, low-weight products. This is underscored by the relatively extreme value-to-weight ratio of air cargo, which is about \$115,779 per ton. In comparison, the overall value-to-weight ratio of cargo carried by all modes combined is less than \$1,100 per ton. In 2015 pipelines moved nearly 3.3 billion tons of goods, valued at about \$1.5 trillion (\$436 per ton), while rail moved more tonnage of lesser value—1.6 billion tons valued at \$623 billion (\$389 per ton) [USDOT BTS AND FHWA 2017].

Shipments moving by water are typically low-value, bulk products similar to those moved by rail.<sup>2</sup> In 2015 the water transportation industry moved 936 million tons worth \$636 billion (nearly \$680 per ton), representing 5.2

<sup>2</sup> Many shipments moving by rail or water are transferred to another mode for delivery to their final destination. In FAF, these shipments are counted under “multiple modes and mail.” Thus the rail and water numbers discussed here may differ from those in other published sources.

**FIGURE 3-1 Value, Tonnage, and Ton-Miles by Distances Traveled: 2015**



**NOTE:** "Other / Unknown" mode includes movements not elsewhere classified such as flyaway aircraft, and shipments for which the mode cannot be determined.

**SOURCE:** U.S. Department of Transportation, Bureau of Transportation Statistics and Federal Highway Administration, Freight Analysis Framework, version 4.3.1, 2017.

**FIGURE 3-2 Freight Flows by Highway, Railroad, and Waterway: 2012**



**SOURCES:** *Highways:* U.S. Department of Transportation, Bureau of Transportation Statistics and Federal Highway Administration, Freight Analysis Framework, version 4.3.1, 2017; *Rail:* Based on Surface Transportation Board, Annual Carload Waybill Sample and rail freight flow assignments done by Oak Ridge National Laboratory, 2017; *Inland Waterways:* U.S. Army Corps of Engineers, Institute of Water Resources, Annual Vessel Operating Activity and Lock Performance Monitoring System data, 2017.

percent of the tonnage and 3.3 percent of the value of all freight shipments [USDOT BTS AND FHWA 2017]. In 2015 approximately 565 million short tons of cargo were moved by vessel along the inland waterways, including the Mississippi River—the Nation’s busiest waterway [USACE WCSC 2016].

In comparison with the rail and water modes, air transport carries high-value products, such as electronics, precision instruments, and pharmaceuticals that require quick delivery. Of

all modes, the value of air-freight shipments is projected to increase the fastest from 2015 to 2045, growing by more than 300 percent [USDOT BTS AND FHWA 2017]. In 2016 U.S. airlines<sup>3</sup> carried a total of 67.9 billion revenue ton-miles of cargo, including 36.8 billion international and 13.8 billion domestic [USDOT BTS 2016].

Over the last 20 years, the U.S. transportation system has become increasingly

<sup>3</sup> In all service classes (scheduled and nonscheduled).

interconnected. Although freight moved via multiple modes<sup>4</sup> accounted for a small share (7.5 percent) of freight tonnage, 18.7 percent of the value of goods were moved in that way in 2015. FAF projects the total value of multiple mode shipments will more than double between 2015 and 2045, from 1.3 billion tons in 2015 to nearly 3.0 billion tons in 2045 [USDOT BTS AND FHWA 2017].

The growth in intermodal rail freight movement is driven, in part, by global supply chain requirements. Between 2000 and 2016, the railroad industry reported a 48.4 percent increase in rail intermodal traffic [AAR 2017a]. The Association of American Railroads (AAR) reports that rail intermodal traffic accounted for 24 percent of U.S. Class I railroad revenue, more than any other single commodity group. [AAR 2017a]. With the growth in container trade and improvements in information and logistics technologies, greater reliance on intermodal transportation expects to continue.

### *Value and Weight of Domestic Shipments by State*

An interconnected freight transportation network contributes to state economic growth by supporting resource development and expanding interstate commerce. Figures 3-3 and 3-4 show the ratios of the value and weight of goods shipped to and from other states. A ratio of outbound to inbound shipments that is greater than 1.0 indicates that a state

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<sup>4</sup> The FAF category for multiple modes and mail includes all multimodal movements and is not limited to traditional intermodal services, such as trailer-on-flatcar and container-on-flatcar rail.

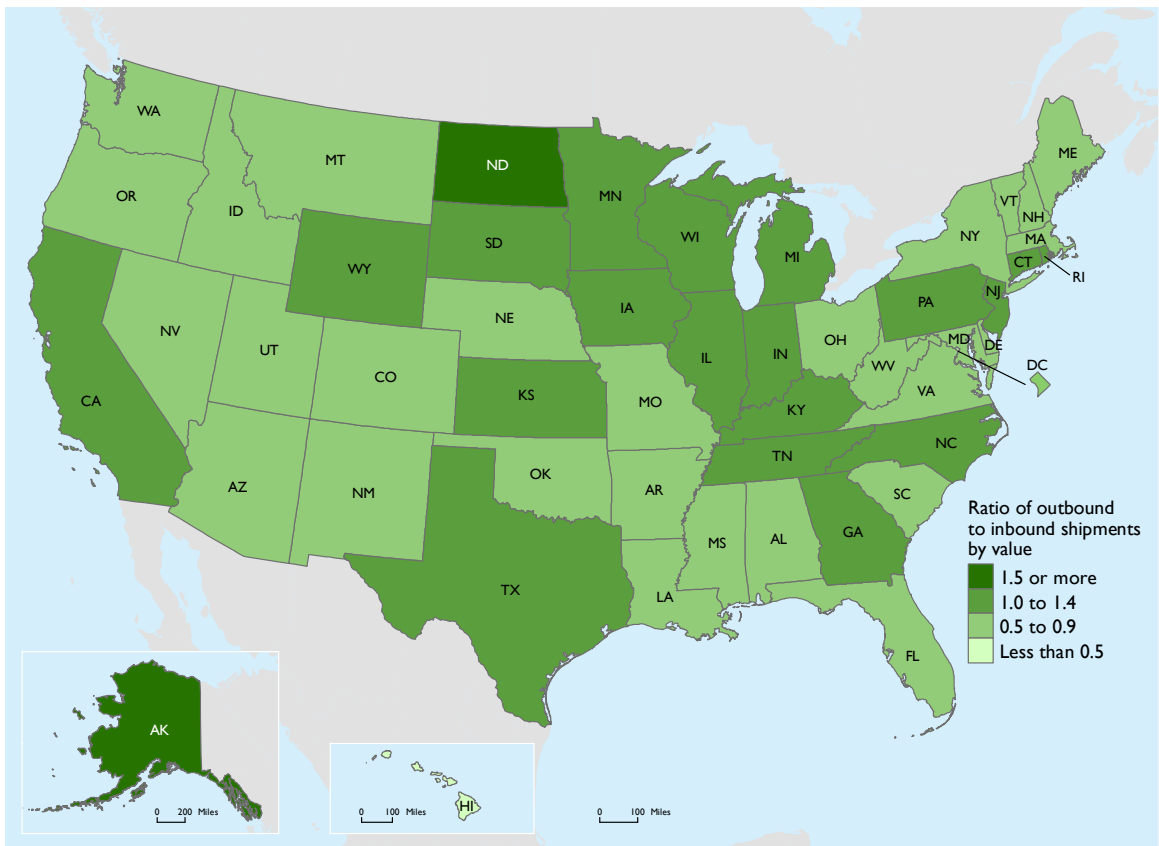
ships more goods, by value, to markets in other states than it receives from other states, whereas a ratio less than 1.0 indicates that a state imports more goods from other states than it exports.

Alaska and North Dakota have the highest ratios of about 2.0, indicating the value of their exports of goods are about two times more than the value of their imports of goods. Although both states have relatively small populations, they are major oil producers. According to the Freight Analysis Framework, nearly all of the crude petroleum moving out of Alaska was transported by water, while pipeline and rail were the primary modes for moving oil out of North Dakota. Other major states that exported more than they imported were California, Connecticut, and Illinois. Electronics was the top outbound domestic shipment category from California, while mixed freight, such as groceries and convenience store goods, food for restaurants, office supplies, and hardware and plumbing items, was the top export from Connecticut. Coal was the top outbound shipment from Illinois. Hawaii had the lowest ratio of interstate outbound-to-inbound shipments by value at 0.09 because of its distant location from the mainland and resource dependency. Other states with low outbound-to-inbound ratios include Florida and Nevada, partly due to demographics.

The picture changes when looking at the ratio of outbound to inbound shipments by weight. All of the top five net exporters by weight are producers of energy commodities: Wyoming, Alaska, Montana, North Dakota, and West Virginia. According to the Energy Information Administration, Wyoming is the largest U.S.



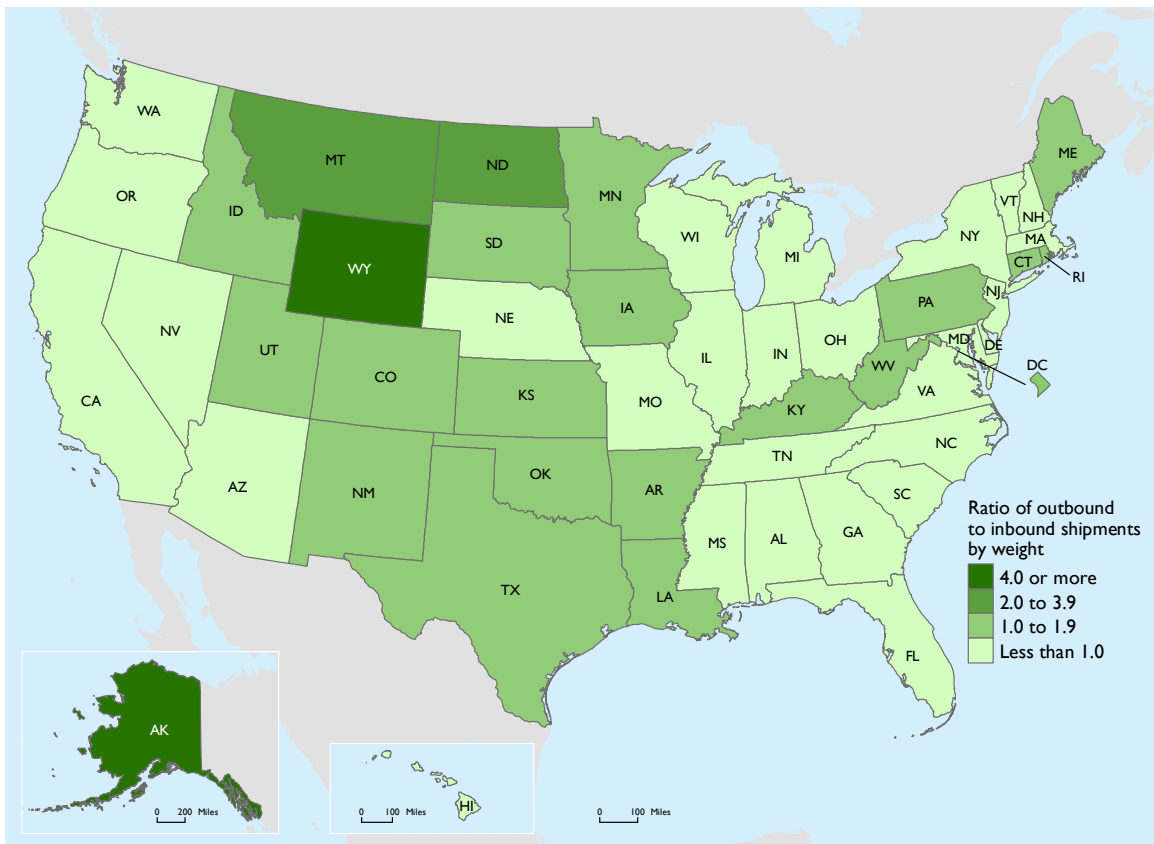
**FIGURE 3-3 Ratio of Outbound to Inbound Domestic Shipments by Value: 2015**



**SOURCE:** U.S. Department of Transportation, Bureau of Transportation Statistics and Federal Highway Administration, Freight Analysis Framework, version 4.3.1, 2017.



**FIGURE 3-4 Ratio of Outbound to Inbound Domestic Shipments by Weight: 2015**



**SOURCE:** U.S. Department of Transportation, Bureau of Transportation Statistics and Federal Highway Administration, Freight Analysis Framework, version 4.3.1, 2017.

coal producer, followed by West Virginia, while Montana is the sixth largest coal producer. For domestic markets, rail and barge are used to transport coal over long distances, primarily to power plants.

### Commodities Moved Domestically

Table 3-3 shows the top 10 commodities moved on the U.S. transportation system in 2015. The leading commodities by weight, comprised entirely of bulk products, accounted for 67.3 percent of total tonnage but only 25.2

percent of the Nation’s freight value. The top five commodities by weight included natural gas, gravel; gasoline; cereal grains; nonmetal mineral products [USDOT BTS AND FHWA 2017].

The finding is different when looking at the value of goods shipped. The leading commodities by value are mostly high value-per-ton goods that require rapid delivery, including electronics, motorized vehicles, mixed freight, machinery, and gasoline. In 2015 the top 10 commodities by value

**TABLE 3-3 Top Commodities by Weight and Value: 2015**

Weight	Millions of tons	Value	Billions of 2012 dollars
Natural gas, coke, asphalt <sup>1</sup>	2,647	Electronics	\$1,673
Gravel	1,820	Motorized vehicles	\$1,467
Gasoline	1,156	Mixed freight <sup>2</sup>	\$1,458
Cereal grains	1,099	Machinery	\$1,148
Nonmetal mineral products	1,073	Gasoline	\$1,059
Fuel oils	1,039	Natural gas, coke, asphalt <sup>1</sup>	\$917
Coal	1,001	Pharmaceuticals	\$903
Crude petroleum	912	Fuel Oils	\$836
Other foodstuffs	704	Miscellaneous manufacturing products	\$791
Waste/scrap	653	Other foodstuffs	\$710
<b>Total, all commodities</b>	<b>17,978</b>	<b>Total, all commodities</b>	<b>\$19,146</b>

<sup>1</sup>This group includes coal and petroleum products not elsewhere classified such as liquefied natural gas, coke, asphalt, and other products of coal and petroleum refining, excluding gasoline, aviation fuel, and fuel oil.

<sup>2</sup>This group includes items (including food) for grocery and convenience stores, supplies and food for restaurants and fast food chains, hardware or plumbing supplies, office supplies, and miscellaneous.

**NOTE:** Data in this version is not comparable to similar data in previous years because of updates to the Freight Analysis Framework.

**SOURCE:** U.S. Department of Transportation, Bureau of Transportation Statistics and Federal Highway Administration, Freight Analysis Framework, version 4.3.1, 2017

accounted for 57.3 percent of total value but only 35.9 percent of total tonnage [USDOT BTS AND FHWA 2017].

The Bureau of Transportation Statistics' Commodity Flow Survey indicates that trucks moved 59.4 percent of the tonnage and 62.8 percent of the value of all hazardous materials shipped from within the United States (table 3-4). However, truck ton-miles of hazardous materials shipments accounted for a much smaller share, about one-third of all ton-miles, because such shipments travel relatively short distances. By contrast, rail accounted for only 4.3 percent of hazardous materials shipments by weight but 27.6 percent of ton-miles.

Flammable liquids, especially gasoline, are the predominant hazardous materials transported

in the United States, accounting for 86.4 percent by value, 85.4 percent by weight, and 66.5 percent by ton-miles. The next largest class of hazardous materials, in terms of ton-miles, is corrosive material at 12.3 percent, followed by gases at about 10.8 percent.

### International Trade and Transportation

The value of total U.S.-international merchandise trade increased from nearly \$2.4 trillion in 2000 to approximately \$3.2 trillion in 2016—a 37.6 percent inflation-adjusted increase (in 2009 dollars) [USDOC Census FTD 2017]. Five of the top 10 U.S. trading partners were Asian countries in 2016. Trade value with China grew the fastest, from 5.8 percent of the total value of U.S. merchandise trade in 2000 to 15.9 percent in 2016. In 2000

**TABLE 3-4 Hazardous Materials Shipments by Transportation Mode: 2007 and 2012**

Transportation mode	Value (\$ billions)		Tons (millions)		Ton-miles <sup>1</sup>		Average distance per shipment (miles)	
	2007	2012	2007	2012	2007	2012	2007	2012
<b>All modes, total</b>	<b>1,448.2</b>	<b>2,334.4</b>	<b>2,231.1</b>	<b>2,580.2</b>	<b>323.5</b>	<b>307.5</b>	<b>96</b>	<b>114</b>
<b>Single modes, total</b>	<b>1,370.6</b>	<b>2,304.7</b>	<b>2,111.6</b>	<b>2,552.9</b>	<b>279.1</b>	<b>275.6</b>	<b>65</b>	<b>68</b>
Truck <sup>2</sup>	837.1	1,466.0	1,202.8	1,531.4	104.0	96.6	59	56
For-hire	358.8	870.9	495.1	882.3	63.3	62.0	214	150
Private	478.3	595.1	707.7	649.1	40.7	34.5	32	33
Rail	69.2	79.2	129.7	111.0	92.2	84.9	578	808
Water	69.2	217.8	149.8	283.6	37.1	54.9	383	212
Air	1.7	4.4	S	Z	S	Z	1,095	1,120
Pipeline <sup>3</sup>	393.4	537.3	628.9	626.7	S	S	S	S
<b>Multiple modes, total</b>	<b>71.1</b>	<b>29.7</b>	<b>111.0</b>	<b>27.3</b>	<b>42.9</b>	<b>31.9</b>	<b>834</b>	<b>654</b>
Truck and rail	7.1	13.3	11.7	17.0	10.1	16.6	779	954
Truck and water	23.5	S	36.6	S	12.4	S	1010	1,181
Rail and water	5.2	2.5	5.7	4.6	2.9	1.4	1,506	S
Parcel, U.S. Postal Service, or courier	7.7	10.3	0.2	0.3	0.2	0.2	836	650
Other multiple modes	27.7	0.0	56.8	0.0	17.3	0.0	233	0
<b>Other modes</b>	<b>6.5</b>	<b>0.0</b>	<b>8.5</b>	<b>0.0</b>	<b>1.5</b>	<b>0.0</b>	<b>58</b>	<b>0</b>

**KEY:** S = data are not published because estimate did not meet publication standards. By far, the most common reason for suppressing a cell is a high coefficient of variation (greater than 50 percent); Z = rounds to zero.

<sup>1</sup> Ton-miles estimates are based on estimated distances traveled along a modeled transportation network.

<sup>2</sup> Truck as a single mode includes shipments that went by private truck only or by for-hire truck only.

<sup>3</sup> Excludes crude petroleum shipments.

**NOTES:** Value-of-shipment estimates have not been adjusted for price changes. Numbers and percentages may not add to totals due to rounding.

**SOURCE:** U.S. Department of Transportation, Bureau of Transportation Statistics and U.S. Department of Commerce, Census Bureau, *2012 Commodity Flow Survey, Hazardous Materials* (Washington, DC: February 2015), table 1b, available at [www.bts.gov/publications/commodity\\_flow\\_survey/](http://www.bts.gov/publications/commodity_flow_survey/) as of November 2017

China ranked fourth among U.S. trading partners. Today it is the leading U.S. trade partner by value, followed by Canada, Mexico, Japan, and Germany, respectively, rounding out the top five [USDOC ITA].

In 2016 vessels carried nearly \$1.5 trillion in imports to and exports from the United States [USDOC Census FTD 2017]. Container ports provide a link between the global and domestic freight network, utilizing intermodal barge, truck, and rail connections to transport containers filled with consumer

goods to their final destinations. U.S. retailers are increasingly dependent on the U.S. transportation system. Particularly, those that build up their inventories in October in anticipation of holiday sales in November and December [CHAMBERS 2012].

### ***U.S. – North American Freight Transportation***

North American trade partners—Canada and Mexico—accounted for 29.3 percent (nearly \$1.07 trillion) of the value of U.S.-international merchandise trade in 2016. Over the 2000 to 2016 period, combined trade (adjusted for



inflation) with Canada and Mexico increased 16.9 percent<sup>5</sup> [USDOC Census FTD 2017]. However, from 2015 to 2016, the value of cross-border freight declined by 3.4 percent in current dollars, largely due to a sharp drop in crude oil and petroleum product prices. However, crude oil prices began to rise during 2016, so an increase in the value of trade with Canada and Mexico in 2017 is likely [USDOT BTS 2017b].

Trucks carried 26.8 percent of the tonnage and 65.5 percent of the value of U.S. merchandise trade with Canada and Mexico, while rail carried 18.2 percent of the tonnage and 15.5 percent of the value in 2016 (table 3-5).

Vehicles and parts (other than railway vehicles and parts) was the top commodity category

<sup>5</sup> The percent increase was calculated by adjusting the 2000 trade data using the CPI Inflation Calculator.

transported between the United States and Canada. Truck and rail transported nearly all of these, carrying \$59.8 and \$43.7 billion respectively in 2016 (table 3-6). On the U.S. – Mexico border, electrical machinery was the top commodity with \$94.0 billion hauled by truck alone. Electrical machinery is a relatively high value commodity group and was also the top commodity moved by air between the United States and both Canada and Mexico. Pipelines are used almost exclusively to move mineral fuels and transported \$45.4 billion between the United States and Canada. Mineral fuels was also the top product moved by vessel between the United States and both Canada and Mexico.

Michigan, which accounts for 13.0 percent of the U.S.-Canada border mileage, was the leading state for freight trade with Canada, amounting to \$71.8 billion or 13.2 percent of

**TABLE 3-5 Value and Tonnage of U.S. Merchandise Trade with Canada and Mexico: 2000, 2010, 2015, and 2016**

(billions of current U.S. dollars and millions of short tons)

Mode	2000		2010		2015		2016	
	Value	Weight	Value	Weight	Value	Weight	Value	Weight
Truck <sup>1</sup>	429	NA	560	176	712	199	700	205
Rail <sup>1</sup>	94	NA	131	114	165	142	166	139
Air	45	<1	45	<1	43	<1	42	<1
Water	33	194	81	210	73	219	58	194
Pipeline <sup>1</sup>	24	NA	65	107	57	180	50	203
Other <sup>1</sup>	29	NA	37	8	56	38	54	24
<b>Total<sup>1</sup></b>	<b>653</b>	<b>NA</b>	<b>921</b>	<b>614</b>	<b>1,106</b>	<b>778</b>	<b>1,069</b>	<b>766</b>

KEY: NA = not available.

<sup>1</sup> The U.S. Department of Transportation, Bureau of Transportation Statistics estimated the weight of exports for truck, rail, pipeline, and other using weight-to-value ratios derived from imported commodities.

**NOTES:** Numbers may not add to totals due to rounding. 1 short ton = 2,000 pounds. "Other" includes shipments transported by mail, other and unknown modes, and shipments through Foreign Trade Zones. Totals for the most recent year differ slightly from the Freight Analysis Framework (FAF) due to variations in coverage and FAF conversion of values to constant dollars. Source for year 2000 Air & Water data is U.S. Department of Commerce, U.S. Census Bureau, Foreign Trade Division, *FT920 - U.S. Merchandise Trade Selected Highlights* (Washington, DC: December 2000).

**SOURCE:** U.S. Department of Transportation, Bureau of Transportation Statistics, TransBorder Freight Data, available at [www.bts.gov/transborder](http://www.bts.gov/transborder) as of April 2017.

**TABLE 3-6 Value of Top 3 U.S. - Canada and U.S. - Mexico Commodities Moved by Mode: 2016**

(billions of dollars)

U.S. - Canada		Mode	U.S. - Mexico	
Vehicles and Parts (Other than railway)	59.8	<b>Truck</b>	Electrical Machinery; Equipment and Parts	94.0
Computer-Related Machinery and Parts	50.2		Computer-Related Machinery and Parts	79.2
Electrical Machinery; Equipment and Parts	23.1		Vehicles and Parts (Other than railway)	44.7
All Other	194.2		All Other	154.8
Vehicles and Parts (Other than railway)	43.7	<b>Rail</b>	Vehicles and Parts (Other than railway)	43.7
Plastics and Articles	6.3		Computer-Related Machinery and Parts	8.8
Wood and Articles	5.7		Plastics and Articles	3.0
All Other	32.7		All Other	21.7
Mineral Fuels; Oils and Waxes	45.4	<b>Pipeline</b>	Mineral Fuels; Oils and Waxes	3.9
Organic Chemicals	0.2		Organic Chemicals	-
All Other	0.1		All Other	0.0
Electrical Machinery; Equipment and Parts	5.0	<b>Air</b>	Electrical Machinery; Equipment and Parts	5.3
Computer-Related Machinery and Parts	4.7		Pearls; Stones; Metals and Imitation Jewelry	2.5
Measuring and Testing Instruments	3.7		Computer-Related Machinery and Parts	2.2
All Other	12.7		All Other	5.6
Mineral Fuels; Oils and Waxes	13.6	<b>Vessel</b>	Mineral Fuels; Oils and Waxes	22.4
Aluminum and Articles	0.8		Vehicles and Parts (Other than railway)	6.2
Ores; Slag and Ash	0.8		Organic Chemicals	3.3
All Other	2.7		All Other	8.5
Special Classification Provisions	6.3	<b>Other &amp; unknown</b>	Special Classification Provisions	6.6
Aircraft; Spacecraft and Parts	5.6		Special Trade Transactions	2.4
Mineral Fuels; Oils and Waxes	3.6		Vehicles and Parts (Other than railway)	1.5
All Other	23.1		All Other	4.7

**NOTES:** Other and unknown modes include, mail; Foreign Trade Zones; powerhouse (electricity); vessels and flyaway aircraft moving under their own power; pedestrians carrying freight; unknown; and miscellaneous other.

**SOURCE:** U.S. Department of Transportation, Bureau of Transportation Statistics, TransBorder Freight Data, available at [www.bts.gov/transborder](http://www.bts.gov/transborder) as of November 2017.

total U.S. trade with Canada in 2016. Michigan has border crossing/entry ports between Detroit, Port Huron, and Sault Ste. Marie and southern Ontario; both Michigan and Ontario have a high concentration of automakers [USDOT BTS 2017b].

Texas, which accounts for 64.2 percent of the U.S.-Mexico border mileage and is home to 11 border crossing/ports-of-entry, led all other states in surface freight with Mexico [USDOT BTS 2017b]. (In total, there are 85 ports-of-

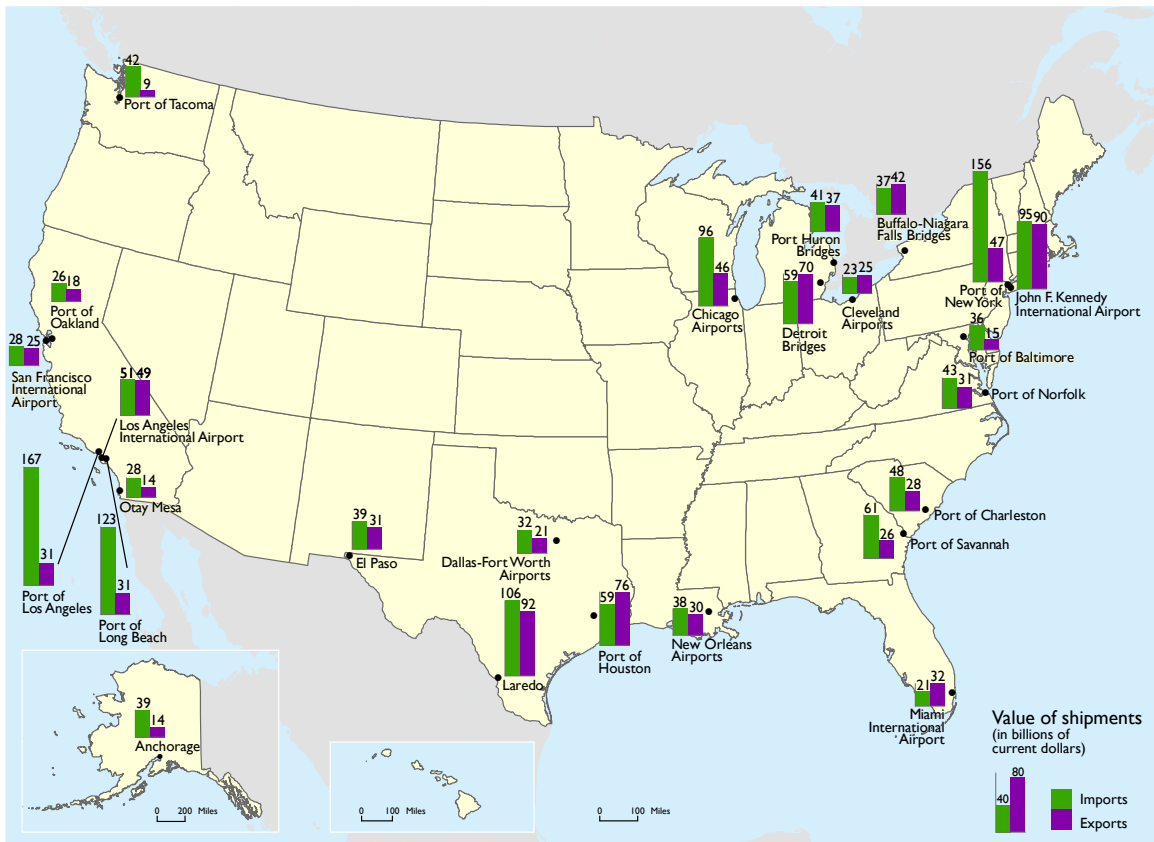
entry along the U.S.-Canada border and 25 on the U.S.-Mexico border.) In 2016 Texas freight trade with Mexico amounted to \$173.7 billion, or 33.1 percent of total U.S. trade with Mexico. Electrical machinery, including equipment and parts, was the top commodity category transported between the United States and Mexico, followed by vehicles and parts (other than railway vehicles and parts). Trucks were the primary mode for transporting both electrical machinery and vehicles in 2016 [USDOT BTS 2017b].

### Freight Transportation Gateways

A large volume of U.S.-international merchandise trade passes through a relatively small number of freight gateways—the entry and exit points for trade between the United States and other countries. According to the U.S. Census Bureau, there are 480 ports of entry, including airports, border crossings, and seaports, that handle international cargo

[USDOC Census FTD 2017]. The latest available data show that in 2015, the top 25 gateways in terms of value handled the greatest share of U.S. international merchandise trade (figure 3-5)—\$2.4 trillion in current dollars or 64.8 percent of the more than \$3.7 trillion in current dollars of total U.S.-international merchandise trade. Twenty of the top 25 gateways handled more imports than exports in 2015, compared to 18 in 2014.

**FIGURE 3-5 Top U.S.-International Freight Gateways by Value of Shipments: 2015**



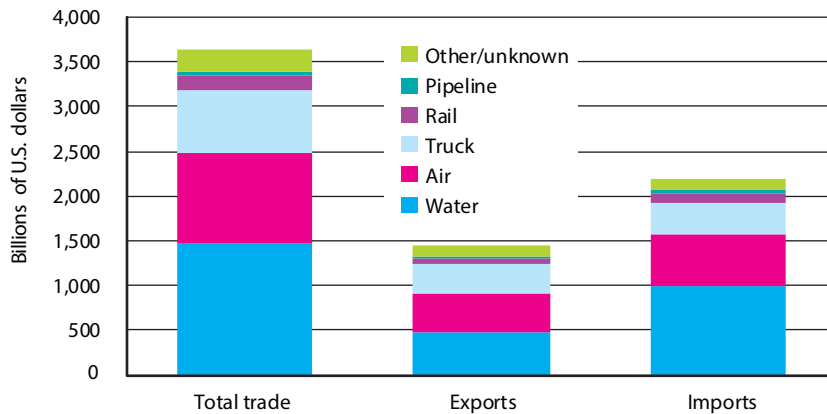
**NOTES:** All data: Flows through individual ports are based on reported data collected from U.S. trade documents and does not include low-value shipments (In general, these are imports valued at less than \$1,250 and exports that are valued at less than \$2,500). Numbers may not add to totals due to rounding. Air: Data for all air gateways are reported at the port level and include a low level (generally less than 2%-3% of the total value) of small user-fee airports located in the same region. Air gateways not identified by airport name (e.g., Chicago, IL and others) include major airport(s) in that geographic area in addition to small regional airports. In addition, due to U.S. Census Bureau confidentiality regulations, data for courier operations are included in the airport totals for JFK International Airport, Chicago, Los Angeles, Miami, New Orleans, Anchorage, and Cleveland.

**SOURCES:** Air: U.S. Department of Commerce, U.S. Census Bureau, Foreign Trade Division, USA Trade Online, November 2017. Land: U.S. Department of Transportation, Bureau of Transportation Statistics, North American TransBorder Freight Data, available at [www.bts.gov/transborder/](http://www.bts.gov/transborder/) as of November 2017. Water: U.S. Army Corps of Engineers, Navigation Data Center, special tabulation, November 2017.

Water is the leading transportation mode for U.S.-international trade both in terms of weight and value. Ships moved 40.5 percent of trade value (figure 3-6a) and more than 71.7 percent of trade weight (figure 3-6b) in 2016. By value, the Port of New York on the Atlantic Coast

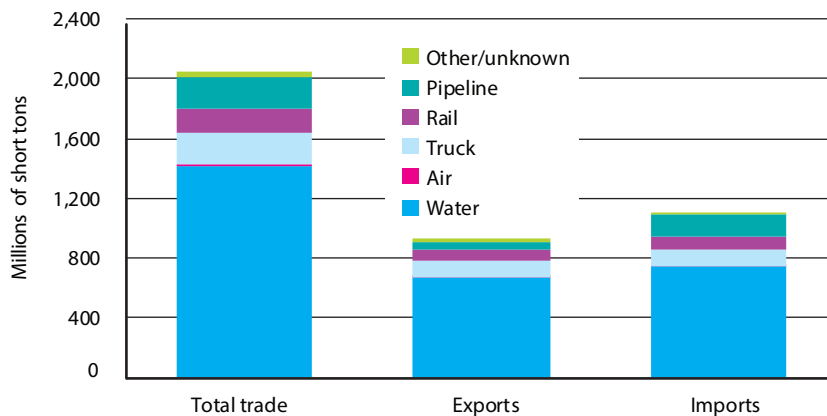
was the leading U.S. water gateway, handling more than \$202.6 billion in trade, while on the Pacific coast, the Port of Los Angeles was the second leading water gateway, handling more than \$198.4 billion in cargo, also mostly imports (figure 3-5).

**FIGURE 3-6a U.S.-International Merchandise Trade Value by Transportation Mode: 2016**



**NOTES:** Totals for 2016 differ slightly from the Freight Analysis Framework (FAF) due to variations in coverage. Numbers may not add to totals due to rounding.  
**SOURCES:** Total, water and air data: U.S. Department of Commerce, U.S. Census Bureau, Foreign Trade Division, *FT920 - U.S. Merchandise Trade: Selected Highlights* (Washington, DC: February 2017). Truck, rail, pipeline, and other and unknown data: U.S. Department of Transportation, Bureau of Transportation Statistics, North American TransBorder Freight Data, available at [www.bts.gov/transborder/](http://www.bts.gov/transborder/) as of May 2017.

**FIGURE 3-6b U.S.-International Merchandise Trade Weight by Transportation Mode: 2016**



**NOTES:** Totals for 2016 differ slightly from the Freight Analysis Framework (FAF) due to variations in coverage. Numbers may not add to totals due to rounding.  
**SOURCES:** Total, water and air data: U.S. Department of Commerce, U.S. Census Bureau, Foreign Trade Division, *FT920 - U.S. Merchandise Trade: Selected Highlights* (Washington, DC: February 2017). Truck, rail, pipeline, and other and unknown data: U.S. Department of Transportation, Bureau of Transportation Statistics, North American TransBorder Freight Data, available at [www.bts.gov/transborder/](http://www.bts.gov/transborder/) as of May 2017.



Air handles less than one-half of one percent of trade weight but 27.5 percent of trade value, due to its focus on high-value, time-sensitive, and perishable commodities. In 2015 John F. Kennedy International airport was the top U.S.-international air gateway by value, handling \$185.5 billion in exports and imports, followed by Chicago area airports (\$141.8 billion) and Los Angeles International (\$99.9 billion) (figure 3-5). By freight tonnage, Memphis International, TN; Ted Stevens Anchorage International, AK; and Louisville International, KY; were the top U.S.-international air gateways, handling about 11.4 million, 8.6 million, and 6.0 million short tons of cargo, respectively, in 2015 [USDOT FAA].

Trucks haul a significant share of imports and exports between the United States and its second and third largest trading partners, Canada and Mexico. In 2016 this resulted in trucks carrying 19.2 percent of the value of total U.S.-international trade (figure 3-6a) and 10.0 percent of the tonnage (figure 3-6b). Laredo, TX, is the top land-border crossing, handling \$198.0 billion in trade between the United States and Mexico, while Detroit, MI, ranked second with \$129.2 billion (figure 3-7).

Trade growth with Canada and Mexico and the tapping of natural resources, such as oil from the Bakken formation, generates increased north-south traffic flows on a domestic transportation infrastructure that was initially developed along east-west corridors during the westward development of the United States.

### ***Waterborne Freight Transportation***

The number of container vessels calling at U.S. ports has increased in recent years. Between

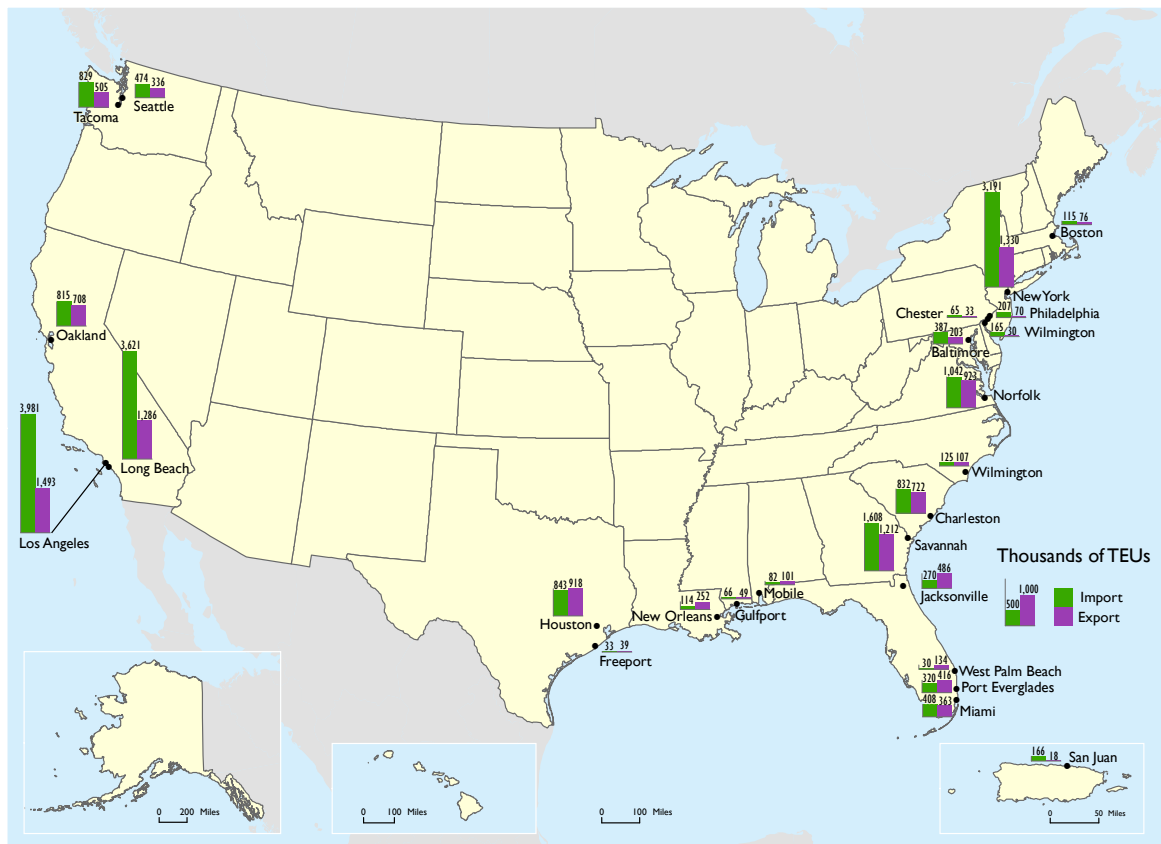
2013 and 2015, vessel calls at U.S. seaports increased by 11.0 percent, from 74,000 in 2013 to 82,000 in 2015, while the tonnage of U.S.-international merchandise trade increased by 0.6 percent. The average displacement of container vessels continued to increase, from 52,421 deadweight tons (dwt) in 2013 to 57,458 dwt in 2015, a 10-percent increase. In 2015 tankers accounted for 40.4 percent of the vessel calls, followed by containerships with 22.8 percent of the more than 82,000 vessel calls [USDOT MARAD 2016a].

In 2015 U.S. seaports handled approximately 32.0 million twenty-foot equivalent units (TEU) of containerized cargo, which is 12.0 percent more than reported in 2010 [USDOT MARAD 2016b]. The ports of Los Angeles and Long Beach on the Pacific coast and the port of New York and New Jersey on the Atlantic coast are the leading container ports. As shown in figure 3-7, container ports are more concentrated along the Pacific and Atlantic coasts.

Bulk cargo, such as coal, crude petroleum, and grain moves predominantly through ports on the Gulf coast and inland waterway system (figure 3-8). The top 25 water ports by tonnage handled 69.1 percent of the weight of all domestic and foreign goods moved by water in 2015. The Port of South Louisiana was the top water gateway by weight, handling 259.1 million short tons, followed by the Port of Houston, moving 240.9 million short tons [USACE WCSC 2017]. A considerable portion of the tonnage moved through these two ports included crude oil and petrochemicals.

U.S.-international trade has had a major impact on all U.S. borders and coasts (figure

**FIGURE 3-7 Top 25 Water Ports by TEU: 2015**



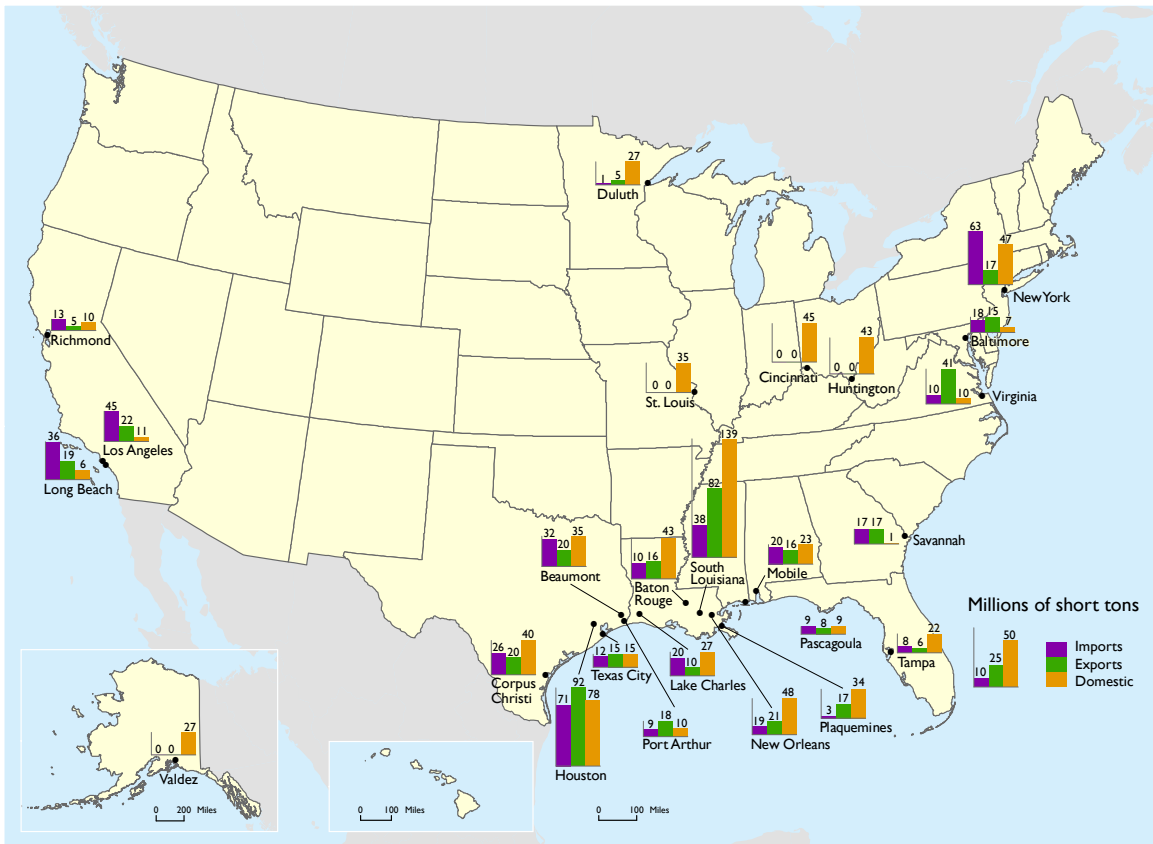
**KEY:** TEU = Twenty-Foot Equivalent Unit.

**SOURCE:** U.S. Department of Transportation, Maritime Administration, *U.S. Waterborne Container Trade by U.S. Custom Ports*, available at [www.marad.dot.gov/resources/data-statistics/](http://www.marad.dot.gov/resources/data-statistics/) as of November 2017.

3-9). For example, an increase in trade with China has resulted in a large share of goods moving through Pacific coast ports. The trend toward larger containerships has led to a concentration of liner service at certain ports, specifically terminals that can accommodate larger containerships due to ample overhead clearance, a deep water draft, and intermodal connections, such as double stack rail. The newly expanded Panama Canal allows larger

vessels, carrying up to 13,000 TEU, to transit between the Atlantic and Pacific Oceans. Ports and airports on the Atlantic coast continued to account for the largest share in terms of trade value. Although the top ports for containerized cargo are primarily on the Pacific and Atlantic coasts, a significant volume of bulk cargo, such as coal, crude petroleum, and grain, moves through ports on the Gulf coast and inland waterway system.

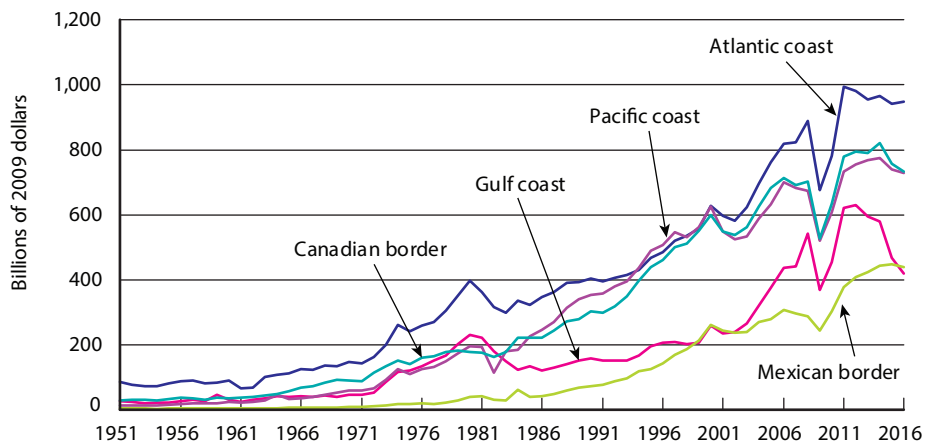
**FIGURE 3-8 Top 25 Water Ports by Tonnage: 2015**



SOURCE: U.S. Army Corps of Engineers, Waterborne Commerce Statistics Center, *Tonnage for Selected Ports in 2015*, available at <http://www.navigationdatacenter.us/> as of November 2017.



**FIGURE 3-9 Value of U.S. International Merchandise Trade by Coasts and Borders: 1951–2016**



**NOTE:** The value of coal shipments through Mobile, AL, are considered proprietary information and are consolidated with ports included under the Atlantic Coast Customs District.

**SOURCES:** 1951-1970: U.S. Department of Commerce, Census Bureau, *Historical Statistics of the United States, Colonial Times to 1970, Bicentennial Edition* (Washington, DC: 1975); 1971-1999: U.S. Department of Commerce, Census Bureau, *Statistical Abstract of the United States* (Washington, DC: annual issues); 2000-2016: U.S. Department of Commerce, Census Bureau, Foreign Trade Division, *FT920 - U.S. Merchandise Trade: Selected Highlights* (Washington, DC: annual issues). **Implicit GDP Deflator:** U.S. Department of Commerce, Bureau of Economic Analysis, *Current-Dollar and Real Gross Domestic Product*, available at [www.bea.gov](http://www.bea.gov) as of April 2017.

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