2 Transportation's Contribution to the Economy

Key Takeaways

- When measured by value-added to gross domestic product (GDP), transportation services contributed $1,066.9 billion, or 5.6 percent, to U.S. GDP in 2016. Specifically, for-hire transportation services contributed $562.4 billion (3.0 percent), in-house transportation contributed $172.3 billion (0.9 percent), and household transportation contributed $332.2 billion (1.8 percent).
- Transportation's contribution to the economy also can be measured as the share of all expenditures on transportation-related final goods and services (known as the final demand for transportation). In this perspective, transportation contributed $1,489.7 billion, or 8.9 percent, to U.S. GDP.
- Transportation-related final demand fell 15.6 percent during the 2007 to 2009 recession, effectively erasing 10 years of growth. It recovered in 2014 when final demand rose above the pre-recession high and then grew slowly (0.2 percent) from 2015 to 2016 (latest available data). The slow growth between 2015 and 2016 resulted from a 7.3 percent decline in private investment — the first year of decline in private investment since steadily rising from the 2009 low.
- Transportation indirectly contributes to the economy by enabling the production of goods and services. In 2016 wholesale and retail trade used the most transportation services at $277.9 billion and required 9.0 cents of transportation services to produce one dollar of output.

Introduction

Transportation's contribution to the economy can be measured by its contribution to gross domestic product (GDP).[1] GDP is an economic measure of all goods and services produced and consumed in the country. GDP can be measured from three different approaches: (1) expenditure, (2) production (known as value-added), and (3) income.[2] With regards to transportation, the expenditure approach identifies the final (finished) transportation goods and services purchased by persons, businesses, governments, and foreigners. The production (value-added) approach measures the contribution of transportation services to the economy. Finally, the income approach measures the contribution of transportation services produced by transportation industries to the economy.

The Bureau of Economic Analysis' (BEA's) national income and product accounts and the Bureau of Transportation Statistics' (BTS') Transportation Satellite Accounts (TSAs) are used to measure transportation's contribution to GDP using the first two approaches:

- the share of all expenditures (by households, private firms, the government, and foreigners) on transportation-related final goods and services (collectively known as the final demand for transportation), and
- the contribution of transportation services produced by transportation industries (known as value-added by transportation industries) to GDP.

The expenditure approach captures the contribution of transportation services as well

[1] Unless otherwise noted, GDP refers to the U.S. GDP.

[2] For a more detailed explanation, also see *Measuring the Economy: A Primer on GDP and the National Income and Product Accounts*, U.S. Department of Commerce, Bureau of Economic Analysis, December 2015. Available at: https://www.bea.gov/sites/default/files/methodologies/nipa_primer.pdf as of September 2018.

as transportation-related goods, such as motor vehicles and fuels used for transportation. In contrast, the production (value-added) approach captures only the contribution of transportation industries to GDP, because data exist for only the total value-added by an industry, i.e., for all output. With regards to the income approach, data are not detailed enough to measure the contribution of transportation to GDP.

This chapter explains and highlights trends in the final demand for transportation and the value-added by transportation industries.

Transportation-Related Final Demand

Transportation-related final demand (box 2-1) is a measure of the expenditures by households, private firms, and the government on final goods and services related to transportation. This measure includes (see box 2-1):

- personal consumption expenditures on transportation-related goods and services (motor vehicles and parts; motor vehicle fuels, lubricants, and fluids; and transportation services);
- private domestic investment in transportation structures and equipment;
- government purchases of transportation goods and services;
- net exports (exports minus imports) of transportation goods and services (e.g., motor vehicles and freight charges for moving goods from and to the United States); and

Box 2-1 National Income Account Terminology

The national income and product accounts use several related terms when discussing the size of the economy and sectors within the economy, such as transportation.

What is Gross Domestic Product (GDP) and Gross Domestic Demand (GDD)?

- GDP is the sum of the value of all goods and services produced in the economy. It can be measured from 3 perspectives:
  - Expenditure approach: Sum of personal consumption, investment, government expenditures, and exports less imports.
  - Production (value-added) approach: Total industry output (sales and other operating income) less the cost of inputs used in production. Alternatively, the sum of employee compensation, taxes on production and imports less subsidies, and gross operating surplus.
  - Income approach: Income earned by households (wages, health retirement benefits, interest income, etc.) and firms (profits including royalties from intellectual property rights, etc.)
- GDD is like GDP but excludes net exports, thereby showing only domestic demand.

What are transportation-related final demand, transportation value-added, and income attributed to transportation?

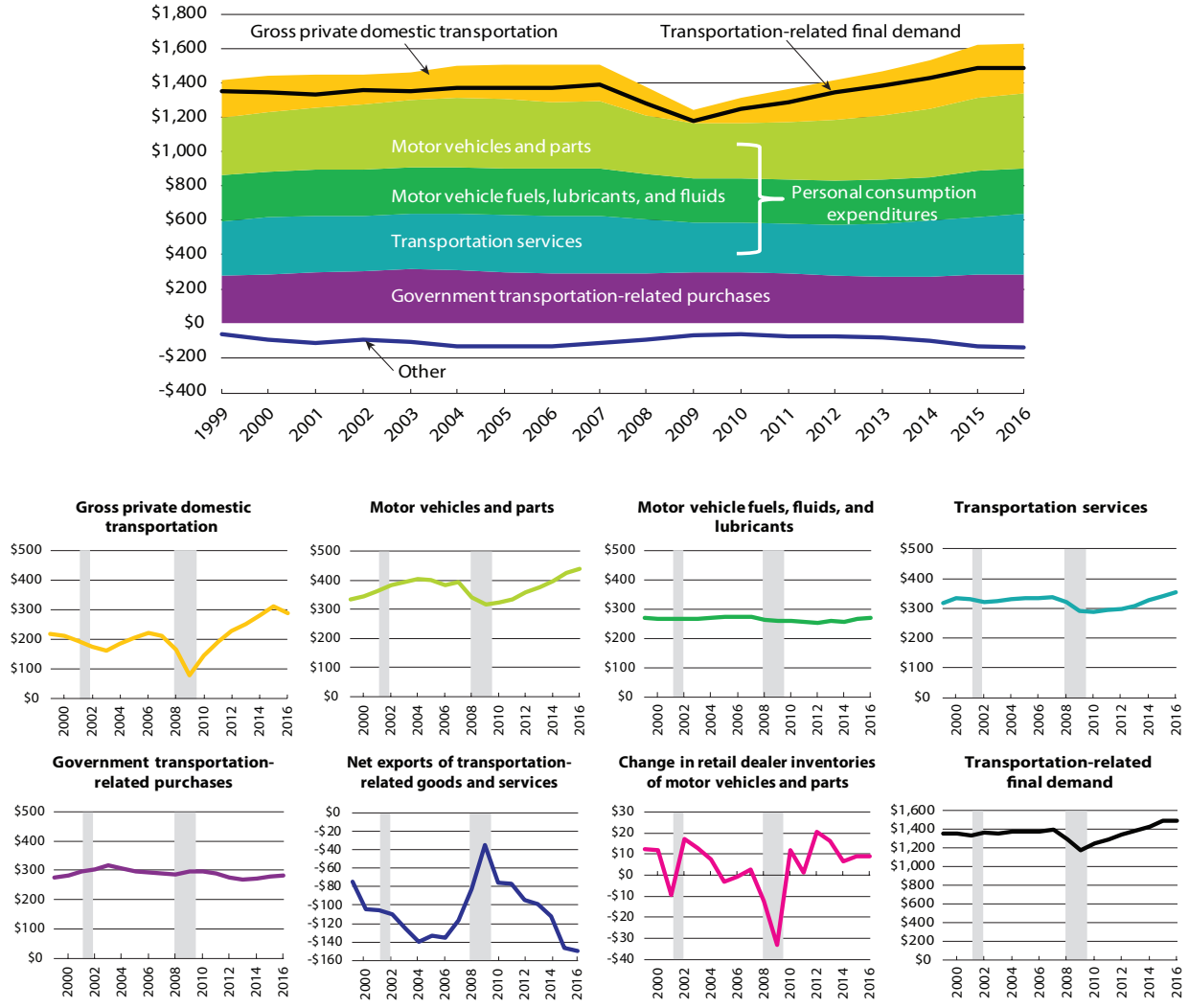
- *Transportation-Related Final Demand* measures the contribution of transportation services to the economy using the expenditure approach. It is the sum of:
  - personal consumption expenditures on transportation-related goods and services (motor vehicles and parts; motor vehicle fuels, lubricants, and fluids; and transportation services);
  - private domestic investment in transportation structures and equipment;
  - government purchases of transportation goods and services;
  - net exports (exports minus imports) related to transportation goods and services; and
  - change in retailers' inventories of motor vehicles and parts.
- *Transportation Value-Added* measures the contribution of transportation services to the economy using the production (value-added) approach. It equals sales, or receipts, and other operating income from transportation services (gross output) less the goods and services used in production (intermediate inputs). Data in this chapter are total value-added.
- *Income attributed to transportation* measures the income generated from the production of transportation goods and services. Data are not available in sufficient detail to measure the contribution of transportation to the economy using this approach.

- change in retailer dealers' inventories of finished goods, such as motor vehicles and parts.

In 2016 the demand for transportation ($1,489.7 billion) accounted for 8.9 percent of U.S. GDP (as measured in chained 2009 dollars) (figure 2-1). The demand included:

- personal consumption expenditures of transportation, such as vehicle and motor fuel purchases ($1,059.5 billion, or 71.1 percent of transportation-related final demand);
- private domestic investment in transportation structures and equipment ($289.0 billion, or 19.4 percent);
- government purchases of transportation goods and services ($282.3 billion, or 19.0 percent);

Figure 2-1 GDP Components of Transportation-Related Final Demand, 1999–2016 (billions, chained 2009 dollars)



NOTES: "Other" is the sum of the change in retail dealer inventories of motor vehicles and parts and net exports of transportation-related goods and services. 2016 data are latest available. Shaded areas indicate economic recessions.

SOURCES: U.S. Department of Commerce, Bureau of Economic Analysis, National Income and Product Accounts Tables, tables 1.1.6, 2.4.6, 3.11.6, 3.15.6, 4.2.6, 5.4.6, 5.5.6 and 5.7.6B, available at https://www.bea.gov/iTable/index_nipa.cfm as of June 2018.

- net exports (exports minus imports) related to transportation goods and services (-$149.9 billion, or -10.1 percent); and
- the change in retailers' inventories of motor vehicles and parts ($8.8 billion, or 0.6 percent).

Transportation-related final demand grew from 1999 (first year for which data are available) through 2016 by 10.0 percent (from $1,354.4 to $1,489.7 billion chained 2009 dollars) despite a significant decline during the December 2007 to June 2009 Great Recession (figure 2-1). Transportation-related final demand fell 15.6 percent (from $1,392.6 billion to $1,175.6 billion chained 2009 dollars) during the 2007 to 2009 recession, falling to its lowest level since 1999 in 2009. The sharp decline during that recession effectively erased 10 years of growth in final demand. Transportation-related final demand recovered in 2014 when it rose above the pre-recession high.

The decline in transportation-related final demand during the recession affected private investment and personal consumption expenditures more than other categories. Imports often decrease during economic declines, and in 2009 they decreased to the point that exports of transportation goods and services nearly equaled imports. After 2009 imports rose and, once again, exceeded the value of exports. Government transportation-related purchases peaked in 2003, and then declined steadily to $287.4 billion (in chained 2009 dollars) in 2008. They then rose in 2009 and 2010 as the government increased spending in response to the recession and to declines in private sector investment.

Total transportation-related final demand increased following the recession, surpassing the 2007 peak in 2014 and continued to climb through 2016. However, transportation-related final demand grew only slightly (0.2 percent) from 2015 to 2016. The 0.2 percent growth from 2015 to 2016 marked a sharp contrast to the growth of 2.9 percent or more following the 2007 to 2009 recession. The slow growth between 2015 and 2016 resulted from a 7.3 percent decline in private investment — the first year of decline in private investment since steadily rising from the 2009 low.

Demand for Transportation Compared to Other Goods and Services

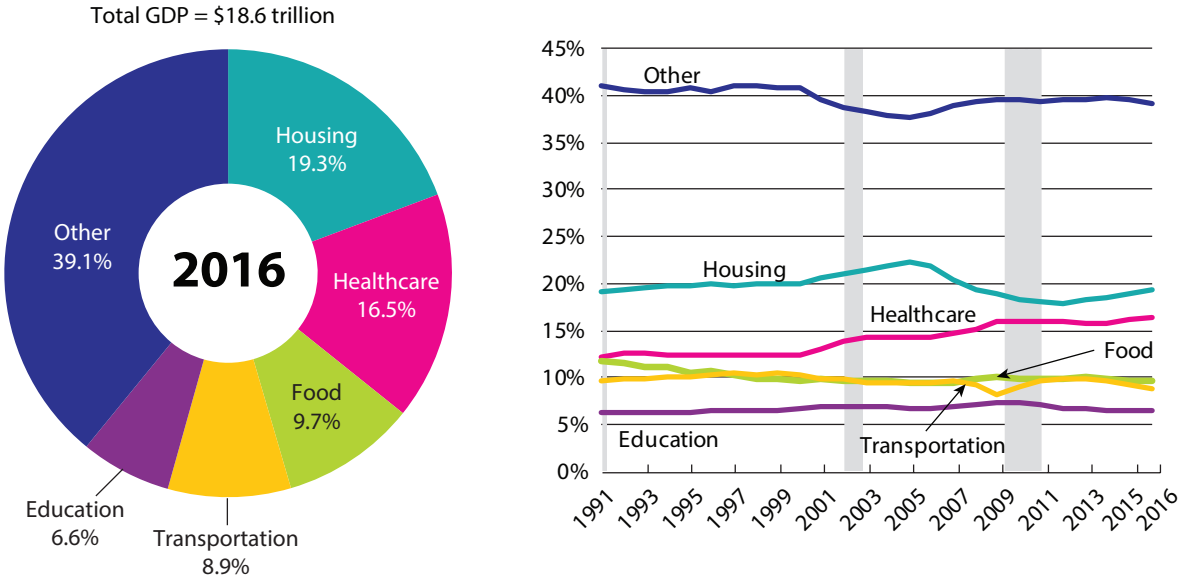
Transportation-related final demand can be compared to the demand for other goods and services, such as housing and healthcare. Figure 2-2 compares transportation-related final demand to the demand for five other categories of goods and services (healthcare, housing, food, education, and all other goods and services).[3] In 2016 transportation continued to be the fourth largest expenditure category, amounting to $1,662 billion, or 8.9 percent, of total U.S. GDP. Housing is the largest expenditure category at 19.3 percent of final demand, slightly more than twice the size of transportation.

The right side of figure 2-2 shows the expenditures for goods and services by category from 1991 to 2016. Transportation-related final demand decreased during the recession from 9.6 percent of total final demand in 2007 to 8.3 percent in 2009, grew from 2009 to 9.8 percent in 2012, and remained at 9.8 percent in 2013. The share of transportation expenditures fell from 2013 to 2016 due to a larger rise in the demand for housing. In absolute dollars, transportation expenditures grew 38.0 percent from 2009 (the lowest level reached during the Great Recession) to 2013 and then by 1.0 percent from 2013 to 2016.

The demand for goods and services does not provide a full picture of the contribution of transportation to the economy. The data allow us to measure demand as expenditures on goods and services. Expenditures may increase due to a greater quantity purchased and/or an increase in the price of the purchased good or service. The two effects cannot be separated to determine the underlying reason for an increase in expenditures

[3] "Other" includes expenditures on entertainment, personal care, and payments to pension plans.

Figure 2-2 Final Demand for Goods and Services by Category, 2016



NOTES: 2016 data are latest available. Shaded areas indicate economic recessions.

SOURCE: U.S. Department of Transportation, Bureau of Transportation Statistics, National Transportation Statistics, table 3-9, available at www.bts.gov.

— whether due to an increase in price for the same amount of goods and services or from an increase in the quantity purchased. Additionally, demand, as measured by expenditures, does not adequately measure the amount needed to support economic activity. For example, if spending on transportation infrastructure falls below the level needed to maintain the system, then the measure underestimates the amount of spending needed.

Contribution of Transportation Services Produced: Value-Added

The production approach, also known as the value-added approach, captures the role of transportation in producing goods and services and the contribution of each industry to the economy as measured by GDP. *Value-added* (box 2-1) is the contribution of an industry to GDP, as measured by total output (i.e., industry revenue) less the cost of inputs, such as fuel and other materials used in production. The value-added by all industries sum to the total GDP. While the previously described method measures how much end users spend on transportation goods and services, the production approach measures the contribution of transportation services produced by transportation industries to the economy. It does not include the contribution of transportation-related goods, such as fuel used for transportation, due to a lack of available data.

For-Hire Transportation Services Produced in the Economy

For-hire transportation services consist of air, rail, truck, passenger and ground transportation, pipeline, and other support services that transportation firms (e.g., transit agencies and common carrier trucking companies) provide to industries and the public on a fee basis. The contribution of for-hire transportation to GDP can be measured using the production, also known as the value-added, approach (box 2-1).

Figure 2-3 shows how much for-hire transportation services and other industries contribute to GDP. Transportation ranks as the 13th largest contributor to GDP among the 18 industries in 2016.

Figure 2-3 Contribution to Gross Domestic Product (GDP) by Industry, 2017

SOURCE: U.S. Department of Commerce, Bureau of Economic Analysis, GDP by Industry table "Real Value-Added by Industry (A) (Q)," available at www.bea.gov/iTable/index_industry_gdpIndy.cfm.

Figure 2-4 shows for-hire transportation services' contribution (value-added) to GDP by transportation industries from 1997 to 2017. In 2017 the three transportation industries with the largest contributions were trucking ($155.5 billion, 0.80 percent of GDP), other transportation and support activities ($129.9 billion, 0.67 percent), and air ($108 billion, 0.56 percent).[4] The transportation industries that grew as a percentage of GDP from 1997 to 2017 include warehousing and storage (from 0.24 to 0.33 percent), pipelines (from 0.08 to 0.15 percent, with peaks of 0.15 percent in 2001 and 2017), water (0.08 to 0.09 percent), and transit and ground passenger (from 0.18 to 0.20 percent). However, the industries with a larger share of GDP decreased, including trucking (from 0.90 to 0.80 percent) and air (from 0.62 to 0.56 percent). Rail contributed the same percent in 2017 as in 1997 (0.23 percent), a slight decline from its peak contribution of 0.27 percent in 2014.

Production of For-Hire Transportation Services by State

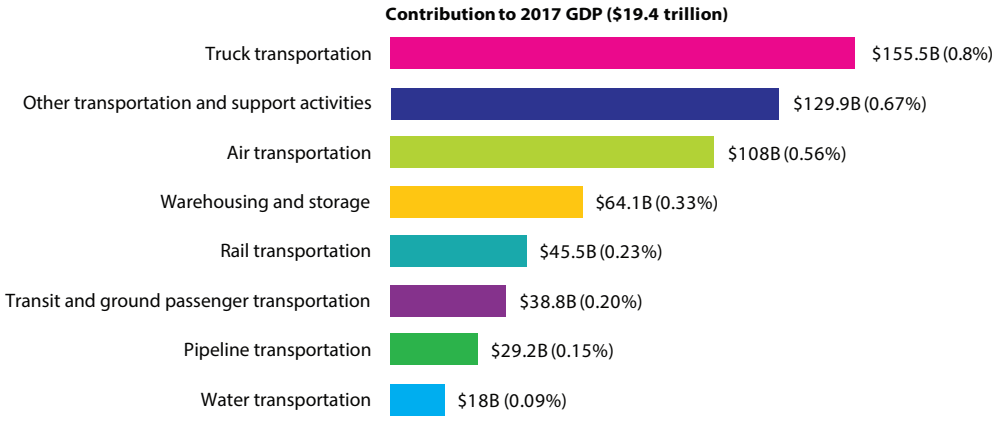
The amount produced by the for-hire transportation industry and its contribution to a state GDP depends on the state's geography, population density, mix of industries, and location of transportation hubs. For example, Nebraska has a major national rail hub in Omaha, and the third-highest percentage of GDP from transportation and warehousing of any state in the country (7.2 percent of Nebraska's GDP in 2017). States with larger total GDPs, such as California ($2.7 trillion) and Texas ($1.70 trillion), also have large transportation and warehousing activities—$69.2 and $60.0 billion, respectively. Because other economic activities are larger in California and Texas, transportation and warehousing services represent a small share of their total GDP (figure 2-5).

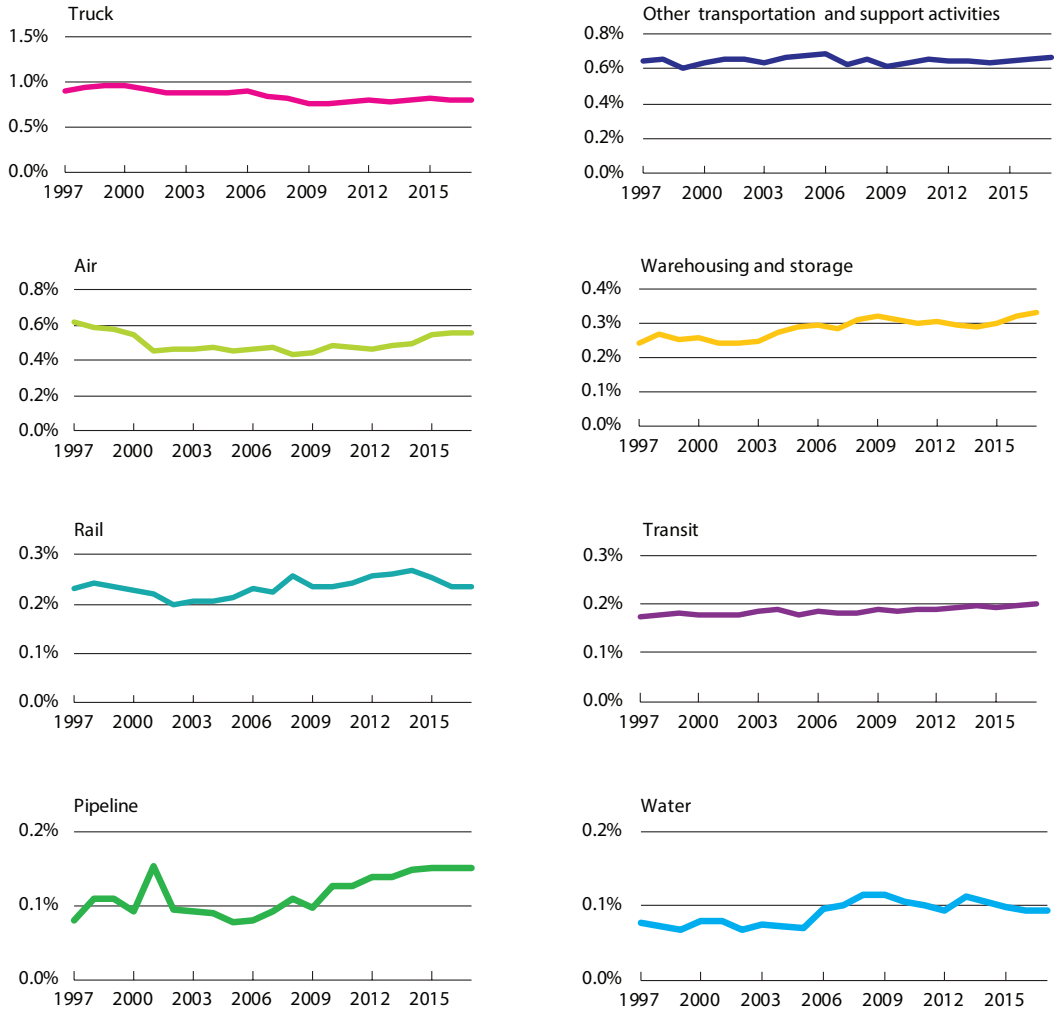
In-house Transportation and Household Services Produced in the Economy

Measuring only for-hire transportation services understates the transportation component of GDP. Many industries produce transportation services for their own use and these services, with few exceptions, are not included in for-hire measure. The transportation services produced by non-transportation industries for their own use are known as in-house transportation, for instance, a grocery chains operating its own truck fleet to move food from distribution centers to stores.

[4] Other transportation and support activities includes scenic and sightseeing transportation and support activities for transportation and couriers and messengers.

Figure 2-4 For-Hire Transportation and Warehousing's Contribution to GDP by Industry (percent)

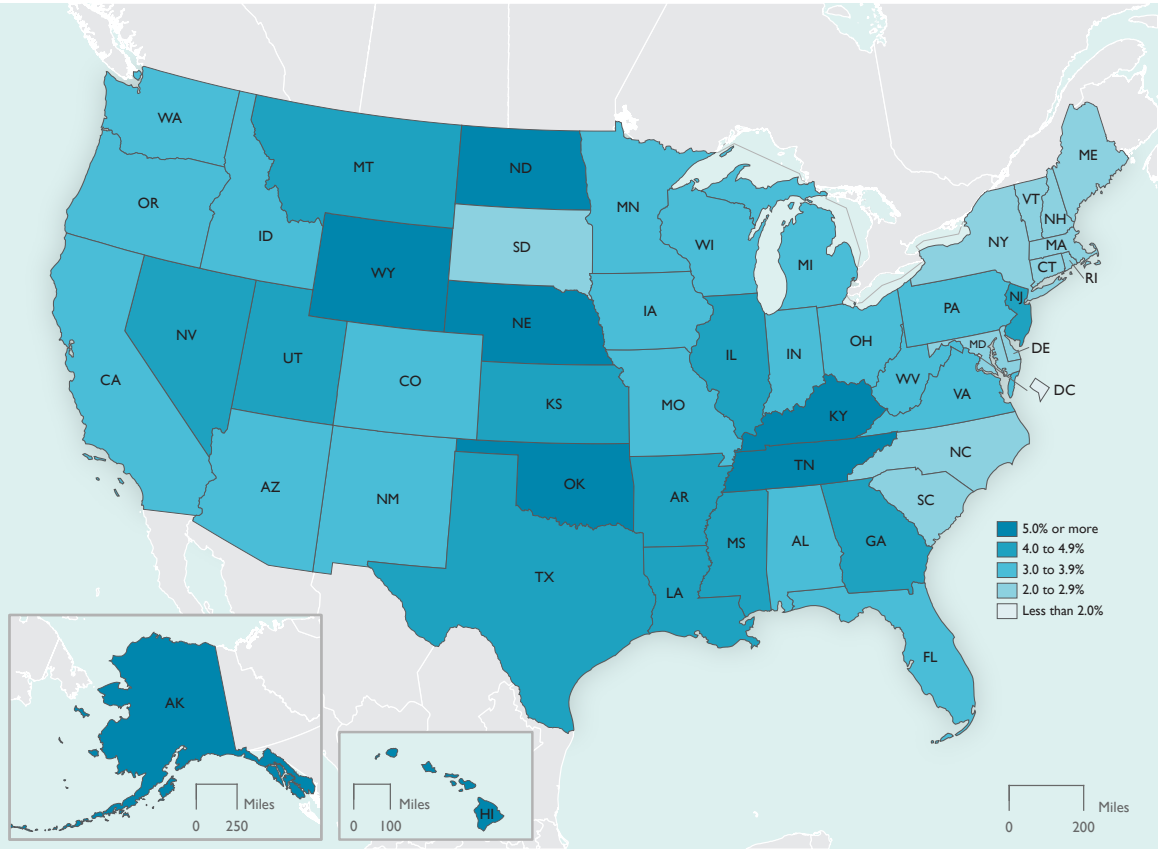




NOTES: Data are from the value-added by industry table of the BEA Industry Economic Accounts. Data for Transportation and Warehousing is Line 40, and for individual modes are in Lines 41 through 48. Current-dollar data appear in *National Transportation Statistics*, table 3-1.

SOURCE: U.S. Department of Commerce, Bureau of Economic Analysis, GDP by Industry, Value-Added by Industry Table (April 19, 2018 release), available at www.bea.gov as of June 2018.

Figure 2-5 State Gross Domestic Product from Transportation and Warehousing as a Percent of State Total Gross Domestic Product, 2016



SOURCE: U.S. Department of Commerce, Bureau of Economic Analysis, "Regional GDP & Personal Income," available at www.bea.gov/iTable/index_regional.cfm.

BTS developed the Transportation Satellite Accounts (TSAs, see box 2-2) to estimate the contribution of in-house transportation services to the economy. The TSAs also show the contribution of transportation carried out by households using household vehicles. The TSAs thereby provide a more comprehensive measure of the size and role of transportation services in the economy than measures that capture only the contribution of for-hire transportation.

In 2016, the latest year for which comprehensive data are available, BTS estimates transportation (for-hire, in-house, and household) services' total GDP contribution at $1,066.9 billion (figure 2-6). The pie chart in figure 2-6 represents total GDP, and the tri-colored slice shows the portion contributed by transportation services based on the TSAs. The colors within the slice show the relative shares of for-hire (3.0 percent), in-house (0.9 percent), and household (1.8 percent) transportation's contribution to the total GDP in 2016. That year for-hire transportation services contributed $562.4 billion (3.0 percent) to a GDP of $19.0 trillion.[5] Transportation services (air, rail, truck, and water) provided by non-transportation industries for their own use contributed an additional $172.3 billion (0.9 percent) to GDP.[6]

[5] The GDP value in the TSAs is larger than the GDP value published in the national income and product accounts because it includes the contribution of household transportation. Household transportation covers transportation provided by households for their own use with household vehicles.

[6] Large retailers, such as Walmart and Target, are captured in for-hire transportation services even though these are actually in-house transportation services provided by a non-transportation industry for their own use.

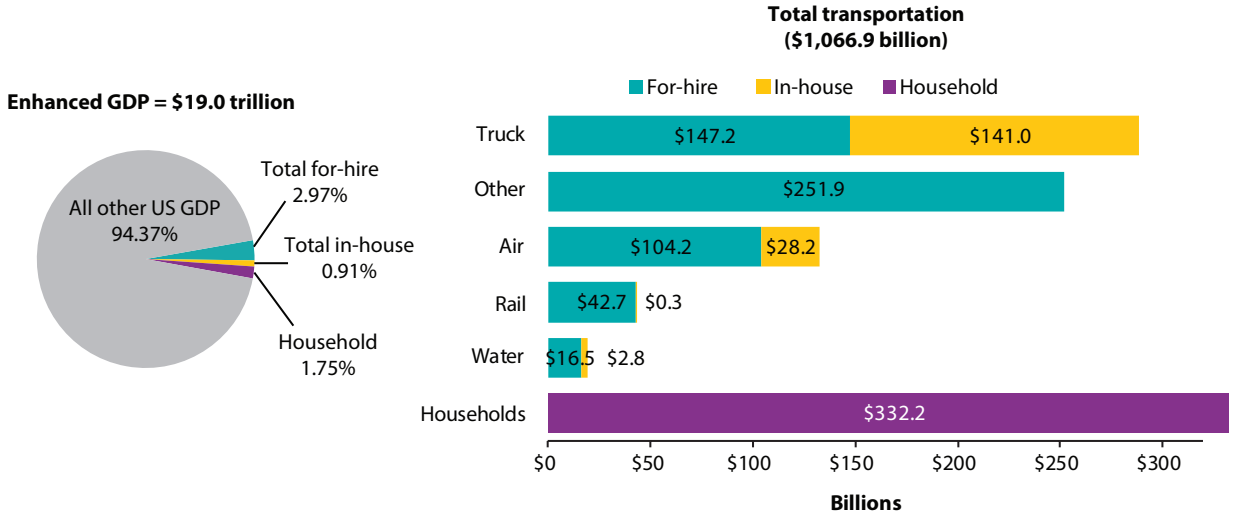
Box 2-2 What are the Transportation Satellite Accounts (TSAs)?

Satellite industry accounts expand on the national income and product accounts and the input-output accounts and supplement these accounts by focusing on one aspect of economic activity. The TSAs capture transportation activities carried out by non-transportation industries for their own purposes and transportation activities carried out by households using a household vehicle.

The TSAs show the contribution of for-hire, in-house, and household transportation services:

- *For-hire transportation* consists of the air, rail, truck, passenger and ground transportation, pipeline, and other support services provided by transportation firms such as railroads, transit agencies, trucking companies, and pipelines, to industries and the public on a fee basis.
- *In-house transportation* consists of air, rail, water, and truck services produced by businesses for their own use—for example, a baker's delivery truck. Business in-house transportation includes privately owned and operated vehicles of all body types, used primarily on public rights of way, and the support services to store, maintain, and operate those vehicles.
- *Household transportation* covers transportation provided by households for their own use using a vehicle, measured by the depreciation cost associated with household ownership of motor vehicles. Air passenger travel is included in for-hire air transportation. The time that households spend operating a private motor vehicle for personal use is not included because it is outside the scope of the U.S. Input-Output (I-O) accounts on which the TSAs are built. The I-O accounts, by design, do not include unpaid labor, volunteer work, and other non-market production.

Figure 2-6 Gross Domestic Product (GDP) Attributed to Transportation Types and Modes, 2016



NOTE: For information on the methodology behind the Transportation Satellite Accounts (TSAs) see box 2-5. The GDP value in the TSAs (referred to as enhanced GDP) is larger than the GDP value published in the National Accounts, because it includes the contribution of household transportation. "Household transportation" covers transportation that households provide for themselves with vehicles. "Other" includes: pipeline, transit, and ground passenger transportation, including State and local government passenger transit; sightseeing transportation and transportation support; courier and messenger services; and warehousing and storage). 2016 data are latest available.

SOURCE: U.S. Department of Transportation, Bureau of Transportation Statistics, Transportation Satellite Accounts, available at https://www.bts.gov/satellite-accounts.

Household transportation (i.e., the depreciation cost associated with households owning motor vehicles) contributed $332.2 billion (1.8 percent) to GDP. [7]

The bars in figure 2-6 show transportation's contribution to GDP by type (for-hire, in-house, or household transportation) and by mode. Total household transportation's contribution to GDP was larger, at $332.2 billion, than any of the other transportation modes. Trucking contributed the second largest amount, at $288.2 billion. In-house truck transportation operations contributed $141.0 billion, while for-hire truck transportation services contributed $147.2 billion. Air contributed a total of $132.4 billion, comprising $104.2 billion of for-hire services and $28.2 billion of in-house services; rail contributed $42.9 billion, comprising $42.7 billion of for-hire services and $0.3 billion of in-house services; and water contributed $19.2 billion, comprising $16.5 billion of for-hire services and $2.8 billion of in-house services.

Use of Transportation Services by Industries

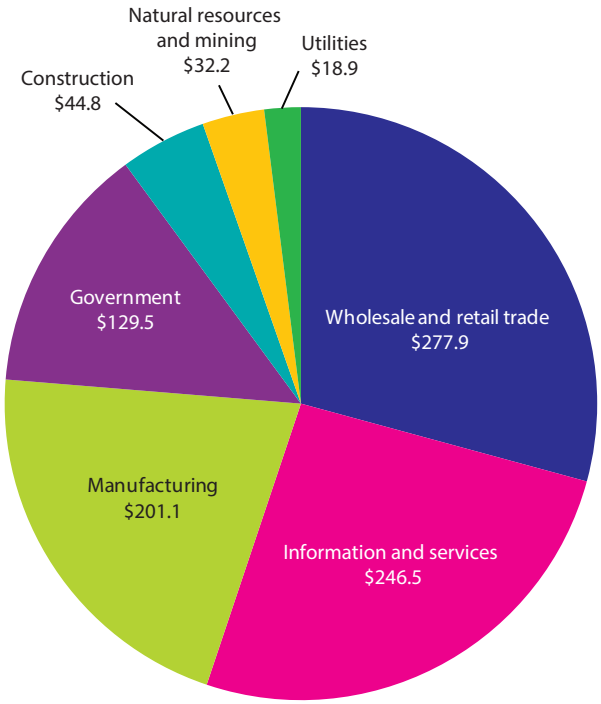
Transportation services indirectly contribute to the economy by enabling the production of goods and services by non-transportation industries. Specifically, industries rely on transportation services as well as transportation infrastructure, such as roadways, shipping channels, and rail lines, to access supplies and customers. Additionally, workers in each industry use transportation to reach their workplace. This section presents data on the amount of transportation used by non-transportation industries and the amount required by these industries to produce a dollar of goods and/or services.

[7] In the TSAs, BTS measures the contribution of household transportation to GDP as the depreciation of automobiles and does not include the value of time spent driving because it is out of scope of the U.S. Input-Output (I-O) accounts on which the TSAs are built. The I-O accounts, by design, do not include unpaid labor, volunteer work, and other non-market production.

Transportation Used by Industries

The TSAs show the amount of transportation services required by non-transportation industries to produce various goods and services. Figure 2-7 shows the value of for-hire and in-house transportation services used by seven major industries. Wholesale and retail trade uses the largest amount of transportation services at $277.9 billion, followed by information and services at $246.5 billion and manufacturing at $201.1 billion.

Figure 2-7 Use of For-Hire and In-House Transportation by Industry Sector, 2016 (billions of dollars)

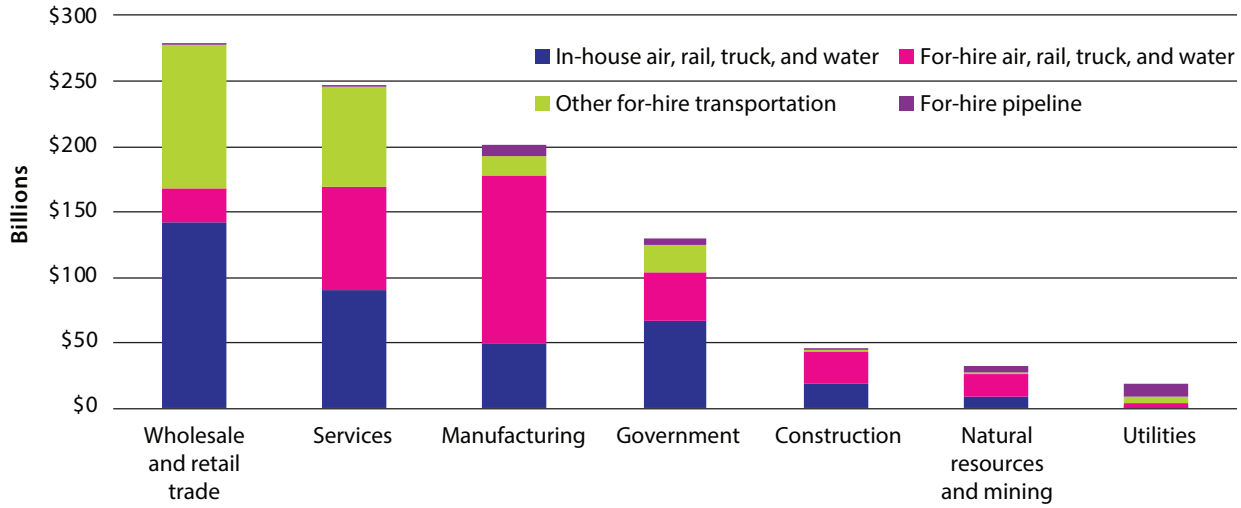


NOTE: 2016 data are latest available.

SOURCE: U.S. Department of Transportation, Bureau of Transportation Statistics, Transportation Satellite Accounts, available at https://www.bts.gov/satellite-accounts.

In the wholesale and retail trade industry, in-house transportation accounts for 51.1 percent of the $277.9 billion total transportation services used (figure 2-8). In-house transportation also represents a large portion of transportation services used in natural resources/mining (30.4

Figure 2-8 Use of For-hire and In-house Transportation by Industry Sector and Mode, 2016 (billions of dollars)



NOTES: "Services" includes information, financial services, professional and business services, education and health services, leisure and hospitality, and all other services. Other for-hire transportation includes pipeline, transit, and ground passenger transportation, including State and local government passenger transit; sightseeing transportation and transportation support; courier and messenger services; and warehousing and storage). 2016 data are latest available.

SOURCE: U.S. Department of Transportation, Bureau of Transportation Statistics, Transportation Satellite Accounts, available at https://www.bts.gov/satellite-accounts.

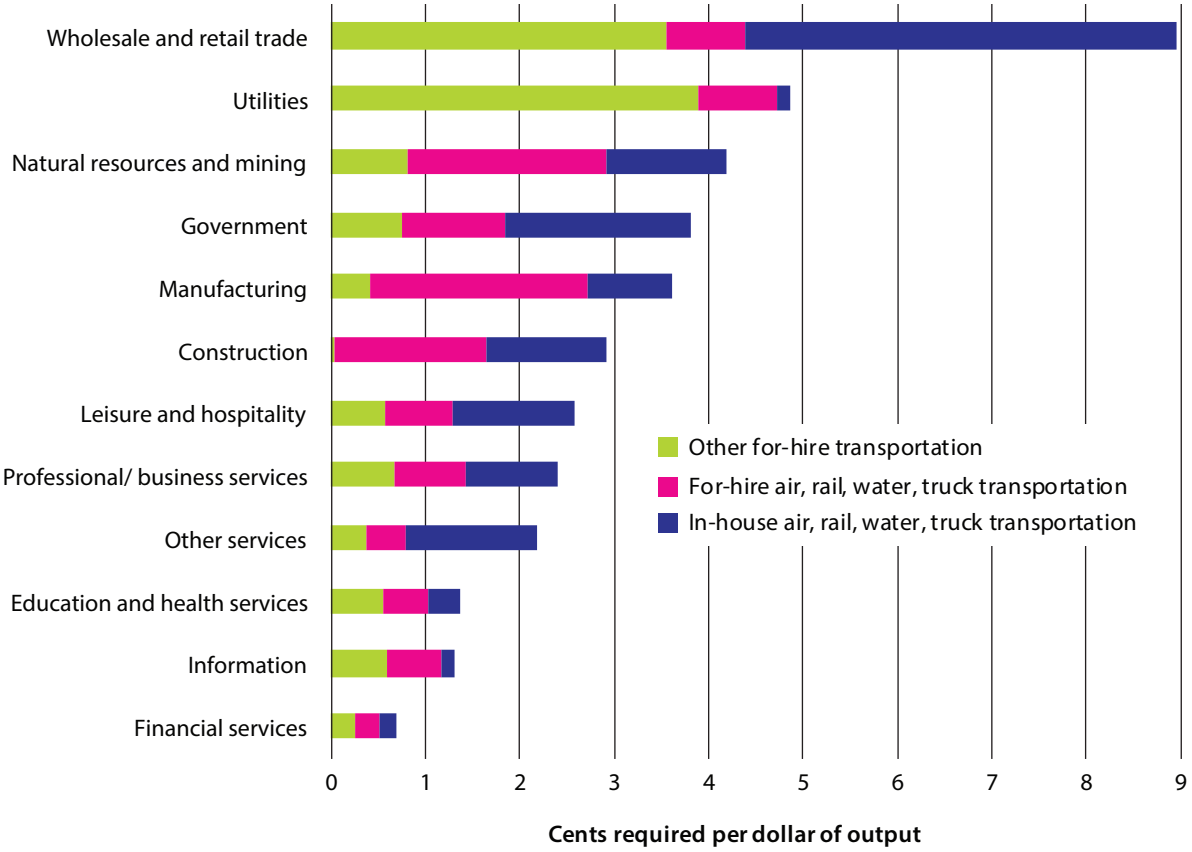
percent of $32.2 billion), construction (43.7 percent of $44.8 billion), and government (51.5 percent of $129. 5 billion). Other sectors, like manufacturing, rely more on for-hire transportation services. In the manufacturing sector, for-hire transportation accounts for 75.4 percent of the $201.1 billion total transportation services used.

Transportation Required Per Dollar of Output by Sector

Looking at the amount of transportation services required to produce each dollar of output shows how much a sector depends on transportation services (figure 2-9). In 2016 the wholesale and retail trade sector continues to require more transportation services to produce one dollar of output than any other sector. It required 9.0 cents of transportation services to produce one dollar of output—4.6 cents of in-house transportation operations, and 4.4 cents of for-hire transportation services.

BTS further discusses transportation's role in the seven major industry sectors in *Industry Snapshots: Uses of Transportation 2017*, available at https://www.bts.gov/product/industry-snapshots.

Figure 2-9 Transportation Required Per Dollar of Output by Sector, 2016



NOTES: Other for-hire transportation includes: pipeline, transit and ground passenger transportation, including State and local government passenger transit; sightseeing transportation and transportation support; courier and messenger services; and warehousing and storage). 2016 data are latest available.

SOURCE: U.S. Department of Transportation, Bureau of Transportation Statistics, Transportation Satellite Accounts, available at https://www.bts.gov/satellite-accounts.