Introduction

Economic activity stimulates the use of transportation; transportation contributed 8.9 percent to the U.S. economy in 2014. Transportation is both an input to goods and services production and an output of consumed mobility and transportation vehicles purchased. This chapter uses data from the Bureau of Economic Analysis’ National Income and Products Accounts to illuminate the economic contribution of transportation. Each section explains the meaning of, and discusses trends for, the following measurement concepts:

- Transportation-Related Final Demand
- For-Hire Transportation Services Produced in the Economy
- Transportation Satellite Accounts

All three measures illuminate the economic contribution of transportation. Transportation-related final demand is a measure of the price paid for all transportation. For-hire transportation services produced in the economy, also called transportation value added, measures the value added to gross domestic product (GDP) by the transportation sector, using an input-output approach. Transportation Satellite Accounts supplement the value-added approach by incorporating transportation data provided by households and non-transportation firms.

Transportation-Related Final Demand

Gross domestic product (box 2-1) attributed to transportation-related final demand is a measure of the total value, or price paid, for all transportation regardless of the sector that produced the transportation goods or services. It includes the value of the inputs that transportation industries purchase, such as fuel, lubricants, equipment, parts, 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. These terms are used both in some of the figures in this chapter and other discussions of transportation economics.

- 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 U.S. economy.
  - GDD is similar to GDP but excludes net exports, showing only domestic demand.

- What are the differences among transportation value added, total transportation expenditures, transportation-related final demand, and the value of all shipments?
  - Transportation Value Added is a measure of the size of the transportation sector based on the difference between the value of the transportation services sold and the goods and services used to produce transportation. The Bureau of Economic Analysis considers industry value added to be a measure of an industry’s contribution to GDP.
  - Total Transportation Expenditure measures what is spent on transportation without deducting the value of goods and services that are inputs. The main additional components are employee compensation and returns to capital.
  - Transportation-Related Final Demand shows the impact of transportation as a factor in the demand for goods and services in the economy.
  - Value of Shipments is the value of the goods transported by the freight transportation sector which is not the same as the value of the service of transporting them.
support services, as well as the value added by transportation industries themselves. Specifically, it includes the following key components:

- Gross Private Domestic Transportation Investment
- Government Transportation-Related Purchases
- Personal Consumption Expenditures
  - Motor vehicles and parts (purchases)
  - Motor vehicle fuels, lubricants and fluids (purchases)
  - Transportation services
- Net Exports of Transportation-Related Goods and Services

The transportation-related final demand data (box 2-2) summarize the final demand by households and government for transportation. Each input is counted in the sector that delivers final goods and services. This process provides information on all the pieces of aggregate demand directly related to transportation. If exports and imports of transportation-related goods and services were equal, i.e., if net exports were zero, then the total transportation-related GDP would be equal to the sum of domestic aggregate demand. However, recently imports have exceeded net exports so that net exports were negative every year. That is why graphical depictions of transportation-related final demand components show total transportation-related final demand including net exports as consistently below the sum of the domestic sources of demand.

Transportation-related final demand is not a perfect measure. For example, if investment in transportation infrastructure is below the level required to maintain the system’s condition, then the measure will underestimate final demand. Transportation-related final demand does not include the full value of for-hire transport (mostly freight) as an intermediate good in the production of other goods. It does, however, include the capital expenditure used to produce such services. Even with these shortcomings, transportation-related final demand can be used to compare the size of the transportation sector to that of other economic sectors such as healthcare and housing.

### Box 2-2 Transportation-Related Final Demand

Transportation-related final demand is the most complete measure of transportation’s role in the economy, specifically gross domestic product (GDP). Transportation-related final demand includes:

- For-hire transportation services
- Motor vehicle purchases
- Motor vehicle fuels, lubricants, and fluids
- Government transportation-related purchases
- Gross private domestic investment in transportation
- Net exports of transportation-related goods and services

### Transportation-Related Final Demand by GDP Component

Figure 2-1 shows transportation-related final demand from 1999 to 2014 in chained 2009 dollars, and the pattern for each of the GDP components that make up final demand. Total transportation-related final demand trended upward from 1999–2007, but turned down dramatically during the 2008 and 2009 recession. The recessionary decline was most evident in private investment and personal consumption expenditure (purchases of motor vehicle fuels and parts, purchases of motor vehicle fuels, lubricants and fluids, and transportation services). Exports of transportation goods and services came close to balancing imports in 2009 (economic declines often reduce imports) but returned to their larger negative balance in subsequent years. 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. Transportation-related final demand
has increased since the recession to 2.3 percent above the 2007 pre-recession peak. The impact of the Great Recession on the transportation industry is demonstrated by the slow climb from the 2009 low to the 2014 level, only 6.0 percent above the 1999 level. For the transportation industry the Great Recession effectively removed over 10 years of growth in final demand. In 2014 the largest share of transportation-related final demand was motor vehicles and parts, as it was in 1999. Total transportation-related final demand in 2014 was $1.42 trillion (in chained 2009 dollars), compared to the BEA’s value added in the for-hire transportation sector, which was $504.8 billion.

**Gross Domestic Product (GDP) by Major Social Function**

**GDP by Major Social Function** reflects broad economic activities, such as housing, transportation, and healthcare. The major
social functions—housing, healthcare, food, transportation, and education—comprise 60 percent of GDP, while the 40 percent “other” category includes entertainment, personal care, and payments to pension plans. The size of each social function is based on final demand (box 2-2).

The wheel in figure 2-2 shows that in 2014 transportation was the fourth largest major social function after housing, healthcare, and food, representing 9.6 percent of total final demand. Housing is the largest single source of final demand in the U.S. economy, nearly twice the size of transportation.

The left-hand side of figure 2-2 shows the pattern of GDP by major social function over time. Transportation-related final demand decreased during the recession from 9.6 percent of GDP in 2007 to 8.2 percent in 2009, and then recovered slowly from 2009 to 2012, when it reached 9.7 percent of GDP. One can see the pre-recession housing bubble as housing peaked just before the recession, in 2005, at 22.4 percent of GDP, and declined during and after the recession to a low of 18.3 percent of GDP in 2012.

For-Hire Transportation Services Produced in the Economy

For-hire transportation services consists of the air, railroads, truck, passenger and ground transportation, pipeline, and other support services provided by transportation firms (e.g., transit agencies and common carrier trucking companies) to industries and the public on a fee basis. Calculating the GDP attributed to for-hire transportation uses a value-added approach that subtracts the cost of inputs (e.g., fuel and equipment costs) from total output (measured by sector revenue, e.g., airline fares).

Figure 2-3 shows how transportation ranks among industries in its economic output. Each industry sector has an estimated contribution to GDP based on its value added (box 2-3). All industry sectors together sum to GDP; thus, looking at their relative sizes shows where economic activity generating GDP occurred. Figure 2-3 shows the contribution of transportation in the context of other sectors and how the economy as a whole leverages the value added by transportation.
Figure 2-3 also highlights transportation and two transportation-reliant sectors (durable goods manufacturing and construction) sorted by industry sector contribution to GDP (on a value-added basis). Durable goods manufacturing is the largest of the three sectors (6.8 percent of GDP), followed by construction (3.8 percent) and transportation (2.7 percent). Transportation ranks 13th among the 17 industry sectors in terms of contribution to GDP.

This ranking likely, however, understates the importance of transportation since all sectors rely on transportation, at least indirectly. To the extent that workers use the roadways to access customers and transit to commute, the ranking of the transportation industry is understated because there is no explicit payment for the full cost of those resources. There is also an understatement of the transportation industry ranking because in-house transportation (transportation undertaken by a business for internal use) is not included in the figure 2-3.

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**Box 2-3 What is Value Added?**

Transportation Value Added is a measure of the contribution of the transportation sector to gross domestic product (GDP) based on the difference between the value of the transportation services sold and the goods and services used to produce transportation. The Bureau of Economic Analysis (BEA) considers industry value added to be a measure of an industry’s contribution to GDP.

The value of transportation sector outputs is estimated using data on the sales of transportation sector services to other parts of the economy. That shows what other parts of the economy are willing to pay for those services. In turn, the transportation sector purchased inputs, such as fuel and equipment, are valued based on what the transportation sector pays for them. The difference is the value added by the transportation sector, which is the transportation sector’s contribution to GDP.

The contribution of the inputs to transportation includes the value added by the sector that produces them. For example, the contribution of the fuel purchased by for-hire carriers is included in the value added by the energy sector, which produced the fuel. It would be double counting the value added by fuel, if fuel purchased by for-hire transportation was not subtracted from the value added by transportation. Examples of other excluded inputs are equipment, spare parts, lubricants, and other materials.

This approach enables BEA to compute total GDP as the sum of the contributions of all sectors of the economy.

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**Figure 2-3 Contribution to Gross Domestic Product (GDP) by Industry Sector, 2015**

<table>
<thead>
<tr>
<th>Industry Sectors</th>
<th>GDP Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finance, insurance, real estate, rental, and leasing</td>
<td>19.4%</td>
</tr>
<tr>
<td>Professional and business services</td>
<td>12.5%</td>
</tr>
<tr>
<td>Government, state and local</td>
<td>8.5%</td>
</tr>
<tr>
<td>Educational services, health care, and social assistance</td>
<td>8.2%</td>
</tr>
<tr>
<td>Manufacturing, durable goods</td>
<td>6.0%</td>
</tr>
<tr>
<td>Manufacturing, nondurable goods</td>
<td>5.9%</td>
</tr>
<tr>
<td>Manufacturing, non-durable goods</td>
<td>5.4%</td>
</tr>
<tr>
<td>Education and health services</td>
<td>5.0%</td>
</tr>
<tr>
<td>Government, federal</td>
<td>4.0%</td>
</tr>
<tr>
<td>Construction</td>
<td>3.8%</td>
</tr>
<tr>
<td>Arts, entertainment, recreation, accommodation, and food services</td>
<td>3.8%</td>
</tr>
<tr>
<td>Transportation and warehousing</td>
<td>2.7%</td>
</tr>
<tr>
<td>Mining</td>
<td>2.3%</td>
</tr>
<tr>
<td>Other services, except government</td>
<td>2.1%</td>
</tr>
<tr>
<td>Agriculture, forestry, fishing, and hunting</td>
<td>1.3%</td>
</tr>
<tr>
<td>Utilities</td>
<td>1.0%</td>
</tr>
</tbody>
</table>

**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/Table/index_industry_gdpIndy.cfm](http://www.bea.gov/Table/index_industry_gdpIndy.cfm) as of July 2016.
industry sector ranking. This understatement is corrected by the Transportation Satellite Accounts, discussed later in this chapter, which adds transportation activity performed by non-transportation firms to the 2.7 percent contribution that is shown in figure 2-3.

The percentage that transportation and warehousing contributes to a state’s GDP depends on the state’s geography, population density, mix of industries, and location of transportation hubs (box 2-4). For example, Nebraska has a major national rail hub in Omaha, and has the second-highest percentage of GDP from transportation and warehousing of any state in the country (7.9% of GDP in 2015). States with larger total GDPs, such as California ($2.46 trillion) and New York ($1.44 trillion), also have large transportation and warehousing activities—$56.1 billion and $26.7 billion, respectively. Because other economic activities are so much larger in California and New York, however, transportation and warehousing is a relatively small share of their total GDP (figure 2-4).

Figure 2-5 breaks out the transportation contribution to GDP by mode and the patterns of change over time in each mode’s percentage contribution to GDP. In 2014 the three modes with the largest contributions were trucking ($135.1 billion, 0.81 percent of GDP), other transportation and support activities ($112.3 billion, 0.56 percent) and air ($84.0 billion, 0.41 percent). The modes that grew as a percentage of GDP from 1997 to 2014 were water (from

Figure 2-4  State Gross Domestic Product from Transportation and Warehousing as a Percent of State Total Gross Domestic Product, 2015

Figure 2-5  For-Hire Transportation Industry’s Contribution to GDP by Mode

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 can be found in NTS Table 3-1.

0.05 percent to 0.12 percent), warehousing and storage (from 0.23 percent to 0.38 percent), and pipelines (from 0.06 percent to 0.13 percent, with peaks of 0.13 percent in 2001 and 2008). However, most modes decreased relative to GDP—trucking (from 0.98 percent to 0.81 percent), air (from 0.75 percent to 0.41 percent), rail (from 0.29 percent to 0.23 percent), transit (from 0.22 percent to 0.17 percent), and other transportation (from 0.72 percent to 0.56 percent).

**Transportation Satellite Accounts**

The Bureau of Economic Analysis measures the value added by for-hire transportation using the Economic Census Survey. For-hire transportation services are produced by transportation firms (trucking companies, railroads, and airlines) and sold to transportation users. In addition to for-hire transportation services, non-transportation industries also produce transportation services for their own purposes. For instance, grocery stores may operate a truck fleet to move food from distribution centers to stores. BEA embeds the value of these services, known as in-house transportation, within the value of the goods purchased by non-transportation industries to carry out in-house transportation operations.

BTS developed the *Transportation Satellite Accounts* (TSAs) to extract the commodities used to carry out in-house transportation operations and estimate the contribution of in-house transportation to the economy. The TSAs also show the contribution of transportation carried out by households through the use of an automobile. The TSAs (box 2-5) thereby provide a more comprehensive measure of the size and role of transportation in the economy.

**Transportation Satellite Account Results**

The TSAs compute transportation's GDP contribution attributed to all transportation modes. In 2012, the latest year for which comprehensive data are available, transportation's total GDP contribution was estimated at $970 billion (figure 2-6). The pie chart in figure 2-6 represents total U.S. GDP, and the slice shows the portion contributed by transportation, based on the TSAs. The colors within the slice show the relative shares of for-hire (2.9 percent), in-house (1.2 percent), and household (1.8 percent) transportation's contribution to GDP. For-hire

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**Box 2-5  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 a particular 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 through the use of an automobile.

The TSAs show the contribution of both 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, common carrier 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. Business in-house transportation includes privately owned and operated vehicles of all body types, used primarily on public rights of way, and the supportive services to store, maintain, and operate those vehicles. A baker's delivery truck is an example of business in-house transportation. Household transportation covers transportation provided by households for their own use through the use of 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 households spend operating a private motor vehicle for personal use is not included, because it is not within 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.
transportation contributed $471.6 billion (2.9 percent) to the U.S. GDP of $16.5 trillion.¹ Transportation services (air, rail, truck, and water) provided by non-transportation industries for their own use (called in-house transportation) contributed an additional $203.2 billion (1.2 percent) to U.S. GDP.²

The bars in figure 2-6 show the contribution by mode, and how much of the contribution for each mode falls into the categories of for-hire, in-house, or household transportation. For example, transportation services provided by trucks contributed a total of $295.1 billion to GDP comprised of for-hire transportation services provided on a fee basis ($123 billion) and in-house transportation services provided by businesses for their own use ($172 billion). Trucking rises in relative size when in-house trucking is added to for-hire trucking, reflecting the use of trucking fleets owned and operated by businesses—from local plumber’s trucks to national fleets owned and operated by many retailers.³ Air contributed a total of $105.2 billion, comprised of $78 billion of for-hire services, and $28 billion of in-house services; and water contributed $16.7 billion, comprised of $13.4 billion of for-hire services and $3.3 billion of in-house services.

Total household transportation (i.e., the depreciation cost associated with households owning motor vehicles) is larger than any of the other modes in terms of contribution to GDP, at $296 billion. The BEA approach in general excludes household production because there are challenges to computing the “price” or “value” of such things as a homecooked meal. For the TSA, BTS measures the contribution of household transportation to GDP as the depreciation of motor vehicles and does not include the value

¹ The GDP value in the TSAs is larger than the GDP value published in the National Accounts, because it includes the contribution of household transportation. Household transportation covers transportation provided by households for their own use through the use of a motor vehicle.

² For example, a grocery chain that operates its own truck fleet.

³ Large retailers, such as Walmart and Target, are captured by BEA in the For-Hire Transportation Sector but smaller retailers are subsumed into the BTS in-house estimate.
of time spent driving. Including household transportation highlights the importance of household transportation provided by households for their own use through the ownership of a vehicle.

**Use of For-Hire and In-House Transportation by Industry**

The TSAs can also compute the extent of transportation services required to produce various goods and services. Figure 2-7 shows the relative importance of in-house and for-hire transportation as inputs to industries using transportation.

Figure 2-7 compares the value of for-hire and in-house transportation services used by seven major industries. When in-house transportation is included, wholesale and retail trade is the largest user of transportation services at $298.6 million, followed by information and services, and manufacturing. In the wholesale and retail trade industry, in-house transportation is 58 percent of the $299 billion total transportation services used (figure 2-8). Other sectors, such as manufacturing, are more reliant on for-hire transportation (in-house transportation is only 33 percent of the $212 billion total transportation services used by manufacturing). In-house transportation also represents a large portion of transportation services in natural resources/mining (49 percent of the $41 billion total transportation services used by natural resources/mining), in construction (61 percent of the $49 billion total transportation services), and in government (59 percent of the $153 billion total transportation services). BTS provides a full discussion of transportation’s role in the seven major industry sectors in *Industry Snapshots: Transportation’s Role in the U.S. Economy* available at bts.gov.

**Figure 2-7 Use of For-Hire and In-House Transportation by Industry Sector, 2012 (Billions)**

- Wholesale and retail trade $298.6
- Information and services $251.9
- Manufacturing $212.3
- Government $152.6
- Natural resources and mining $41.3
- Utilities $16.1
- Construction $48.7
- Natural resources and mining $41.3
- Utilities $16.1
- Construction $48.7

**NOTE:** The Transportation Satellite Accounts Use Table quantifies how transportation (both freight and passenger) is used by non-transportation sectors of the economy to create the goods and services that make up GDP. It includes in-house transportation activity (i.e., that which firms provide to move their own products) as well as for hire transportation. Data are shown by industry.

NOTES: The Transportation Satellite Accounts Use Table quantifies how transportation (both freight and passenger) is used by businesses in other sectors of the economy to create the goods and services that make up GDP. It includes in-house transportation activity (i.e., that which firms provide to move their own products) as well as for hire transportation. Data are shown by industry. Pipeline transportation is only shown separately for the Utility and Natural Resources industries. It is less than 5% of total transportation for other industries.