# Freight Analysis Framework Commodity Flow Forecast Study (FAF Version 5): Final Forecasting Results

U.S. Department of Transportation

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| **16. Abstract**<br>This technical report accompanies the Freight Analysis Framework Forecasts Version 5 (FAF5.2). The technical report outlines the data and methodology used to develop freight forecasts using the 2017 base-year FAF data for 2020, 2022, 2023, 2025, and long-term forecasts in 5-year increments from 2030 to 2050. FAF5 estimates are updated periodically as new data becomes available; please refer to the most current version of the FAF5 for latest estimates. This report also summarizes the observed trends and the outlook for domestic, imported, and exported goods movement for the United States. Three freight flow scenarios driven by different macroeconomic assumptions are analyzed and presented. | | |
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## SI* (MODERN METRIC) CONVERSION FACTORS

### APPROXIMATE CONVERSIONS TO SI UNITS

| Symbol | When You Know | Multiply By | To Find | Symbol |
|---|---|---|---|---|
| | | **LENGTH** | | |
| in | inches | 25.4 | millimeters | mm |
| ft | feet | 0.305 | meters | m |
| yd | yards | 0.914 | meters | m |
| mi | miles | 1.61 | kilometers | km |
| | | **AREA** | | |
| $in^2$ | square inches | 645.2 | square millimeters | $mm^2$ |
| $ft^2$ | square feet | 0.093 | square meters | $m^2$ |
| $yd^2$ | square yard | 0.836 | square meters | $m^2$ |
| ac | acres | 0.405 | hectares | ha |
| $mi^2$ | square miles | 2.59 | square kilometers | $km^2$ |
| | | **VOLUME** | | |
| fl oz | fluid ounces | 29.57 | milliliters | mL |
| gal | gallons | 3.785 | liters | L |
| $ft^3$ | cubic feet | 0.028 | cubic meters | $m^3$ |
| $yd^3$ | cubic yards | 0.765 | cubic meters | $m^3$ |
| | **NOTE**: volumes greater than 1,000 L shall be shown in $m^3$ | | | |
| | | **MASS** | | |
| oz | ounces | 28.35 | grams | g |
| lb | pounds | 0.454 | kilograms | kg |
| T | short tons (2,000 lb) | 0.907 | megagrams (or "metric ton") | Mg (or "t") |
| | | **TEMPERATURE (exact degrees)** | | |
| °F | Fahrenheit | 5 (F-32)/9<br>or (F-32)/1.8 | Celsius | °C |
| | | **ILLUMINATION** | | |
| fc | foot-candles | 10.76 | lux | lx |
| fl | foot-Lamberts | 3.426 | $candela/m^2$ | $cd/m^2$ |
| | | **FORCE and PRESSURE or STRESS** | | |
| lbf | poundforce | 4.45 | newtons | N |
| $lbf/in^2$ | poundforce per square inch | 6.89 | kilopascals | kPa |

### APPROXIMATE CONVERSIONS FROM SI UNITS

| Symbol | When You Know | Multiply By | To Find | Symbol |
|---|---|---|---|---|
| | | **LENGTH** | | |
| mm | millimeters | 0.039 | inches | in |
| m | meters | 3.28 | feet | ft |
| m | meters | 1.09 | yards | yd |
| km | kilometers | 0.621 | miles | mi |
| | | **AREA** | | |
| $mm^2$ | square millimeters | 0.0016 | square inches | $in^2$ |
| $m^2$ | square meters | 10.764 | square feet | $ft^2$ |
| $m^2$ | square meters | 1.195 | square yards | $yd^2$ |
| ha | hectares | 2.47 | acres | ac |
| $km^2$ | square kilometers | 0.386 | square miles | $mi^2$ |
| | | **VOLUME** | | |
| mL | milliliters | 0.034 | fluid ounces | fl oz |
| L | liters | 0.264 | gallons | gal |
| $m^3$ | cubic meters | 35.314 | cubic feet | $ft^3$ |
| $m^3$ | cubic meters | 1.307 | cubic yards | $yd^3$ |
| | | **MASS** | | |
| g | grams | 0.035 | ounces | oz |
| kg | kilograms | 2.202 | pounds | lb |
| Mg (or "t") | megagrams (or "metric ton") | 1.103 | short tons (2,000 lb) | T |
| | | **TEMPERATURE (exact degrees)** | | |
| °C | Celsius | 1.8C+32 | Fahrenheit | °F |
| | | **ILLUMINATION** | | |
| lx | lux | 0.0929 | foot-candles | fc |
| $cd/m^2$ | candela/m2 | 0.2919 | foot-Lamberts | fl |
| | | **FORCE and PRESSURE or STRESS** | | |
| N | newtons | 2.225 | poundforce | lbf |
| kPa | kilopascals | 0.145 | poundforce per square inch | $lbf/in^2$ |

*SI is the symbol for International System of Units. Appropriate rounding should be made to comply with Section 4 of ASTM E380. (Revised March 2003)

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## LIST OF ABBREVIATIONS

| | |
|---|---|
| BMI | Business Market Insights |
| BTM | Business Transactions Matrix |
| BTS | Bureau of Transportation Statistics |
| CAGR | Compound Annual Growth Rate |
| CBP | County Business Pattern |
| CFS | Commodity Flow Survey |
| CPI | Consumer Price Index |
| FAF | Freight Analysis Framework |
| FAF5 | Freight Analysis Framework Version 5 |
| FHWA | Federal Highway Administration |
| GDP | Gross Domestic Product |
| GTA | Global Trade Atlas® |
| I/O | Input/output |
| ISIC | International Standard Industrial Classification |
| LPG | Liquified Petroleum Gas |
| MSA | Metropolitan Statistical Area |
| n.e.c. | not elsewhere classified |
| NAICS | North American Industry Classification System |
| SCTG | Standard Classification of Transported Goods |
| SCTG2 | Standard Classification of Transported Goods, two-digit level |
| EIA | Energy Information Administration |

# CHAPTER 1. INTRODUCTION

The U.S. Department of Transportation Federal Highway Administration (FHWA), in partnership with the U.S. Bureau of Transportation Statistics (BTS), developed and maintains the Freight Analysis Framework (FAF), a national, commodity-based, freight flow analysis tool. Originally designed by FHWA as a tool for multimodal transportation policymaking, the FAF has found applications for other purposes because it is the only publicly available source for long-distance national freight movement data for all modes of transportation. The FAF integrates data from a variety of sources to create a comprehensive national picture of freight movement. It includes estimates of commodity flows and relates freight transportation activities among States, sub-State regions, and major international gateways. Additionally, FAF estimates truck volumes on a highway network that includes roads in the National Highway System.

## BACKGROUND

The FAF has been used in a variety of freight-related transportation, investment, and multimodal freight policy analyses. It has also become an important freight data source for transportation practitioners and researchers. State departments of transportation and metropolitan planning organizations use FAF to understand regional and State freight transportation needs and to justify new initiatives. FAF Version 5 (FAF5) is based primarily on the 2017 Commodity Flow Survey (CFS); the FAF5 forecast provides future estimates of freight with the horizon year 2050 on a regional basis by origin-destination pairs.[1] FAF5 follows FAF4, which is based on 2012 CFS.

The FAF includes long-term forecasts of transported freight and provides details for domestic, import, and export freight movement. Domestic flow of freight represents freight transported from domestic origins to domestic destinations, import forecasts represent flows of freight transported from foreign origins to domestic destinations, and export freight forecasts include freight moved from domestic origins to foreign destinations.

This is the final report for the Freight Analysis Framework Inter-Regional Commodity Flow Forecast Study, which documents updated FAF freight forecasts for FAF5.2. These forecasts have the same data dimensions as the base-year 2017 FAF5 data, released in 2021 (see FAF Version 5 User's Guide, January 2021, at https://www.bts.dot.gov/faf/faf5-user-guide). For technical documentation of the FAF5 base-year data, data files, development, and application, go to the FAF web page at https://ops.fhwa.dot.gov/freight/freight_analysis/faf/.

## GEOGRAPHIC DESIGNATIONS

### Domestic

The geographic detail of the FAF5 forecast origin-destination flows are the same as in the base-year FAF5 data, specifically, the 132 domestic regions (figure 1) and 8 international

[1] https://ops.fhwa.dot.gov/freight/freight_analysis/faf/; https://www.bts.gov/faf/faf5-user-guide; https://www.bts.gov/browse-statistical-products-and-data/freight-analysis-framework/faf5-base-year-data-development

regions. The FAF5 domestic regions are mutually exclusive regions that fully partition the 50 States and the District of Columbia. They include States, State portions of large metropolitan areas, and remainders of States. Metropolitan areas consist of Metropolitan Statistical Areas or Consolidated Statistical Areas as defined by the U.S. Office of Management and Budget. When a metropolitan area is entirely within a State, or when a state's portion of a multi-State metropolitan area is large enough to support the sampling procedures in the CFS, the area is a separate FAF region. Small single-State metropolitan areas and small portions of a multi-State metropolitan area are part of the State or Remainder of State (more information on FAF zones is available in FAF5 User Guide).[2] These domestic regions are listed in the appendix (table 13). The exports from and imports to these 132 domestic regions are forecasted with respect to 8 international geographic regions.

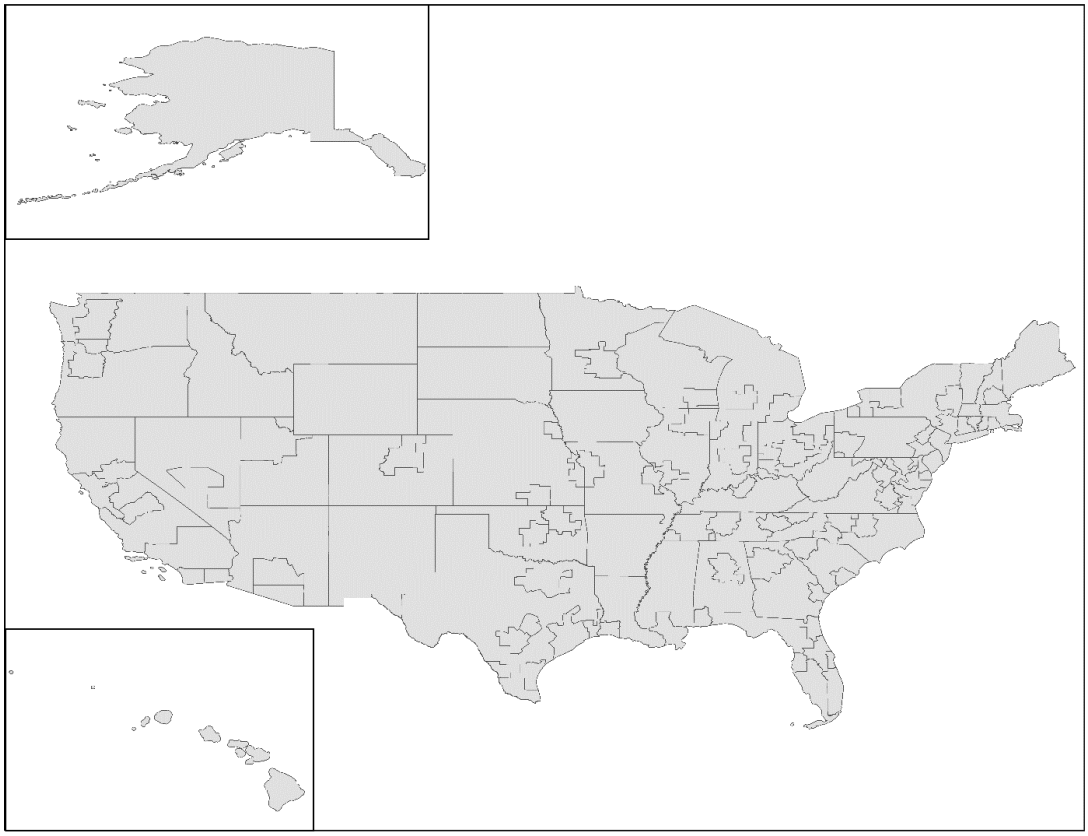


**Figure 1. Map. Freight Analysis Framework Version 5 Domestic Zones.**
*Source: FHWA.*

**International**

These regions together cover the entire world outside the United States. Canada and Mexico are their own individual international regions. The rest of the world is grouped into the following six multicountry regions:

- The rest of the Americas

[2] https://www.bts.gov/faf/faf5-user-guide.

- Europe
- Africa
- Southwestern and Central Asia
- Eastern Asia
- Southeastern Asia and Oceania

These six international regions are based on information obtained from the United Nations Statistics Division. The countries in each international region are listed in the appendix (table 14).

## TRANSPORTATION MODES

Freight flow forecasts are further categorized into 8 domestic modes of transportation, 7 international modes, and 42 commodity classes. Modes include truck, rail, water, air (including truck-air), multiple modes and mail, pipeline, other/unknown, and no domestic mode (used for oil processed at the dock). The result is a detailed database of forecasted domestic and international freight flows into and out of each CFS-defined region.[3]

## DATA UPDATES

Updates of the FAF are produced every 5 years, tied to the update cycle for the CFS, which is the primary foundation for FAF. BTS partners with the Census Bureau to conduct the CFS as part of the U.S. Economic Census, which is updated every 5 years. The CFS is a national shipper survey of U.S. business establishments with detailed commodity, transportation mode, and origin-destination details of domestic and export freight activity. Additional data sources, such as U.S. Census merchandise import and export statistics, are used to supplement the CFS to produce the more comprehensive view of national freight activity available in FAF5.

## ROLE OF FORECAST

The FAF5 forecast described in this report is intended to provide policymakers and planners with projections of future freight demand to inform their decision making. Information quantifying expected changes in freight system demand are important to planning prioritization, investment needs planning, and assessments of impacts of policy changes affecting transport modes, commodities, and the freight network geography. The specific objectives of this project are to provide the following:

- Baseline scenario freight flow forecasts consistent with the most likely path of development in the economy.
- Alternative freight flow forecasts consistent with high-growth and low-growth economic forecast scenarios to suggest a range of possibilities for the baseline forecast.

This report documents the approach to the FAF5 freight flow forecast modeling as well as a summary of the forecast results. The report presents three scenarios based on a range of

[3]The CFS region definitions represent the basic geographic unit of analysis. The forecasting process focuses on interregional flows; hence, the FAF5 forecasts are referred to throughout this report as interregional forecasts. However, forecasted values are also provided for freight flows both originating and terminating within each region to fully account for U.S. goods movement.

economic growth and freight demand projections through 2050. Detailed data for the forecasts is available on the FAF5 website.

This report describes the assumptions, methodology and approach, and results from the FAF5 forecasts. FAF5 forecasts are developed using data and assumptions provided by third parties that do not necessarily represent the views of FHWA or the U.S. Federal Government. The third parties are a commercial economic forecasting and information firm and their information suppliers.

This report has the following sections:

- Key assumptions, summarizing macroeconomic trends and factors affecting U.S. domestic and international commodity flows.
- Forecast results, summarizing the resulting FAF5 forecast of commodity flows by commodity type using the at the 2-digit level of the Standard Classification of Transported Goods (SCTG2) between the 132 domestic zones and 8 foreign zones. Forecasts are provided for the baseline, high-growth, and low-growth scenarios.
- Appendix on forecast methodology, describing the processes used to generate the forecast results.

# CHAPTER 2. KEY ASSUMPTIONS

This section of the report describes the key macroeconomic assumptions underpinning the FAF5 forecasts. The subsequent forecast methodology section of this document describes in detail the processes by which the long-term macroeconomic assumptions were combined with the FAF 2017 base-year database, resulting in the FAF5 forecasts.

The FAF5 forecasts of interregional domestic and international freight flows, tonnage, and value are based on macroeconomic assumptions regarding the short- and long-term trends of the U.S. economy at the time of the FAF5 forecasts development in April 2021. These assumptions about the national economy form the basis of national forecasts of output, consumption, and trade, by industry for FAF regions, which are applied to the FAF5 base-year database to drive the FAF5 forecasts. The significant impacts on the U.S. and world economies from national events are captured in data available through April 2021, including the characteristics of the 2020 recession and the start of the economic recovery in the United States and in other countries. The assumptions regarding the recovery in economic activity have necessarily included best estimates of 2021 and 2022 pandemic conditions, including the assumption that subsequent waves of COVID-19 variants will occur. There are significant unknowns in these assumptions as the pandemic was ongoing when these forecasts were made.

Because a third party provided the macroeconomic assumptions, the views summarized in this section do not reflect the views of FHWA or the Federal Government. Rather, the data and models derived from these assumptions were procured to enhance Government -published data. FHWA compiles and publishes the FAF5 base-year database using information collected from shippers in the most recent 5-year CFS and from other information sources on freight transportation operator and commodity trade activity. The process of combining third-party and Federal Government data resulted in forecasts for 2020, 2022, 2023, and 2025 and long-term forecasts in 5-year increments from 2025 to 2050.

## TRANSPORTATION

This section discusses the assumptions regarding the economic conditions that provide for goods-consumption demand, which is the source of demand for freight transportation. Other assumptions regarding the transportation system are also incorporated into these forecasts. Those assumptions include that modal shares of commodity shipments are fixed to the share in the base year throughout the forecast period for each commodity's origin-destination pair. Modal shares change over time in the forecast when they are aggregated by commodity, origin-destination pair, or both, reflecting a differential growth forecast among the commodities being shipped and the geographic market shares of commodity flows. Other assumptions have greater or lesser potential impact, such as the following:

- Relative stability in the economic regulatory environment in the United States, Canada, Mexico, and other key commodity trading partner countries.
- Allowance for increased environmental transportation regulation.
- Allowance of transportation service providers' labor and capital productivity shifts as new technologies are developed and adopted, including automation.

- Allowance for shifts in transportation infrastructure and operations funding, such as less reliance on petroleum fuel tax revenues.

The underlying transportation system infrastructure and operations are assumed to accommodate future commodity demand in the aggregate. No explicit transportation system capacity constraint is imposed on any mode or commodity in the forecasts. This assumption implies adequate investment by the public and private sectors are made in the aggregate to meet freight demand. This assumption does not imply uniform or even adequate investment everywhere.

## TRADE POLICY

Relative costs are allowed to influence the geography of commodity flows, implying some producer regions with higher cost or inadequate capacity may lose shares to geographic pairs with lower cost or sufficient capacity. The assumptions regarding relations between trade areas include that trade policy or regulation changes since April 2021 that could affect suppliers' relative competitiveness will not be significant enough, to independently cause shifts in modal commodity shares.

The long-term impacts of existing trade policy, such as companies taking advantage of the United States-Mexico-Canada Agreement North American free trade zone to expand U.S. trade with Canada and Mexico, are assumed to continue. Assumptions regarding industry productivity include sustained capital investments in technology, including digitizing supply chain operation and increasing automation. Consumer behavior is assumed to reflect a permanence to the shift in retail purchasing behavior toward electronic commerce (e-commerce) and away from traditional in-store purchases. The patterns of goods movement modal shares, freight flow geography, and volumes are anchored in the base year 2017 FAF origin-destination flows. However, observed data through 2020 from the U.S. Census for international commodity trade, from the U.S. Energy Information Administration for energy commodities, and from the U.S. Department of Agriculture for agricultural commodity shipments are incorporated into the basis of commodity activity that was used to produce the forecasts. The use of updated data inputs is critical to the attempt to consider current effects on the world economy for the FAF5 forecast.

## 30-YEAR MACROECONOMIC OUTLOOK

The rest of this section describes the baseline macroeconomic scenario for the U.S. economy, as well as two alternative forecast growth scenarios. These scenarios guide the development of various macroeconomic and industry forecasting data applied in this study. These data inputs drive the baseline, high-growth, and low-growth FAF5 forecasts summarized in this report.

The 30-year macroeconomic outlook suggests that the U.S. economic fundamentals remain solid following the recession of 2020. The FAF5 freight flow forecast presents three economic forecast growth scenario projections: baseline, high-growth, and low-growth.

The baseline scenario projection assumes that the economy suffers no major mishap between now and 2050. This projection is best described as depicting the mean of all possible paths that the economy could follow in the absence of major disruptions. Such disruptions include large oil price shocks, unforeseen swings in macroeconomic policy, natural disasters, a financial

meltdown, or a sudden collapse of the Organization of Petroleum-Exporting Countries (OPEC) or the eurozone.

The forecast modeling allows for general technological advancement across the economy, as has been true historically. The growth scenarios reflect different levels of overall capital investment, which affects the pace of adopting new technologies across industries. This general technology adoption approach extends to vehicle automation, in which a bottom-up analysis of the timeline for U.S. vehicle fleet automation, including trucking was outside this project's scope. Although the degree of automation (or adoption of various levels of autonomous vehicle features) is not explicitly modeled, the forecasts do assume that vehicle automation development continues at a pace that reflects the development to date.

In the high-growth scenario projection, economic growth proceeds smoothly but more rapidly than in the baseline, while prices rise slowly. In this projection, population, labor force, and capital stock growth, as well as exogenous technological changes, occur quicker than in the baseline scenario. Potential output thus climbs more rapidly, and because output is primarily supply determined in the long run, real per capita gross domestic product (GDP) grows 0.3 percentage points quicker per year.

In the low-growth scenario projection, growth proceeds smoothly but slower than in the baseline, and productivity growth is weaker. In this projection, population, labor force, and capital stock growth, together with exogenous technological changes, occur less rapidly than in the baseline. Output per capita GDP thus climbs 0.4 percentage points slower per year. The outlook highlights the analysis of recent trends and projected future trends: Real GDP growth will average 2.1 percent per year from 2021 to 2050 (figure 2).

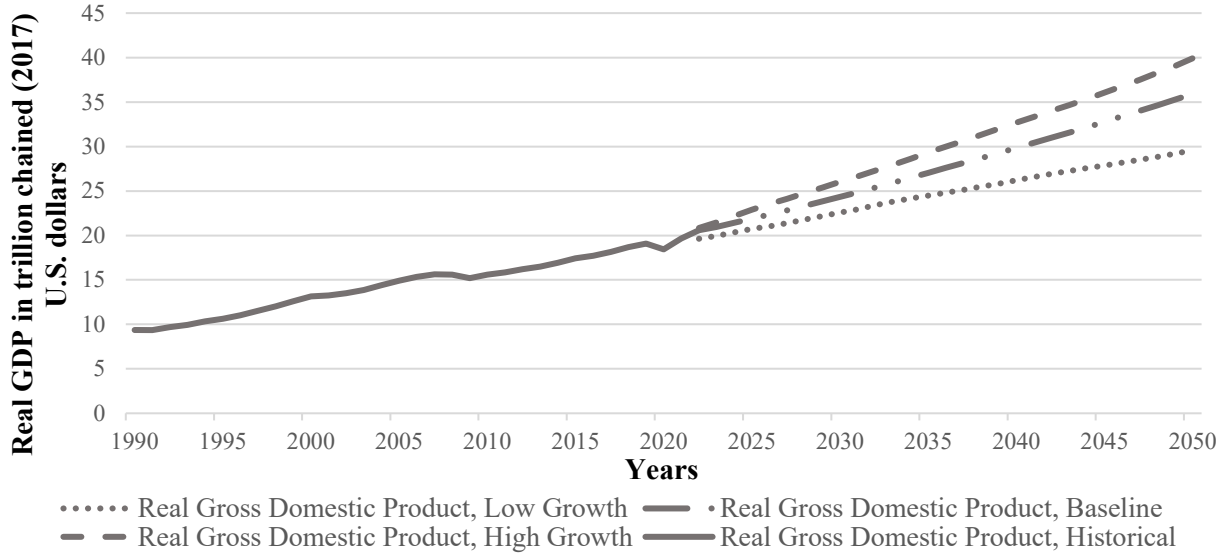



**Figure 2. Graph. Historical and Forecasted Growth in Real Gross Domestic Product, 1990–2050.**

*Source: FHWA.*

The outlook for inflation remains moderate. Consumer Price Index (CPI) inflation will average 2.4 percent per year over the forecast period. Core inflation will average 2.5 percent (figure 3).

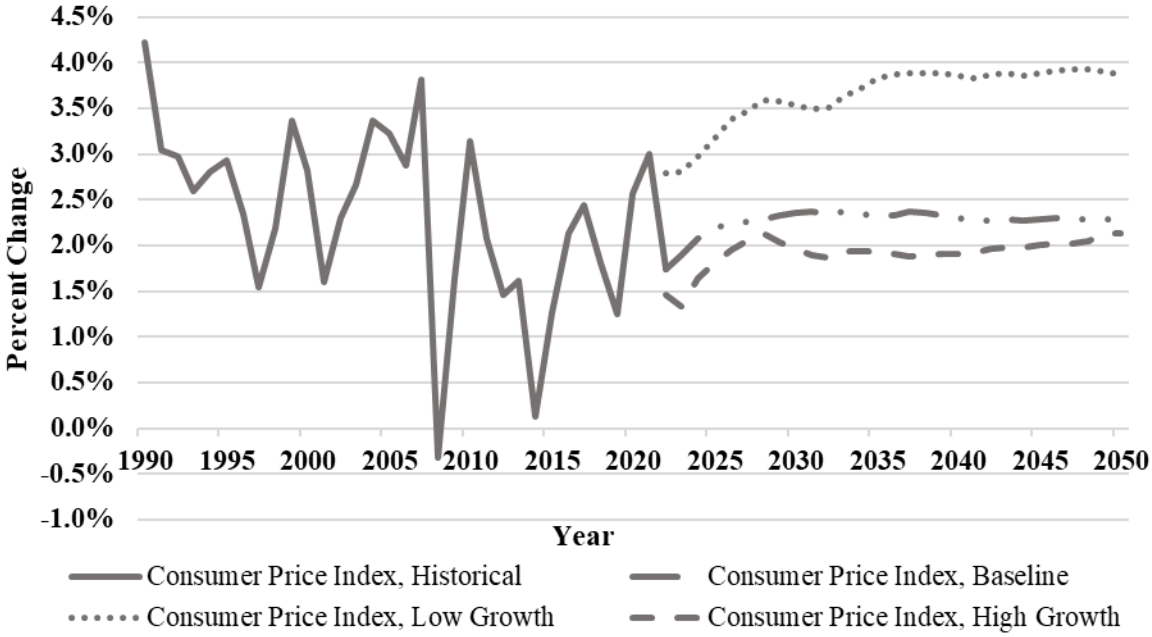



**Figure 3. Graph. Historical and Forecasted Consumer Price Index by Freight Analysis Framework Version 5 Scenario, 1990–2050.**

*Source: FHWA.*

## FISCAL POLICY

Forecasts for federal spending on defense, transfer payments, and Federal aid to State and local governments are forecasted to consume a significant share of GDP. As a result, the Federal Government is expected to post deficits in the unified budget over the entire forecast period in the baseline, high-growth, and low-growth forecasts. The current account deficit remains negative over the forecast period, averaging 3.3 of GDP (figure 4).

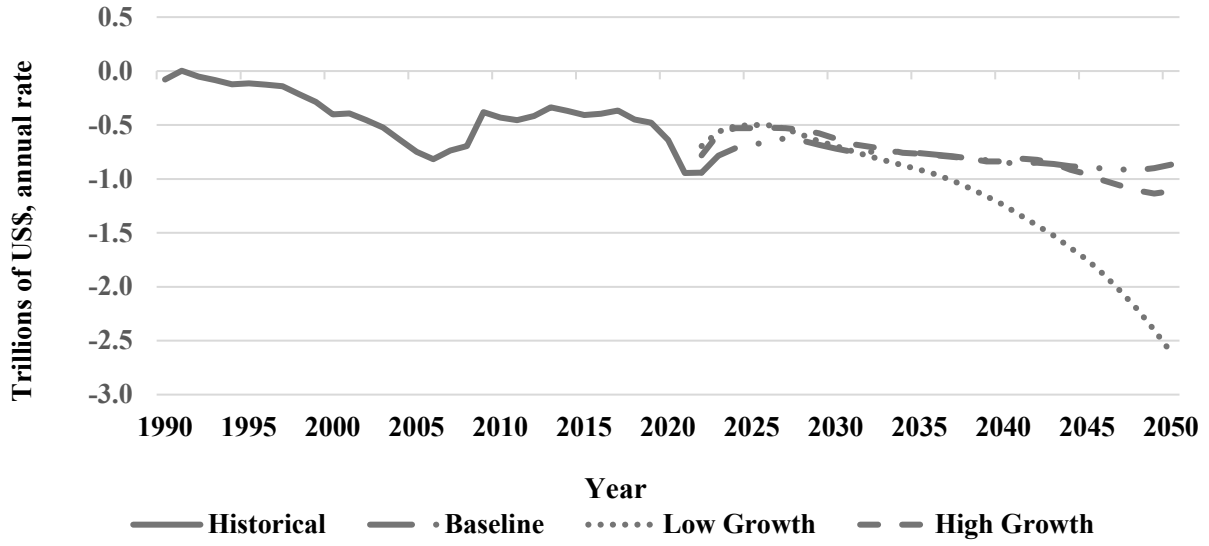



**Figure 4. Graph. Historical and Forecasted Balance on Current Account by Freight Analysis Framework Version 5 Scenario, 1990–2050.**

*Source: FHWA.*

The Federal budget remains in a deficit through 2050 (figure 5).

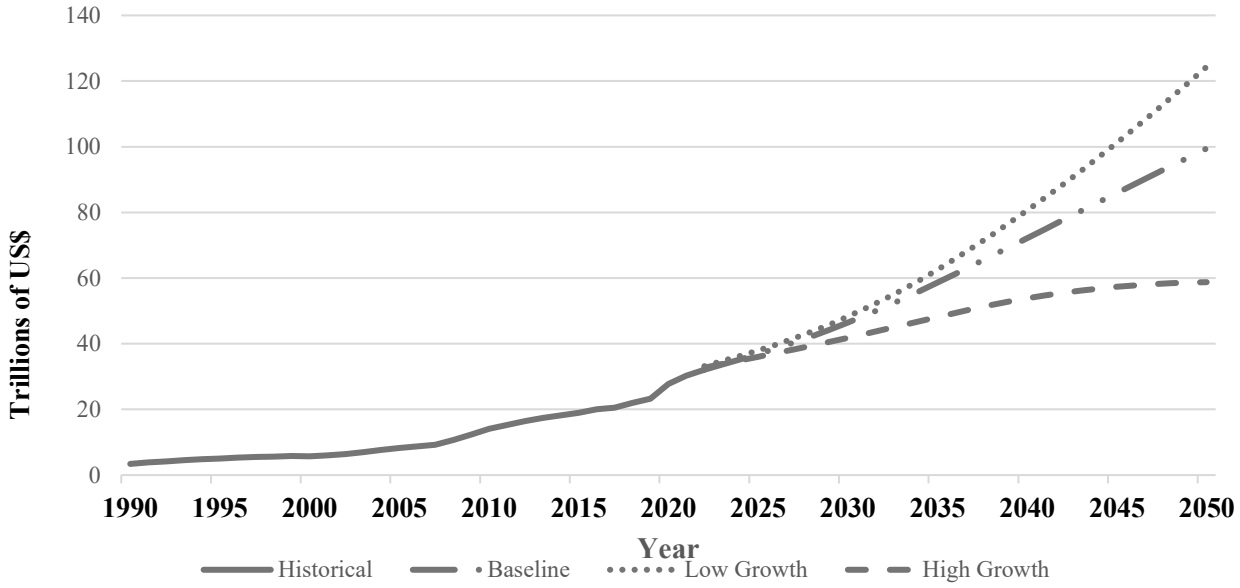



**Figure 5. Graph. Historical and Forecasted Outstanding Federal Debt by Freight Analysis Framework Version 5 Scenario, 1990–2050.**

*Source: FHWA.*

## ENERGY

Oil prices plunged in the first half of 2020 but have since recovered most of that decline. The Brent oil price is expected to exceed and remain above $100 per barrel after 2039.With

worldwide demand steadily increasing, OPEC will maintain some pricing power. The West Texas Intermediate oil price is projected to climb to $123 per barrel by 2050, compared with the 2011 average barrel price of $26 (figure 6). In the long run, scarcity tends to bring energy prices up, while new technologies tend to hold them down. In the end, these two forces will roughly balance out over the forecast period.

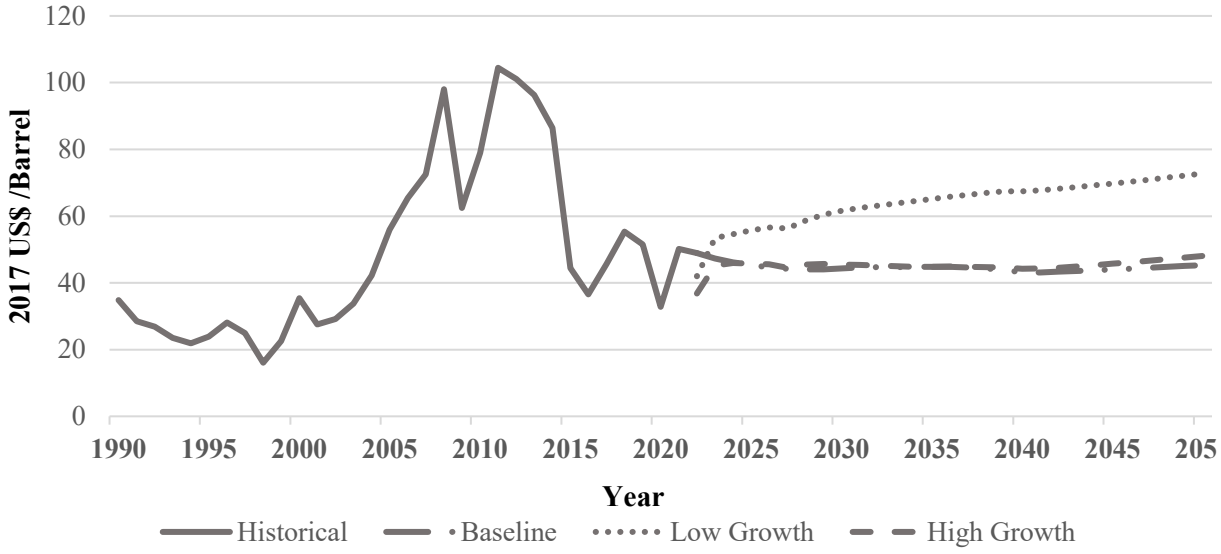



**Figure 6. Graph. Historical and Forecasted Real Oil Price Per Barrel, by Freight Analysis Framework Version 5 Scenario, 1990–2050.**

*Source: FHWA.*

In the low-growth scenario, nominal and real oil prices are higher than in the baseline. In the high-growth scenario, nominal and real oil prices are below what they are in the baseline. It is likely that there will be periods, possibly of several years at a time, when prices are either above or below the baseline. A price outcome higher than the projected baseline could result from stronger demand growth (perhaps notably in mainland China and India) or weaker supply (more disappointments in non-OPEC supply and loss of productive capacity in OPEC because of political upsets). A price outcome lower than the projected baseline could arise from recession, enforcement of higher efficiency standards, or better-than-expected supply prospects.

The unemployment rate peaked at 13.0 percent in the second quarter of 2020 and eventually settled around 4.6 percent (figure 7).

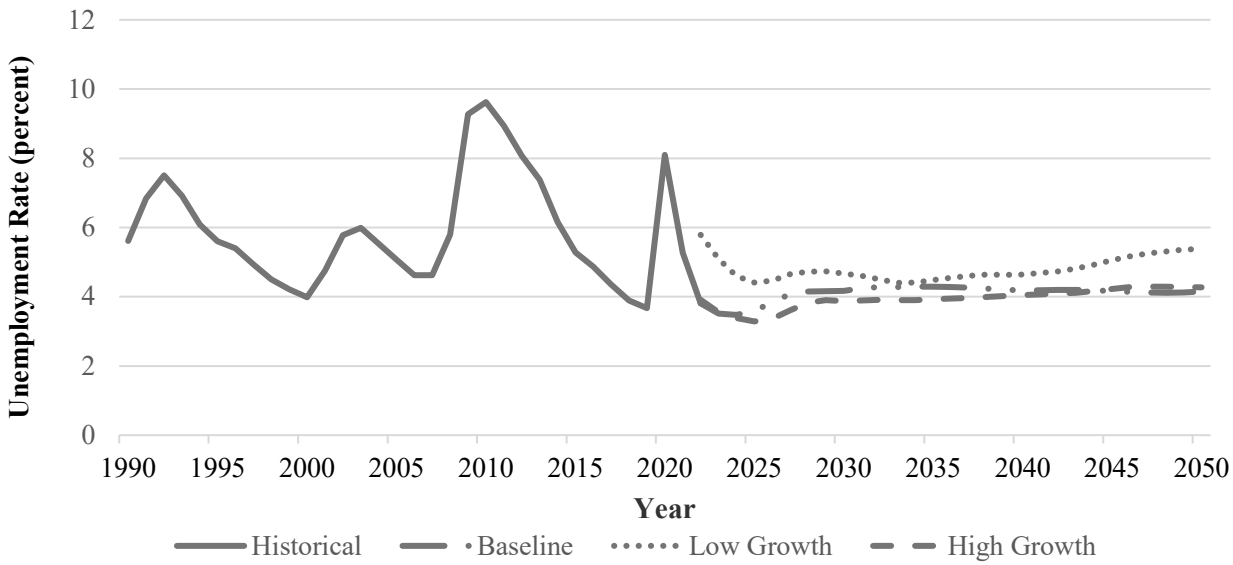



**Figure 7. Graph. Historical and Forecasted Unemployment Rate, by Freight Analysis Framework Version 5 Scenario, 1990–2050.**

*Source: FHWA.*

## DEMOGRAPHICS

Demographic factors are a primary driving force in any long-term economic projection. The population's growth rate and changes in its composition have considerable impacts on the labor force, the employment rate, housing demand, and other spending categories, most notably health services consumption and State and local governments' purchases.

The baseline projection is based on specific assumptions about immigration, fertility, and mortality rates. According to projections, the fertility rate will fall, while the mortality rate is forecasted to continue to improve. Meanwhile, net immigration is expected to rise on average by about 1 million per year through 2050. Based on these assumptions, the U.S. population will average 0.4-percent growth per year through 2050, down from the 0.9-percent pace during the last 30 years. Thus, total population will rise from 330 million in 2020 to 376 million in 2050 (figure 8).

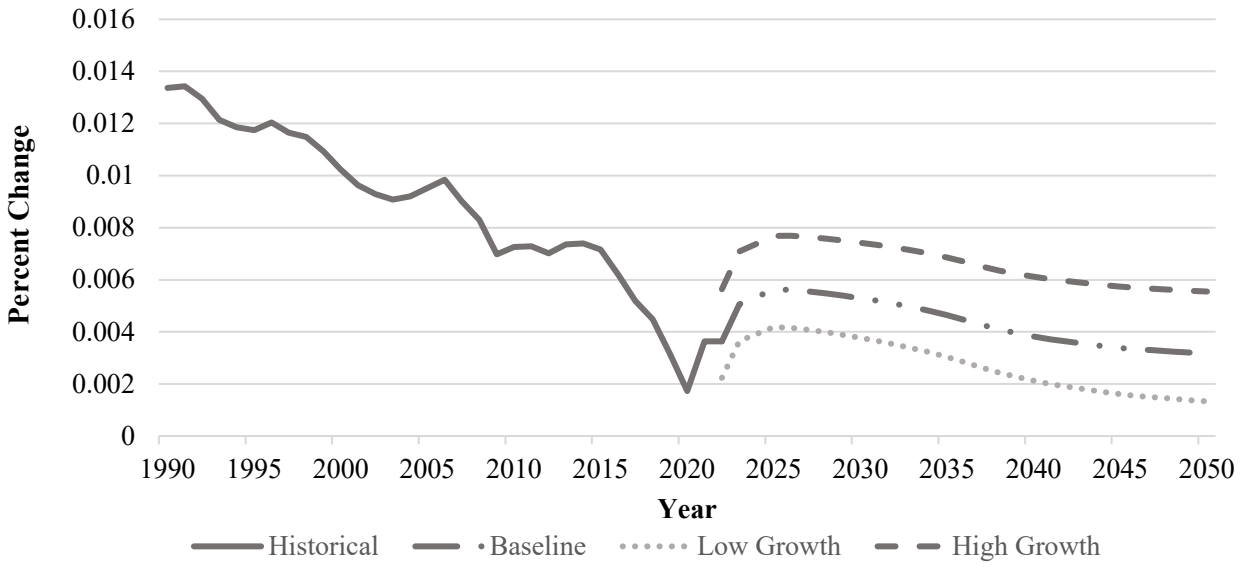



**Figure 8. Graph. Historical and Forecasted Population Change, by Freight Analysis Framework Version 5 Scenario, 1990–2050.**

*Source: FHWA.*

The population's age distribution is also an important factor in the long-term outlook. As baby boomers continue to retire, the share of the U.S. population aged 65 years and over will jump from 17 percent in 2020 to 23 percent by 2050, increasing spending for Social Security, Medicare, and Medicaid. In addition, the growth rate of the working-age population will slow more than that of the overall population. After increasing 0.9 percent annually over the past 30 years, the population aged 16 to 64 years will grow only 0.2 percent over the forecast period.

The high- and low-growth alternatives embody population projections different from those in the baseline forecast. The high-growth outlook assumes the U.S. population will increase at a quicker rate because of higher net immigration. Conversely, the low-growth alternative constricts growth in the labor force because of lower assumed net immigration from the start of the forecast period. As a result, annual population growth averages 0.6 percent in the high-growth scenario and 0.3 percent in the low-growth scenario. By 2050, the current population increases to 402 million in the high-growth projection but to only 357 million in the low-growth scenario, compared with 376 million in the baseline.

## MONETARY POLICY AND INFLATION

Monetary policy remains important in the long-term projections, not so much in determining the level of output, but rather in determining the rate of inflation. Ultimately, the Federal Reserve determines the steady-state inflation rate. Monetary policy can cause inflation to accelerate by being overly accommodative and pushing the unemployment rate temporarily below the rate at which inflation is stable. Alternatively, it can cause inflation to decelerate by being restrictive and pushing the unemployment rate temporarily above the rate at which inflation is stable. In this forecast, it is assumed that the Federal Reserve's ultimate goal is a stable inflation rate. The CPI inflation rate is volatile in the early years of the forecast because of erratic oil prices and eventually settles to about 2.6 percent. Bond yields will generally move parallel to the funds rate

over the forecast interval but run somewhat higher. The yield on the 10-year Treasury note rises slowly and eventually converges to about 3.1 percent. The forecast implies a real Federal funds rate of about −0.3 percent and a real long-term bond rate of 0.4 percent (figure 9). In the high-growth scenario, the Federal Reserve is assumed to keep a tighter rein on the money supply, permitting little acceleration of inflation. Conversely, in the low-growth scenario, the Federal Reserve is assumed to be reluctant to put the economy through the pain necessary to bring inflation back to baseline levels, choosing instead to tolerate an inflation rate that is higher than in the baseline.

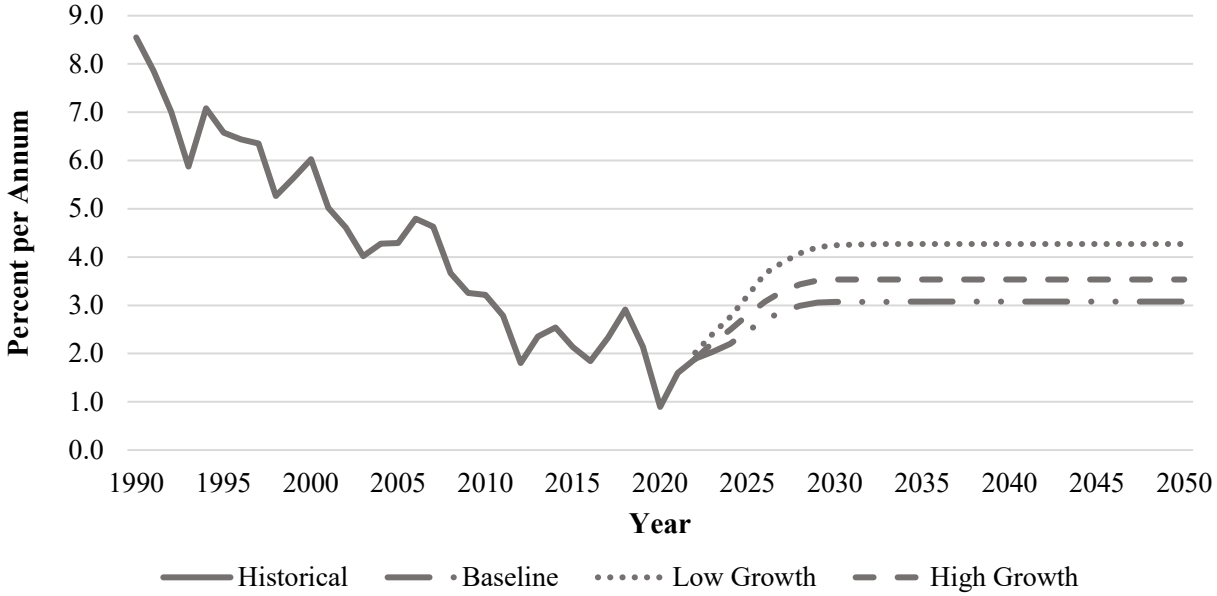



**Figure 9. Graph. Historical and Forecasted Yield on 10-Year Treasury Notes, by Freight Analysis Framework Version 5 Scenario, 1990–2050.**

*Source: FHWA.*

## INTERNATIONAL

In the baseline projection, the major U.S. trading partners are assumed to follow a growth pattern similar to that in the United States, with the pace of growth averaging 1.6 percent over the forecast period, down from an average of 1.8 percent for the past 30 years. This slowdown reflects demographic forces similar to those operating in the United States. Steady pressure from the current account deficit causes the real value of the dollar to fall sharply until 2023 and appreciate unevenly thereafter, while remaining well below the high of the second quarter of 2020.Variations in the international environment are reflected in the alternative scenarios.

## DEMAND MIX

Although the overall level of output is determined by supply conditions, many mixes of aggregate demand are consistent with that level of output. For the forecast period, the demand mix will be dominated by the need to boost exports to balance the current account. The share of GDP going to exports increases slightly from 10 percent in 2020 to 12 percent in 2050. The sum of the remaining shares of GDP must decline to make room for the rising share devoted to

exports. Government spending will bear some of the burden from 2021 to 2050; the government's share of GDP will decline about 5 percentage points. Real net exports from 1990 to 2050 for the three scenarios are outlined in figure 10.

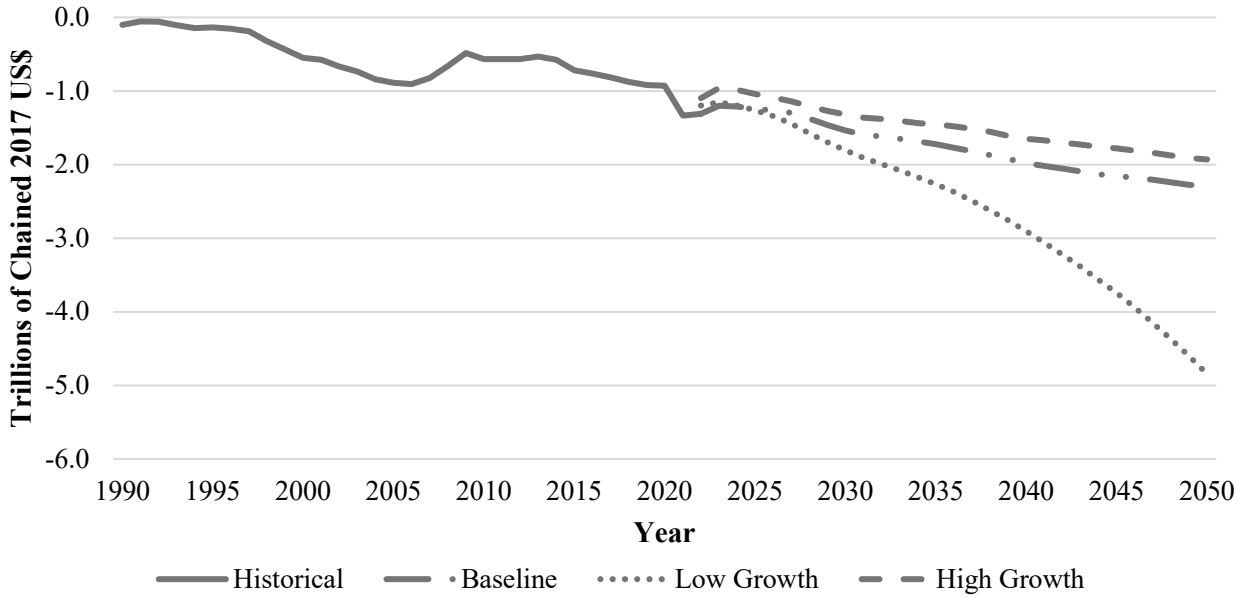



**Figure 10. Graph. Historical and Forecasted Real Net Exports of Goods and Services, by Freight Analysis Framework Version 5 Scenario, 1990–2050.**

*Source: FHWA.*

## INDUSTRIAL PRODUCTION AND EMPLOYMENT

Industrial production growth is forecasted in the baseline scenario to average 1.7 percent from 2021 to 2050, a modest increase in the 1.5-percent average annual growth experience from 1990 to 2020. In the low-growth scenario, by 2050, the index of industrial production is about 16 percent below the baseline level (figure 11). In the high-growth scenario, with an annual average growth of 2.4 percent, industrial production more than doubles from the 2020 to 2050. The United States saw average annual nonfarm business productivity growth of 1.5 percent from 1990 to 2020. In the FAF5 forecast baseline scenario, productivity growth averages 1.9 percent from 2020 to 2050, while under the low-growth scenario, productivity growth averages 1.4 percent annually. The high-growth scenario includes a forecast annual average productivity growth of 2.3 percent from 2020 to 2050, reflecting greater investment in productivity-enhancing technology and processes.

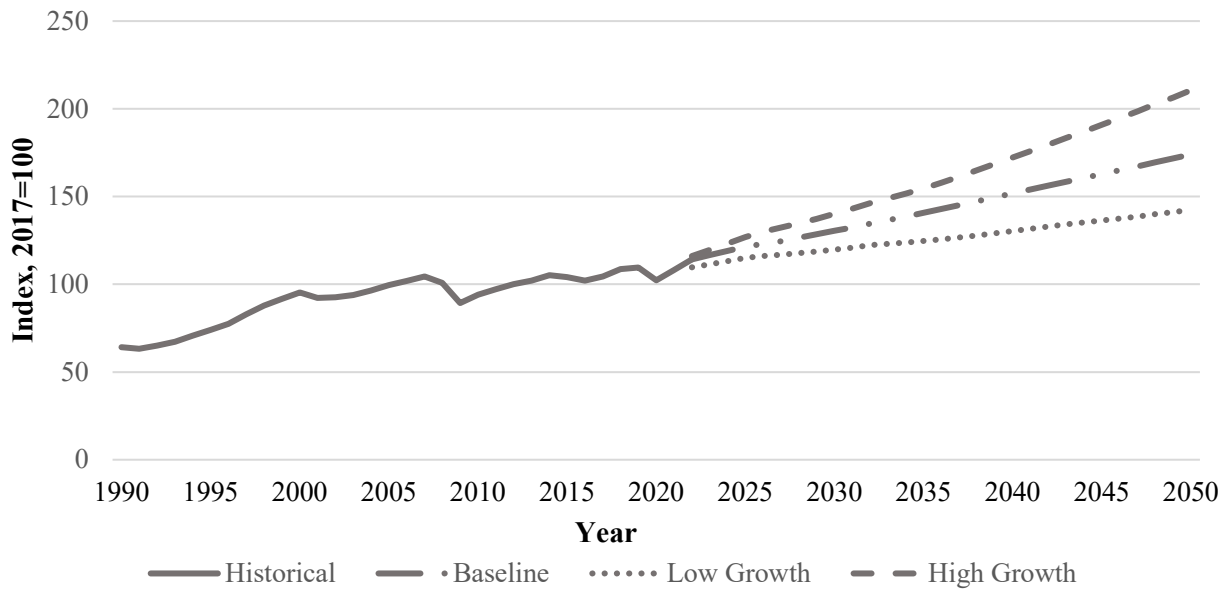



**Figure 11. Graph. Historical and Forecasted Industrial Production by Freight Analysis Framework Version 5 Scenario, 1990–2050.**

*Source: FHWA.*

In the forecast period, employment is partly dependent on the size of the available labor force, which is affected by demographics, labor force participation, and policy. Under the baseline scenario, labor force growth averages 0.6 percent annually from 2020 to 2050. That is 0.2 percent slower average annual growth than during the 1990 to 2020 period, primarily due to changing demographics of slower population growth and an aging population with more retirees. The low-growth scenario has an average of 0.2-percent labor force growth, while the high-growth scenario has an average of 0.9-percent labor force growth. In terms of number of employees in workforce, from 2020 to 2050, total payroll employment rises by about 32 million in the baseline, 40 million in the high-growth, and 24 million in the low-growth scenario. Historically, the last 30 years saw payrolls increase by about 34 million workers. Payroll employment in the high-growth scenario is about 5 percent above its baseline level by 2050. Manufacturing employment is 12.4 million in 2050 in the high-growth scenario, up only slightly from 2020. In the low-growth scenario, manufacturing payrolls decline to 11.2 million (figure 12).

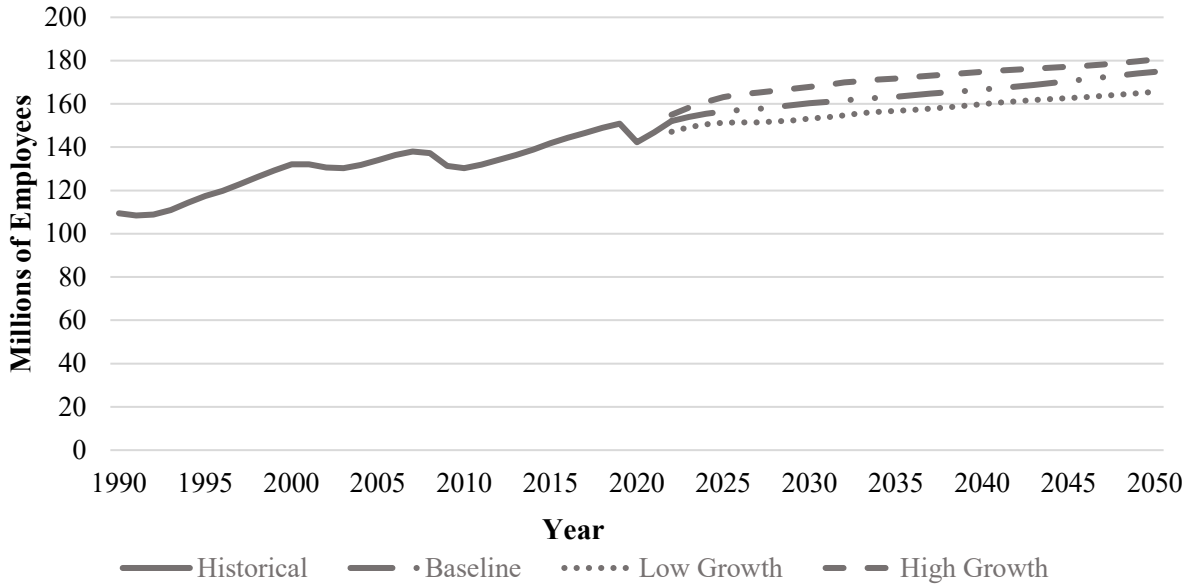



**Figure 12. Graph. Historical and Forecasted Total Nonfarm Payrolls, 1990–2050.**
*Source: FHWA.*

Table 1 summarizes the employment forecasts for the growth scenarios by industry. Employment growth forecasts vary significantly by sector, reflecting differences in the outlook by sector in the economy, including a few with declines in employment projected under all three scenarios.

**Table 1. Employment Forecasts, by Industry, by Freight Analysis Framework Version 5 Scenario (Percentage Change)**

| Industry | History: 1992–2020 | Baseline: 2021–2050 | High Growth: 2021–2050 | Low Growth: 2021–2050 |
|---|---|---|---|---|
| Mining | 1.0 | 0.6 | 1.0 | 0.5 |
| Utilities | 1.1 | 0.9 | 1.2 | 0.4 |
| Manufacturing (SIC basis) | 1.6 | 2.2 | 3.0 | 1.5 |
| Food | 1.2 | 1.8 | 2.2 | 1.3 |
| Textile mills | −2.7 | −1.6 | 0.0 | −4.3 |
| Apparel | −7.8 | −1.5 | 0.0 | −1.9 |
| Logging | −0.4 | 0.1 | 0.8 | −0.2 |
| Furniture and related products | −0.1 | 0.5 | 2.0 | 0.1 |
| Paper and products | −0.7 | 0.5 | 2.6 | −0.5 |
| Newspapers, periodicals, books | −3.5 | 0.0 | 0.9 | −0.1 |
| Petroleum and coal products | 0.5 | −-0.6 | −0.3 | −0.7 |
| Chemicals | 0.7 | 2.4 | 3.4 | 2.1 |
| Rubber and plastics products | 1.0 | 1.3 | 2.8 | 1.0 |
| Leather and allied products | −3.8 | −2.5 | −0.9 | −2.7 |

| Industry | History: 1992–2020 | Baseline: 2021–2050 | High Growth: 2021–2050 | Low Growth: 2021–2050 |
|---|---|---|---|---|
| Nonmetallic mineral products | 0.5 | 1.0 | 1.8 | 0.4 |
| Primary metals | −0.1 | 0.4 | 1.8 | −0.1 |
| Fabricated metal products | 0.8 | 1.2 | 2.4 | 0.3 |
| Machinery | 0.9 | 2.1 | 2.8 | 1.4 |
| Computers and electronic products | 11.7 | 3.2 | 4.0 | 1.7 |
| Electronic equipment, appliances, and components | 0.2 | 1.8 | 2.4 | 1.1 |
| Transportation equipment | 1.3 | 1.8 | 2.7 | 1.2 |
| Miscellaneous | 1.2 | 2.7 | 3.4 | 1 |
| All manufacturing (NAICS) | 1.8 | 2.2 | 3.1 | 1.5 |
| Durable goods | 3.0 | 2.3 | 3.2 | 1.5 |
| Nondurable goods | 0.3 | 2.0 | 2.9 | 1.2 |
| All less computer communications, and chips | 0.4 | 1.9 | 2.8 | 1.3 |

NAICS = North American Industry Classification System; SIC = Standard Industrial Classification.

Table 2 summarizes key differences among the baseline, high-growth, and low-growth scenarios. The underlying rate of growth in the long-term trend forecast is consistent with history, as well as with inferences about the economy's unfolding structure. It can be regarded as the best unbiased projection of the economy.

**Table 2. Historical and Projected U.S. Macro Forecast Percentage Change by Freight Analysis Framework Version 5 Scenario, April 2021**

| Type | Macroeconomic Factor | History 1990–2020 | Baseline 2021–2050 | High Growth 2021–2050 | Low Growth 2021–2050 |
|---|---|---|---|---|---|
| Average annual real growth | Average annual real growth of potential output (smoothed value of full-employment real GDP, annual rate) | 2.5 | 2.0 | 2.4 | 1.4 |
| | Average annual real growth of GDP (real GDP, annual rate) | 2.3 | 2.1 | 2.6 | 1.6 |
| | Average annual real growth of consumption (real consumer spending: total personal consumption expenditures, annual rate) | 2.5 | 2.6 | 2.9 | 1.8 |
| | Business fixed investment | 4.0 | 2.7 | 3.4 | 2.2 |
| | Government | 1.2 | .6 | 0.7 | 0.2 |
| | Exports | 4.1 | 3.3 | 4.5 | 3.3 |
| | Imports | 4.7 | 3.9 | 4.1 | 3.1 |

| Type | Macroeconomic Factor | History 1990–2020 | Baseline 2021–2050 | High Growth 2021–2050 | Low Growth 2021–2050 |
|---|---|---|---|---|---|
| Average annual growth | Labor force | 0.8 | 0.6 | 0.9 | 0.3 |
| | Productivity | 2.0 | 1.9 | 2.3 | 1.4 |
| | Industrial production | 1.5 | 1.7 | 2.4 | 1.1 |
| | Inflation (chain-weight implicit GDP deflator) | 2.0 | 2.2 | 1.7 | 3.5 |
| Average level | Unemployment | 5.9 | 4.2 | 4.0 | 4.9 |
| | Average percent of GDP | N/A | N/A | N/A | N/A |
| | Fuel import bill | 1.4 | 1.1 | 1.0 | 1.8 |
| | Trade balance | −2.9 | −3.3 | −2.3 | −1.9 |
| | Federal deficit | −3.8 | −3.7 | −1.8 | −5.8 |
| | Fixed investment | 12.9 | 13.1 | 13.1 | 13.5 |

GDP = Gross Domestic Product.

N/A= Not available

## CHAPTER 3. FORECAST RESULTS

This section summarizes the FAF5 forecast results for the domestic, import, and export components and the relative growth trajectories of the high-growth and low-growth forecasts for domestic, import, and export freight flows.

The total forecast (domestic, import, and export) for the baseline, high-growth, and low-growth scenarios is represented in figure 13. Total tonnage growth from 2017 to 2050 is 46 percent, or an increase of freight flows at 1.1 percent compound annual growth rate (CAGR) for the FAF5 forecast period. The export forecast is expected to see the highest pace of growth, at 1.9 percent-CAGR, while import and domestic forecasts are expected to grow at 1.3 percent and 1.1 percent, respectively, during the FAF5 forecast period.

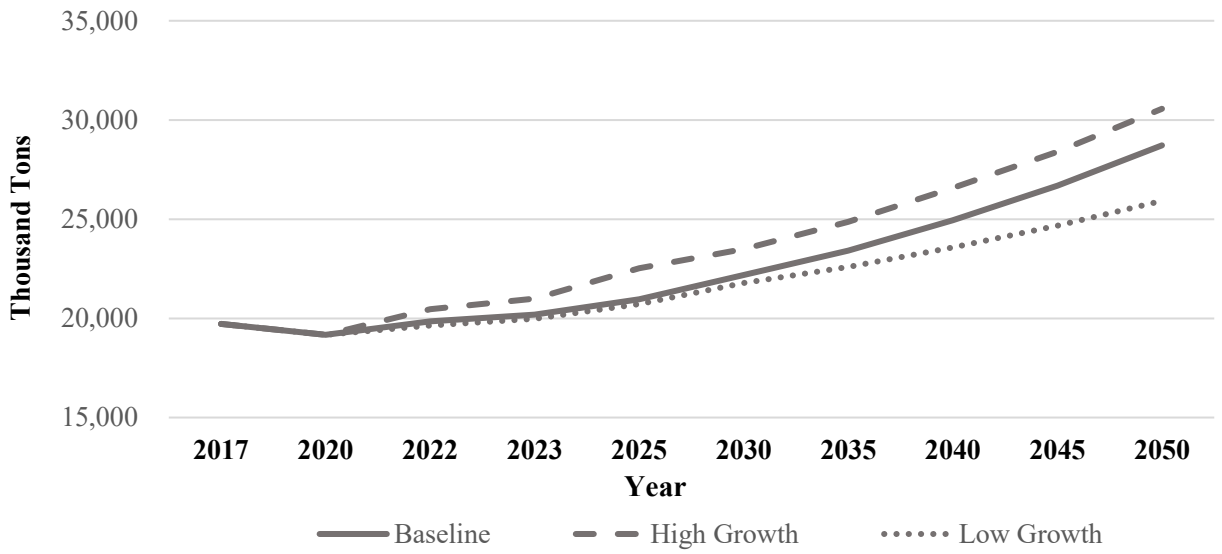



**Figure 13. Graph. Freight Growth From 2017 to 2050 by Freight Analysis Framework Version 5 Scenarios**

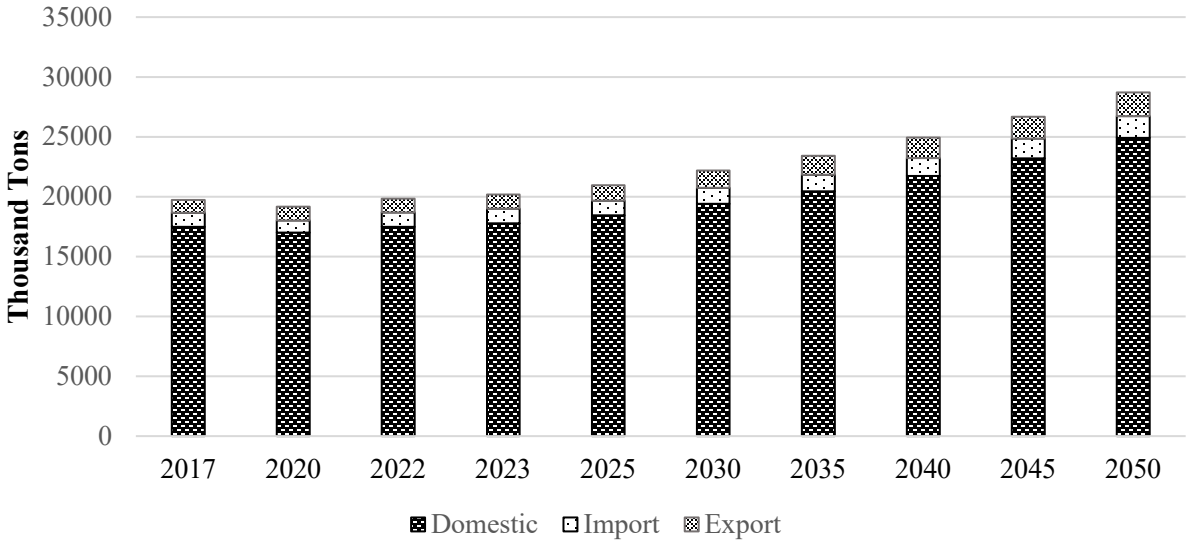
*Source: FHWA.*

The basis for the FAF5 tonnage forecast scenario results are the different levels of economic activity under each growth scenario. The high-growth scenario is characterized by strong GDP growth and moderate inflation, with higher growth rates in capital spending and productivity relative to the baseline forecast. The low-growth scenario forecast is expected to follow the baseline scenario closely until 2030, mostly because of escalating energy prices. The high-GDP-growth, low-inflation environment assumed in the high-growth scenario will be very favorable to a continuation of the high levels of durable-goods spending observed starting during 2020, such as that related to construction and motor vehicles. The low-growth scenario is assumed to remain close to the baseline until 2030, as government stimulus continues to support growth during this period, although growth is lower because of more moderate recovery in other sectors after the 2020 recession. Export growth is expected to remain strong because of increased demand for U.S.-produced goods from trading partner countries as well as the exchange rates between the currencies of the United States and each trading partner. The consequences for the

total tonnage growth forecasted under the high- and low-growth scenarios is expected to be 1.3 percent and 0.8 percent, respectively.

## BASELINE SCENARIO

The baseline scenario FAF5 forecast has three parts: domestic, imports, and exports. Between 2017 and 2050, U.S. freight flow tonnage is expected to grow by 9 billion tons: from 19.7 billion tons in 2017 to 28.7 billion tons in 2050 (figure 14).

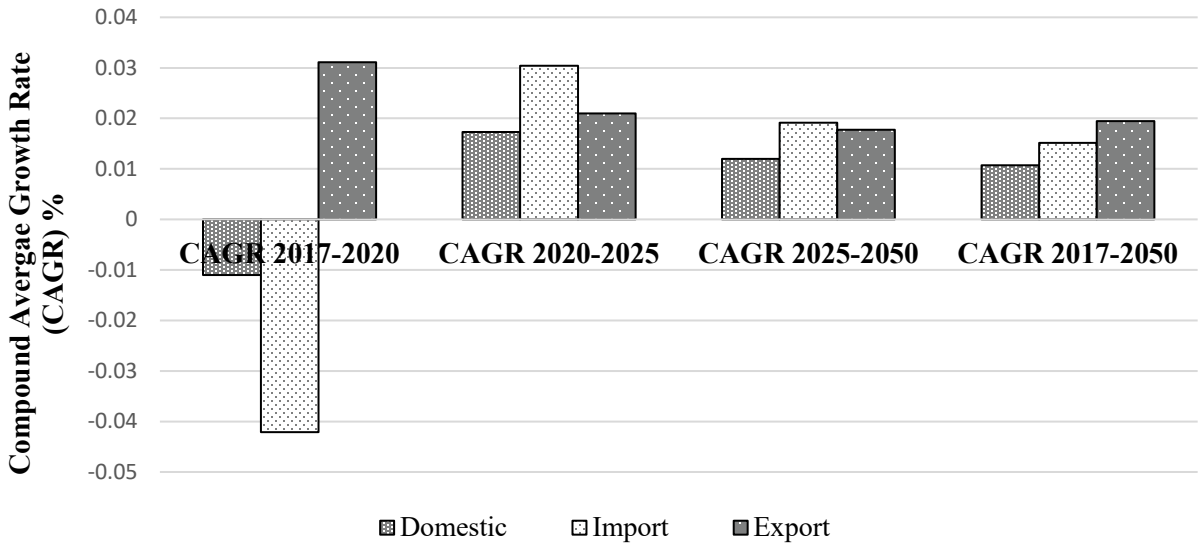



Note: 2017 is Freight Analysis Framework Version 5 base year.

**Figure 14. Chart. Freight Tonnage Forecast, Baseline Scenario.**

*Source: FHWA.*

This amounts to a CAGR of 1.1 percent from 2017 to 2050. Growth will be highest from 2020 to 2025, at 1.8 percent, reflecting the U.S. economy's rebound from the 2020 recession. Growth in tonnage will slow from 2025 to 2030 to 1.1 percent, reflecting the strong but modest growth forecasted for the macroeconomic outlook. Over the final 25 years of the forecast, total freight flow growth rates moderate, from 1.1 percent to 1.5 percent, reflecting longer term forecasts of the U.S. economy. During this time, imports and exports grow more rapidly, at 1.9 percent and 1.3 percent, respectively, while domestic flows growth moderates at 1.1 percent, partially reflecting lower long-term growth in U.S. domestic output as well as changing energy consumption (figure 15).




Note: 2017 is the Freight Analysis Framework Version 5 base year.

**Figure 15. Chart. Forecast Growth Rates for Domestic, Import and Export Freight Tonnage for Selected Time Periods, Baseline Scenario.**

*Source: FHWA.*

### Domestic Freight Flows

In the baseline scenario, total domestic freight flow tonnage grows by 7.4 billion tons from 2017 to 2050 (figure 16), an increase of nearly 43 percent, for a 1.1-percent CAGR.

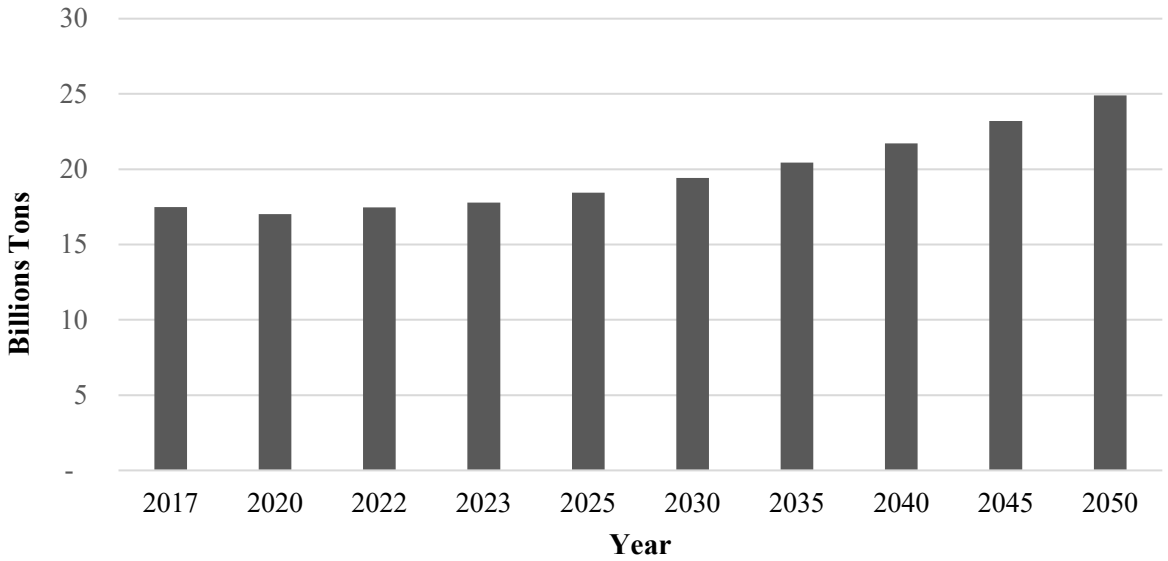



**Figure 16. Graph. Domestic Freight Flows Tonnage Forecast, Baseline Scenario.**

*Source: FHWA.*

However, that 33-year view masks key shorter-term trends. Specifically, the early years of the forecast period exhibit much higher growth because of recovery from the recession during 2020.

Moreover, the earlier year forecast strength reflects a generally stronger economic outlook earlier in the forecast period, as recent trends favor more modest but still robust growth from 2020 to 2025 of 1.8 percent. This more modest but still relatively strong growth in domestic tonnage reflects the macroeconomic forecast suggesting mostly favorable, albeit slowly declining, macroeconomic indicators through 2025. After 2025, the rate of growth is expected to slow to a steady 1.2-percent CAGR from 2025 to 2050, partially reflecting lower overall U.S. economic growth potential. However, a major factor weighing down long-term growth rates is the changing pattern of energy consumption and production in the United States.

The top 10 domestic freight flows in the FAF5 base-year database (table 3) include coal and petroleum products not elsewhere classified (n.e.c.) (SCTG2 19), including natural gas and natural gas liquids, gravel and crushed stone (SCTG2 12), gasoline (SCTG2 17), nonmetallic mineral products (SCTG2 31), cereal grains (SCTG2 2), fuel oils (SCTG2 18), and coal (SCTG2 15). Combined, these commodities represent about 57 percent of the total domestic tonnage moved in 2017. By 2050, however, some major shifts occur. Most notably, coal continues its major decline, falling to 33rd in the rankings. This reflects macroeconomic outlook assumptions for the continued shift in U.S. domestic power generation toward the use of natural gas and renewables. Meanwhile, by 2050, basic chemicals (SCTG2 20) rank as the 4th domestic commodity by tonnage, compared with 16th in 2017. Similarly, other prepared foodstuff (SCTG2 07) ranks as the 7th domestic commodity by tonnage in 2050, compared with 10th ranking in 2017. The strong growth in basic chemicals reflects the rapid investment in chemical manufacturing due to the availability of economical feedstocks from domestic natural gas exploration and production. Growth in other prepared foodstuff reflects the expected long-term growth in U.S. production and consumption of food and reflects expected U.S. population growth.

**Table 3. Top 10 Domestic Freight Flows in the Baseline Scenario, 2017, Total Tons**

| SCTG2 | SCTG2 Commodity | 2017 Tons (Million) | Rank 2017 | 2050 Tons (Million) | Rank 2050 | CAGR 2017–2050 (%) | Growth 2017–2050 (%) |
|---|---|---|---|---|---|---|---|
| 19 | Coal and petroleum products, n.e.c. | 2,538 | 1 | 4,126 | 1 | 1.5 | 63 |
| 12 | Gravel | 1,882 | 2 | 2,961 | 2 | 1.4 | 57 |
| 17 | Gasoline | 1,367 | 3 | 1,023 | 6 | −0.9 | −25 |
| 31 | Nonmetal mineral products | 1,227 | 4 | 1,845 | 3 | 1.2 | 50 |
| 2 | Cereal grains | 1,211 | 5 | 1,230 | 5 | 0.05 | 2 |
| 18 | Fuel oils | 875 | 6 | 778 | 10 | −0.4 | −11 |
| 15 | Coal | 790 | 7 | 96 | 33 | −6.2 | −88 |
| 3 | Other agricultural products | 648 | 8 | 709 | 13 | 0.3 | 9 |
| 41 | Waste/scrap | 642 | 9 | 703 | 14 | 0.3 | 10 |
| 7 | Other foodstuffs | 628 | 10 | 967 | 7 | 1.3 | 54 |

CAGR = compound annual growth rate; n.e.c. = not elsewhere classified; SCTG2 = Standard Classification of Transported Goods, two-digit level.

Gravel and stone (SCTG2 12) tonnage are expected to increase by 1.4 percent per year on average from 2017 to 2050, the result of new construction and ongoing maintenance and repair of the national transportation infrastructure network, which is linked in part to economic growth. Slow growth in cereal grains (SCTG2 2), at 0.05 percent, also relates to growth in the domestic economy, reflecting the use of these commodities for food and energy purposes. Coal and petroleum products' growth (SCTG2 19) at 1.5 percent is mostly due to growth in natural gas, liquefied petroleum gas (LPG), and petroleum products and byproducts as demand for these products is expected to increase. The increase in natural gas production in the United States is expected to continue as natural gas replaces coal as an energy source, especially with a goal to reduce greenhouse gas emissions by 2030[1]. The LPG production increase can be attributed to the adoption of LPG as an alternative fuel and its use as a cleaner energy source. The basic chemicals (SCTG2 20) increase at 3.7 percent is due to increased chemical production in the United States due to cheaper feedstocks from natural gas exploration and production.

Many of the commodity groups forecasted to see declines are related to the energy sector. Nuance is important in interpreting these results. In addition to general macroeconomic conditions, industry-specific factors contribute significantly to the forecasts. First, coal, which is primarily used to generate electricity, is in structural decline as represented by an annualized decline of 6.2 percent over the forecast period. The discovery and economic extraction of natural gas, combined with new gas-fired power plants' capital costs being less than coal-powered plants' capital costs and with solar and wind power equipment's lower costs, is significantly altering the long-term U.S. energy consumption mix profile. Development of renewable power generation and compliance with environmental regulations will also contribute to declining shares of coal-fired power generation and associated production and shipments. Meanwhile, natural gas and other petroleum-related products, such as natural gas liquids, rise through 2050, the former from displacements of coal use for domestic power generation and the latter mainly to supply a rejuvenated domestic chemicals and plastics manufacturing base. The growth in domestic energy product transportation peaks around 2025 as unconventional domestic energy production (e.g., shale gas) plays mature.

The fastest growing domestically moved commodities over the forecast interval also generally make up the lower ranked commodities in terms of weight. The bubble chart (figure 17) depicts the 10 commodities with the highest CAGR during the forecast interval. Historically, this group's growth rates reflect a gradual shift in the U.S. manufacturing base toward producing higher value goods that also require more technically advanced processes. In general, this trend still holds, as the fastest growing commodity groups are among the smallest in total tonnage and involve substantial value-added services.

Excluding basic chemicals, which ranks 16th by tonnage in 2017, the fastest growing commodity groups from 2017 to 2050 are:

- Live animals and fish (SCTG2 01) at 3.7 percent (rank 22 out of 42 by tonnage in 2050).
- Pharmaceutical products (SCTG2 21) at 3.6 percent (rank 36).

[1] https://www.whitehouse.gov/briefing-room/statements-releases/2021/04/22/fact-sheet-president-biden-sets-2030-greenhouse-gas-pollution-reduction-target-aimed-at-creating-good-paying-union-jobs-and-securing-u-s-leadership-on-clean-energy-technologies/

- Miscellaneous manufacturing products (SCTG2 40) at 3.2 percent (rank 23).
- Fertilizers (SCTG2 22) and chemical products (SCTG2 23), both at 3 percent (rank 18).
- Precision instruments (SCTG2 38) at 2.9 percent (rank 40).

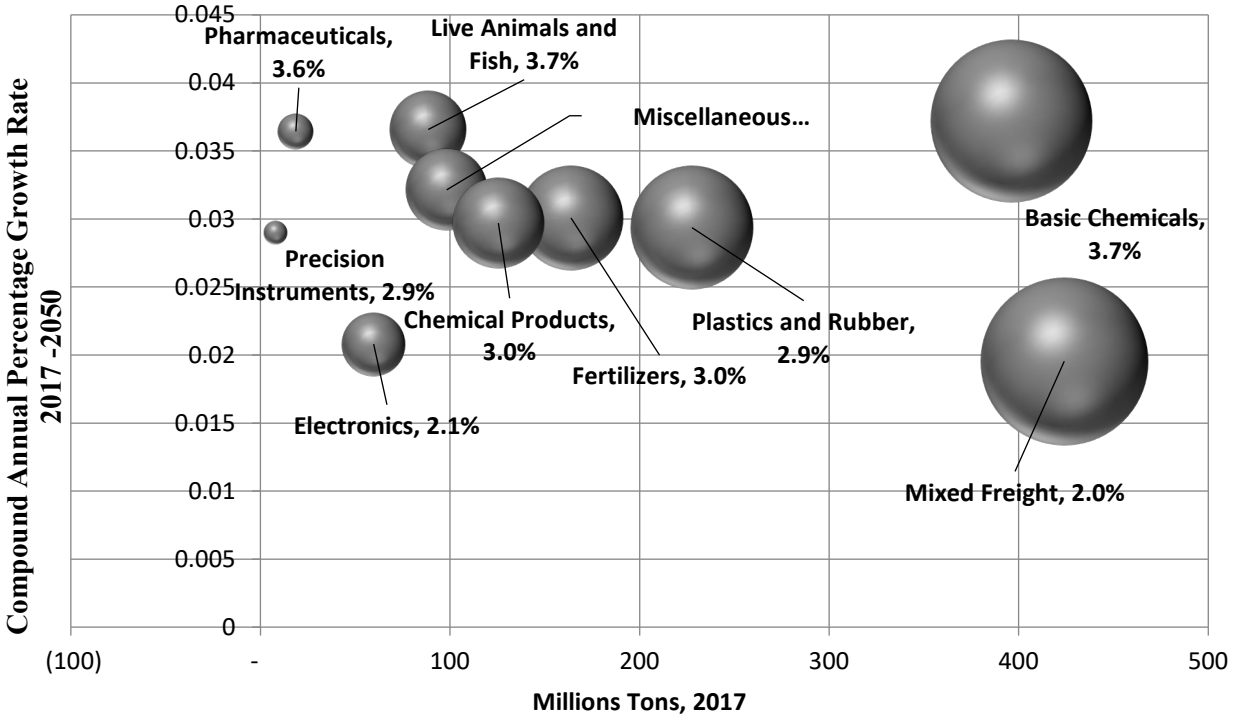



**Figure 17. Graph. Top 10 Fastest Growing Domestic Freight Flows, Baseline Scenario.**
*Source: FHWA.*

The bubble chart also illustrates some midsized commodity groups among the fastest growing. Specifically, basic chemicals (SCTG2 20, rank 16 in 2017) are forecasted to grow 3.7 percent from 2017 to 2050, mixed freight (SCTG2 43, rank 14 in 2017) are expected to grow 2.0 percent from 2017 to 2050, plastics and rubber (SCTG2 24, rank 20 in 2017) are expected to grow 2.9 percent from 2017 to 2050, and fertilizers (SCTG2 22, rank 21 in 2017) are expected to grow 3.0 percent from 2017 to 2050. They are all among the top 10 fastest growing domestic commodities from 2017 to 2050.

Growth in domestic chemical, plastic, and fertilizer transportation relates to the resurgence of chemical manufacturing in the United States. As detailed in the Domestic Freight Flows section above, abundant and relatively less expensive petrochemical feedstocks from domestic unconventional oil and gas extraction have contributed to the massive current and planned expansion of chemical manufacturing in the United States. These new plants are concentrated on the U.S. Gulf Coast, but there have also been investments in the regions of the Marcellus and Utica shale play areas of the Appalachian Mountains (mainly in Pennsylvania, West Virginia, and Ohio, but also in Kentucky and New York). The United States is switching from a long-held position as being a major petrochemical importer to being a major exporter of numerous widely traded petrochemical commodities, such as methanol and plastic resins. Growth in mixed freight reflects the increasing trend toward containerization and intermodal transportation, as well as the

associated growing importance of e-commerce fulfillment centers and warehousing and distribution centers supporting intermodal logistics for global and national supply chains. This trend is especially evident with growing e-commerce retail sales that accelerated tremendously during 2020.[2.]

The trend in real value of domestic freight matches the trend of tonnage growth. Figure 18 illustrates the growth in domestic commodity flow value, in real terms. From 2017 to 2020, real value drops by about $60 million (−0.1-percent CAGR) from $15.1 trillion to $15 trillion, and then grows by $2.4 trillion to $17.4 trillion by 2025 (3.0-percent CAGR from 2020 to 2025). Over the entire period of this forecast, value grows from $15.1 trillion in 2017 to $28.4 trillion in 2050, representing a CAGR of 1.9 percent.

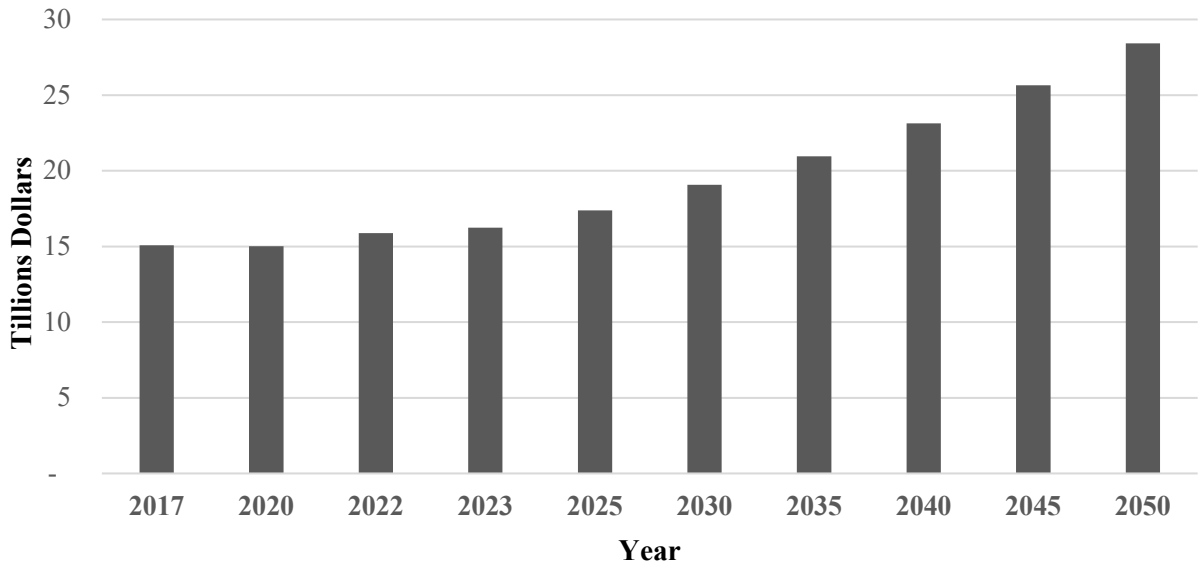



**Figure 18. Graph. Domestic Freight Flows Forecast for Real Value, Baseline Scenario.**
*Source: FHWA.*

The real value measure, which is based on the 2017 U.S. dollar, excludes the impact of inflation for future years. According to this forecast, the growth rate of real value (1.9-percent CAGR) exceeds the growth rate of tonnage (1.1-percent CAGR), indicating that the mix of domestically moved tonnage evolves over time toward higher value commodities (basic chemicals (SCTG2 20) are expected to grow 3.7 percent from 2017 to 2050; pharmaceutical products (SCTG2 21) are expected to grow 3.6 percent from 2017 to 2050; miscellaneous manufactured products (SCTG2 40) are expected to grow 3.2 percent from 2017 to 2050)).

**Export Freight Flows**

In general, demand for U.S. exports is influenced by each trading partner's demand for U.S.-produced goods as well as the relative currency exchange rates between the United States and each trading partner and international trade policies, such as tariffs. Starting in the years of

[2]U.S. Department of Commerce, U.S. Census Bureau, Economic Indicators Division, Retail Indicator Branch. "Quarterly U.S. Retail E-commerce **S**ales: 4th Quarter 2020," February 19, 2021, https://www2.census.gov/retail/releases/historical/ecomm/20q4.pdf.

economic recovery following the 2008–2009 Great Recession, the U.S. dollar has gained strength compared with other currencies up through the 2020 recession. A stronger U.S. dollar has dampened the U.S. export growth generally, as export prices are converted to higher prices in foreign currency terms. The strong dollar is effectively making U.S.-produced goods relatively more expensive for foreigners to buy. In addition, trade policies the U.S. government has pursued since 2016 and tariffs the trade partner countries have applied to U.S. exports over this time dampened the demand for the U.S. goods exported to affected countries.

Coming out of the 2020 recession, recent strengthening of U.S. growth compared with lagging recoveries in Europe and many developing economies has led to an appreciation of the U.S. dollar relative to other global currencies in 2020. This trend will contribute to the U.S. import growth increasing more rapidly than export growth from 2020 to 2022. The baseline scenario forecast is based on the assumption that the trend will start to reverse in 2021 and 2022, as the rest of the world is also in recovery, and economic growth increases more outside of the United States. This situation will see the dollar depreciate and U.S. exports rise faster than imports.

With foreign country demand growth, trade policies, and exchange rates as key factors, U.S. exports are forecasted to grow at 2.8 percent from 2017 to 2020, compared with 1.9 percent over the entire forecast period. Exports will grow the fastest between 2020 and 2025, at an annualized rate of 2.0 percent, including the current strong recovery from the 2020 recession. Figure 19 illustrates the export flow forecasts over the FAF5 forecast period.

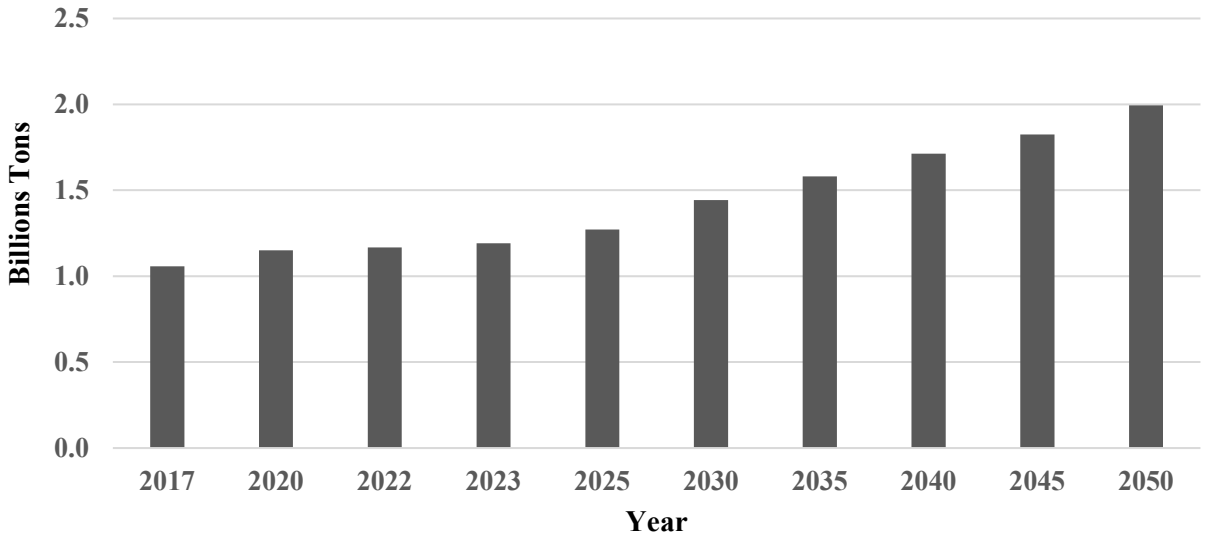



**Figure 19. Graph. U.S. Export Freight Tonnage Flows, Baseline Scenario.**
*Source: FHWA.*

Not surprisingly, export growth is led by trade with Southeastern and Southwestern Asia, Canada, and the rest of the Americas, at growth rates of 3.0 percent, 3.0 percent, 2.3 percent, and 2.4 percent, respectively, from 2017 to 2050. Developing Asian countries' growth is expected to increase at about 0.9 percent over the forecast period from 2017 to 2050. Growth is highest for basic chemicals (SCTG2 20), plastics (SCTG2 24), pharmaceuticals (SCTG2 21), other agricultural products (SCTG2 3), and transportation equipment (SCTG2 37), at 2.1 percent,

3.7 percent, 2.7 percent, 1.7 percent, and 1.8 percent, respectively. Eastern Asia represents the largest historical U.S. trading partner region and includes the countries of China, Japan, and South Korea. As these countries are faced with slow or even declining population and workforce growth in the long term, their importance to the United States among total world trade diminishes through the forecast period.

U.S. cross-border exports to Canada and Mexico are expected to remain strong, partly as a result of the effects of the U.S.-Mexico-Canada Agreement, which replaced the North American Free Trade Agreement in 2020, and partly due to shifts in U.S. supply chain country sourcing practices following the recent-year disruptions to overseas U.S. trade. Table 4 illustrates growth by region from 2017 to 2050.

Export growth to other regions will vary from 0.9 percent to 2.4 percent annually (table 4). Exports to Europe, currently the fifth largest U.S. export market, will see the slowest regional growth, 0.9 percent, from 2017 to 2050. Headwinds for long-term economic growth in Europe result in lower consumer demand and, hence, slowing demand for U.S. exports.

**Table 4. U.S. Export Tons by Destination, Baseline Scenario**

| Region Code | Destination Region | Export Tons, 2017 (million) | Export Tons, 2050 (million) | CAGR 2017–2050 (%) | Growth 2017–2050 (%) |
|---|---|---|---|---|---|
| 801 | Canada | 191 | 404 | 2.3 | 112 |
| 802 | Mexico | 201 | 397 | 2.1 | 98 |
| 803 | Rest of Americas | 158 | 347 | 2.4 | 120 |
| 804 | Europe | 143 | 192 | 0.9 | 34 |
| 805 | Africa | 26 | 48 | 1.9 | 85 |
| 806 | Southwestern and Central Asia | 62 | 163 | 3.0 | 163 |
| 807 | Eastern Asia | 222 | 299 | 0.9 | 35 |
| 808 | Southeastern Asia and Oceania | 55 | 145 | 3.0 | 164 |
| | Total | 1,058 | 1,994 | 1.9 | 88 |

CAGR = compound annual growth rate.

In terms of total tons in 2017, the largest exported commodity was coal (SCTG2 15), with 119 million tons, followed by fuel oil (SCTG2 18), with 117 million tons, and cereal grains (SCTG2 2), with 103 million tons. The declining use of coal translates to 1.5 percent reduction from 2017 to 2050, making it only the 12th highest exporting commodity by volume. Fuel oils (SCTG2 18) will top exports in 2050 with 1.7 percent compound annual growth, followed by crude petroleum (SCTG2 16), animal feed (SCTG2 4), coal and petroleum products (SCTG2 19) growing by 2.9 percent, 2.5 percent, and 2.4 percent, respectively (table 5). Crude petroleum export was very strong in 2020, especially with the introduction of fracking and the reduction of imported oil into United States. Crude exports have been very strong from 2017 to 2020 but are expected to remain flat from 2020 to 2050.

**Table 5. Top 10 Export Commodities in 2017 by Tonnage, Baseline Scenario**

| SCTG2 | SCTG2 Commodity | 2017 Tons (Million) | Rank 2017 | 2050 Tons (Million) | Rank 2050 | CAGR 2017–2050 (%) | Growth 2017–2050 (%) |
|---|---|---|---|---|---|---|---|
| 15 | Coal | 119 | 1 | 74 | 12 | −1.5 | −38 |
| 18 | Fuel oils | 117 | 2 | 203 | 1 | 1.7 | 74 |
| 2 | Cereal grains | 103 | 3 | 152 | 4 | 1.2 | 48 |
| 3 | Other agricultural products | 75 | 4 | 132 | 6 | 1.7 | 76 |
| 19 | Coal and petroleum products, n.e.c. | 72 | 5 | 159 | 3 | 2.4 | 121 |
| 17 | Gasoline and aviation turbine fuel | 68 | 6 | 136 | 5 | 2.1 | 100 |
| 16 | Crude petroleum oil | 64 | 7 | 163 | 2 | 2.9 | 155 |
| 20 | Basic chemicals | 56 | 8 | 113 | 8 | 2.2 | 102 |
| 41 | Waste/scrap | 48 | 9 | 124 | 7 | 2.9 | 158 |
| 4 | Animal feed | 42 | 10 | 95 | 9 | 2.5 | 126 |

CAGR = compound annual growth rate; n.e.c. = not elsewhere classified; Standard Classification of Transported Goods, two-digit level.

Major U.S. export gateways are shown in table 6. Agricultural products are the most-exported commodity from New Orleans in terms of tons in 2017. Other high-volume commodities are fuel oils I (SCTG2 18), coal (SCTG2 15), and crude petroleum (SCTG2 16). Fuel oils, crude, and basic chemicals are exported mainly through Houston and other parts of Texas. Commodities exported through Detroit are mainly petroleum products, crude, and vehicles. Exports from region 512 (Virginia Beach-Norfolk) are 60 percent coal and are expected to decline 1.7 percent from 2017 to 2050, which will result in export growth in this region for the forecast period of 0.1 percent.

**Table 6. Top 10 Export Gateways in 2017, Baseline Scenario**

| Region Code | Port | Export Tons, 2017 (million) | Export Tons, 2050 (million) | CAGR, 2017–2050 (%) |
|---|---|---|---|---|
| 223 | New Orleans, LA-MS (Louisiana part) | 129 | 218 | 1.6 |
| 486 | Houston, TX | 100 | 221 | 2.4 |
| 261 | Detroit, MI | 69 | 182 | 3.0 |
| 489 | Rest of Texas | 57 | 106 | 1.9 |
| 512 | Virginia Beach-Norfolk, VA-NC (Virginia part) | 54 | 56 | 0.1 |
| 61 | Los Angeles, CA | 47 | 89 | 2.0 |
| 487 | Laredo, TX | 46 | 91 | 2.1 |
| 483 | Corpus Christi, TX | 46 | 87 | 1.9 |
| 482 | Beaumont, TX | 38 | 83 | 2.4 |
| 380 | North Dakota | 35 | 74 | 2.3 |

CAGR = compound annual growth rate.

The growth in the real value of U.S. exports will slightly outpace tonnage growth. As illustrated in figure 20, export value in the baseline scenario grows from $1.5 trillion in 2017 to $3.1 trillion by 2050, a CAGR of 2.1 percent.

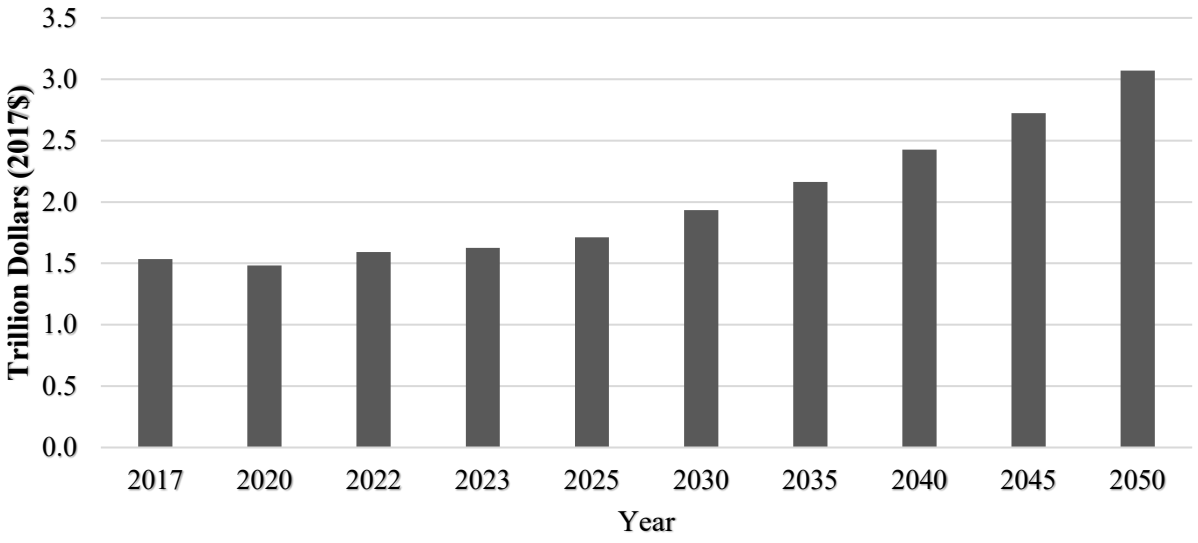



**Figure 20. Graph. Real Value of Export Freight Flows, Baseline Scenario.**
*Source: FHWA.*

### Import Freight Flows

Demand for imports is also affected by the overall demand for goods, trade policy, and the relative strength of the dollar versus other currencies. From 2011 through 2020, the

strengthening dollar exchange rate boosted import price competitiveness and boosted import volumes. However, after 2020 a weakening of the dollar is forecasted to dampen demand for imports, as many imports become relatively more expensive compared with domestically produced goods. Thus, the overall trend in imports diverges from that of exports. Imports dropped 5.1 percent from 2017 to 2020 due to import tariffs and the drop in trade during the 2020 recession. The near-term forecast from 2020 to 2022 is for imports' increase of 9.1 percent annually, due to strong demand for e-commerce, consumer, and home goods imported from mostly Asian countries. Import demand is then forecasted to grow more slowly during the 2022 to 2030 period (1.2-percent CAGR), during which the U.S. dollar initially appreciates and, after which, grows slightly to an average of 1.6 percent from 2030 to 2050. Figure 21 illustrates the forecast of tons of U.S. import growth, which is expected to increase from 1.2 billion tons in 2017 to 1.8 billion tons in 2050 (1.3-percent CAGR).

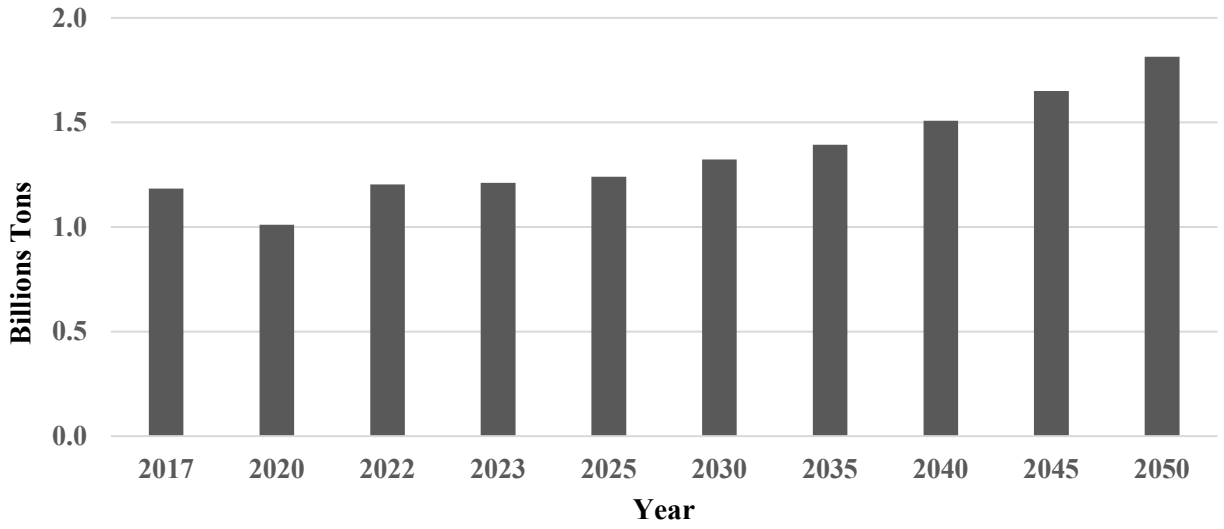



**Figure 21. Chart. Import Freight Flows in Tonnage, Baseline Scenario.**
*Source: FHWA.*

Canada retains its role as the leading U.S. trade partner, with a growth of 1.7 percent from 2017 to 2050. Imports from the Southeastern Asia and Oceania regions are expected to have the highest average growth from 2017 to 2050, at 2.0 percent, mostly due to increased importance of this region. Manufacturing and sourcing will move away from China gradually, particularly as manufacturing growth spreads further to lower cost emerging economies, such as Vietnam and Bangladesh. Table 7 illustrates growth in import tonnage by region from 2017 to 2050.

**Table 7. Import Tons by Foreign Origin, Baseline Scenario**

| Region Code | Origin Region | Import Tons, 2017 (million) | Import Tons, 2050 (million) | CAGR, 2017–2050 (%) | Growth, 2017–2050 (%) |
|---|---|---|---|---|---|
| 801 | Canada | 441 | 776 | 1.7 | 76 |
| 803 | Rest of Americas | 165 | 196 | 0.5 | 19 |
| 806 | Southwestern and Central Asia | 133 | 102 | −0.8 | −23 |
| 807 | Eastern Asia | 121 | 227 | 1.9 | 88 |
| 802 | Mexico | 118 | 211 | 1.8 | 79 |
| 804 | Europe | 114 | 193 | 1.6 | 69 |
| 805 | Africa | 56 | 40 | −1.0 | −29 |
| 808 | Southeastern Asia and Oceania | 36 | 69 | 2.0 | 92 |
| | Total | 1,184 | 1,815 | 1.3 | 53 |

CAGR = compound annual growth rate.

Nevertheless, Eastern Asia remains a very important growing origin for U.S. imports (1.9-percent CAGR over the FAF5 forecast period), continuing a long-term, yet slowing trend in manufacturing in China, South Korea, Japan, and elsewhere for export. Imports from Mexico are also expected to remain strong and grow 1.8 percent from 2017 to 2050, mainly due to growth in imports of manufacturing products, vehicles, consumer goods, and agriculture. Imports from Africa and Southwestern and Central Asia are expected to drop over the forecast period from 2017 to 2050, at 1.0 percent and 0.8 percent, respectively. This drop is mostly due to a drop in imports of energy products from Africa and Southwestern and Central Asia.

Crude petroleum (SCTG2 16) was the most imported commodity in 2017, with 438 million tons, and will be the top-ranked commodity in 2050, growing at a 0.3-percent CAGR. Canada's share of imported crude will almost double by the end of the forecast period as imports from the rest of the Americas and Southwestern and Central Asia drop. Coal and petroleum products (SCTG2 19), fuel oils (SCTG2 18), and gasoline (SCTG2 17) will all decrease significantly by 2050 as demand for alternative fuels increases. Fertilizers (SCTG2 22), mainly from Canada, and nonmetallic minerals (SCTG2 31) from the Americas will increase by 3.7 percent and 3.3 percent, respectively, substituting energy products in the top 10 imports (table 8).

**Table 8. Top 10 Imported 2017 Commodities by Total Tons, Baseline Scenario**

| SCTG2 | SCTG2 Commodity | 2017 Tons (million) | Rank 2017 | 2050 Tons (million) | Rank 2050 | CAGR 2017–2050 (%) | Growth 2017–2050 (%) |
|---|---|---|---|---|---|---|---|
| 16 | Crude petroleum | 438 | 1 | 484 | 1 | 0.3 | 11 |
| 19 | Coal and petroleum products, n.e.c. | 69 | 2 | 48 | 10 | −1.1 | −30 |
| 18 | Fuel oils | 61 | 3 | 47 | 11 | −0.8 | −23 |
| 32 | Base metal | 45 | 4 | 69 | 7 | 1.3 | 53 |

| SCTG2 | SCTG2 Commodity | 2017 Tons (million) | Rank 2017 | 2050 Tons (million) | Rank 2050 | CAGR 2017–2050 (%) | Growth 2017–2050 (%) |
|---|---|---|---|---|---|---|---|
| 17 | Gasoline | 42 | 5 | 36 | 20 | −0.5 | −14 |
| 13 | Nonmetallic minerals | 36 | 6 | 105 | 2 | 3.3 | 192 |
| 31 | Nonmetallic mineral products | 34 | 7 | 39 | 17 | 0.4 | 15 |
| 36 | Motorized vehicles | 33 | 8 | 73 | 5 | 2.4 | 121 |
| 22 | Fertilizers | 31 | 9 | 103 | 3 | 3.7 | 232 |
| 20 | Basic chemicals | 30 | 10 | 37 | 18 | 0.6 | 23 |

CAGR = compound annual growth rate; n.e.c. = not elsewhere classified; SCTG2 = Standard Classification of Transported Goods, two-digit level.

Major U.S. import gateways are illustrated in table 9. Crude oil (SCTG2 16) is the most imported commodity in terms of weight in 2017 at these gateways. As domestic production increases, crude imports will remain flat until 2050. Imports are expected to decline in the southern United States and increase in the northern United States, as exports increase from Canada. Imports to the Los Angeles FAF zone are mainly consumer goods, which are expected to increase throughout the forecast period. Imports at FAF zone 341 (the Port of New York and New Jersey) were predominately gasoline and fuel oils in 2017, but by 2050, nonmetallic minerals from Africa and the Americas (excluding Canada and Mexico) will be the second-highest commodity, growing at a 4.1-percent CAGR.

**Table 9. Top 10 Import Gateways, Baseline Scenario**

| Region Code | Import Port | Import Tons, 2017 (million) | Import Tons, 2050 (million) | CAGR, 2017–2050 (%) |
|---|---|---|---|---|
| 380 | North Dakota | 161 | 374 | 2.6 |
| 61 | Los Angeles, CA | 93 | 137 | 1.2 |
| 486 | Houston, TX | 92 | 99 | 0.2 |
| 261 | Detroit, MI | 77 | 101 | 0.8 |
| 341 | New York, NY-NJ-CT-PA (New Jersey part) | 63 | 96 | 1.3 |
| 223 | New Orleans, LA-MS (Louisiana part) | 61 | 79 | 0.8 |
| 421 | Philadelphia, PA-NJ-DE-MD (Pennsylvania part) | 45 | 39 | −0.4 |
| 64 | San Francisco, CA | 45 | 50 | 0.3 |
| 482 | Beaumont, TX | 36 | 16 | −2.4 |
| 539 | Rest of Washington | 35 | 35 | 0.0 |

CAGR = compound annual growth rate.

The real value of U.S. imports will outpace tonnage growth. As illustrated in figure 22, import value grows from $2.3 trillion in 2017 to $4.7 trillion by 2050, a CAGR of 2.3 percent. This increase is driven by imports of high-value goods, including electronics and other technology from Eastern and Southeastern Asia and Mexico, vehicles from Mexico, Canada, and Europe and consumer goods from Eastern and Southeastern Asia.

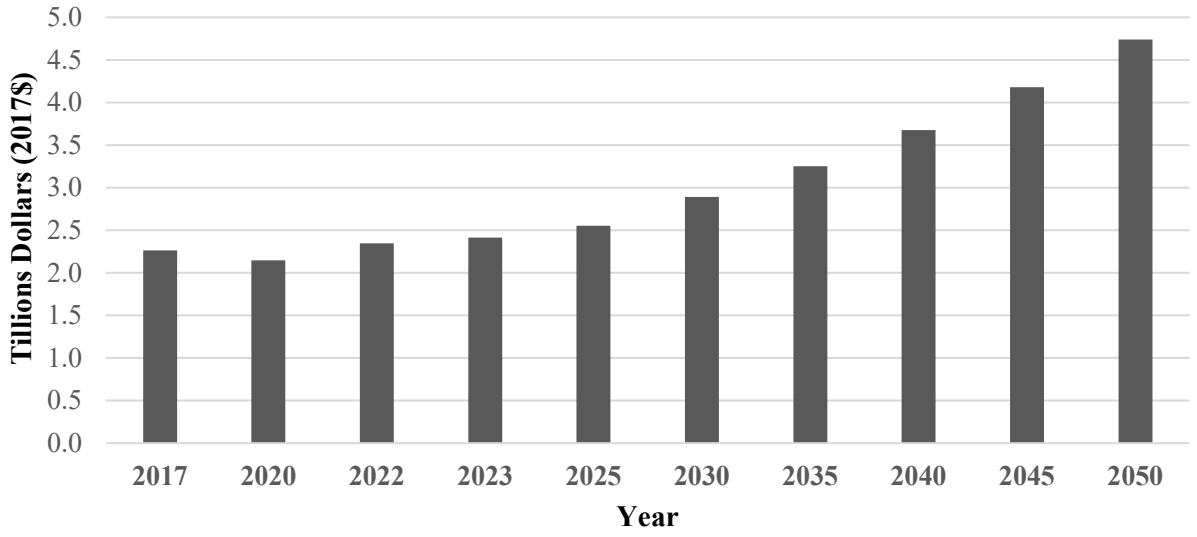



**Figure 22. Chart. Real Value of Import Freight Flows, Baseline Scenario.**
*Source: FHWA.*

## HIGH- AND LOW-GROWTH SCENARIOS

The high and low freight growth scenarios for FAF5 forecast data are based on the IHS alternative macroeconomic scenarios described in Key Assumptions section of this report. The U.S. Macroeconomic Outlook provides these alternate scenario projections in addition to the baseline or "most likely" case. The macroeconomic assumptions for the high- and low-growth macroeconomic scenarios are then flowed through regional employment and economic output models, which in turn drive the forecasts of interregional freight flows. The process is described in greater detail in the appendix.

The same methodology used to create the baseline scenario FAF5 forecasts was followed to create the high- and low-growth scenarios forecasts.

### Domestic Tonnage in the High- and Low-Growth Scenarios

Figure 23 and figure 24 summarize the high- and low-growth scenarios compared with the baseline scenario. Years 2017 to 2020 were deemed to be "historical forecast" years; consequently, the deviation from the baseline scenario began in 2020.

In the high-growth scenario, total domestic tonnage is expected to grow by 1.3 percent on average per year from 2017 to 2050, as opposed to a 1.1-percent CAGR in the baseline scenario. This yields 26.5 billion tons of domestic commodity flow in 2050, 1.6 billion tons higher than in the baseline scenario. Growth in the high-growth scenario assumes the impact from the

Infrastructure and Investment Jobs Act[3] is more robust, which constitutes another source of modest upside risk, potentially adding several tenths of a percentage point to growth over 2023 to 2026. In the low-growth scenario, total domestic tonnage is projected to grow by 0.8 percent on average per year from 2017 to 2050, resulting in 22.5 billion tons of domestic commodity flow in 2050, 2.4 billion tons less than the baseline scenario forecast. Forecast for the low-growth scenario drops after 2040 due to higher impacts from slower population growth, labor growth, and overall economic growth.

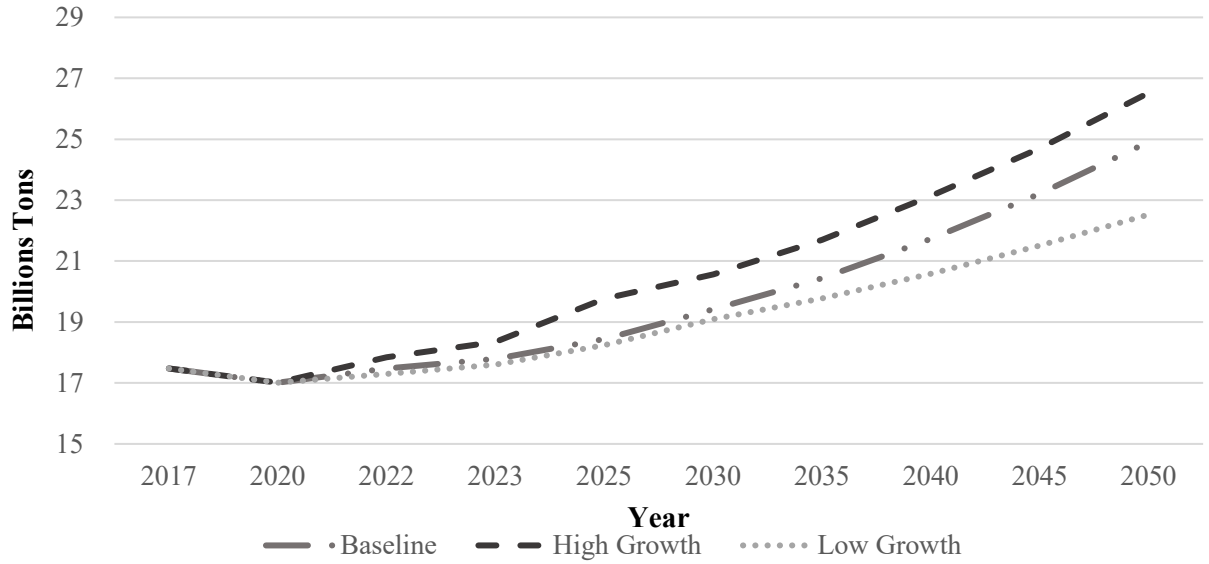



**Figure 23. Graph. Growth in Total Domestic Tons by Freight Analysis Framework Version 5 Scenarios.**

*Source: FHWA.*

[3] Pub. L. No. 117-58.

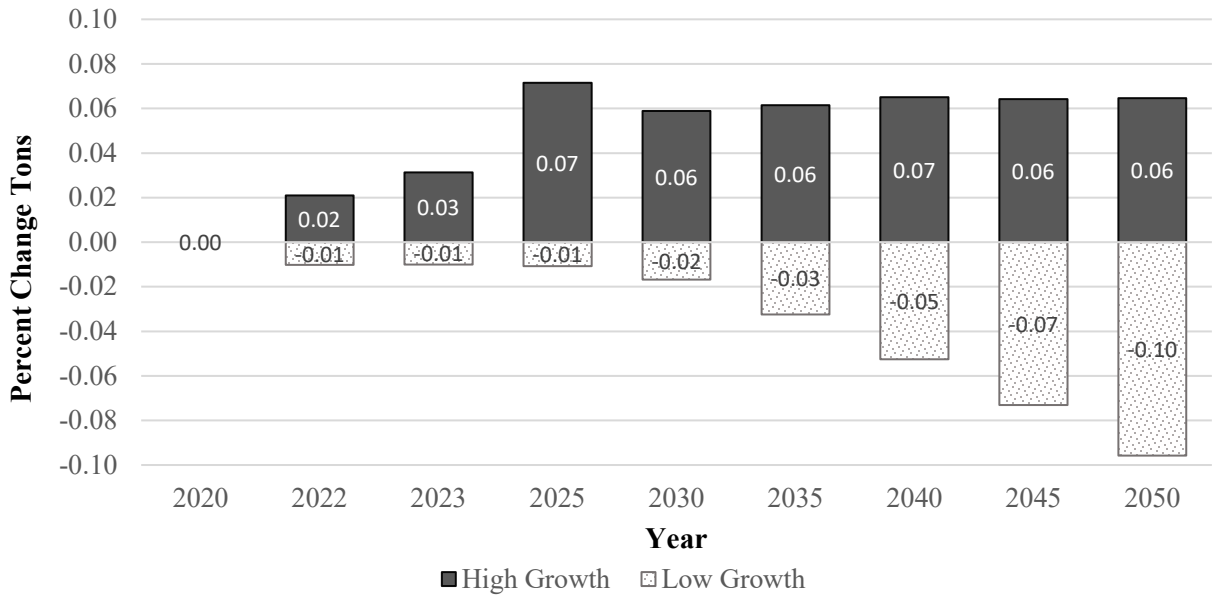



**Figure 24. Chart. Domestic Tonnage—Variations from the Baseline Scenario in the High- and Low-Growth Scenarios, 2020–2050.**

*Source: FHWA.*

### Export and Import Tonnage in the High- and Low-Growth Scenarios

In the high-growth scenario, total export tonnage is expected to grow by 2.1 percent on average per year from 2017 to 2050, as opposed to a 1.9-percent CAGR in the baseline scenario. As a result, export tonnage is estimated to reach 2.1 billion tons in 2050, about 122 million tons higher than the baseline scenario forecast. In the low-growth scenario, total export tonnage is projected to grow by 1.6 percent on average per year from 2017 to 2050, resulting in 1.8 billion tons of exports in 2050, about 198 million tons less than the baseline scenario forecast (figure 25).

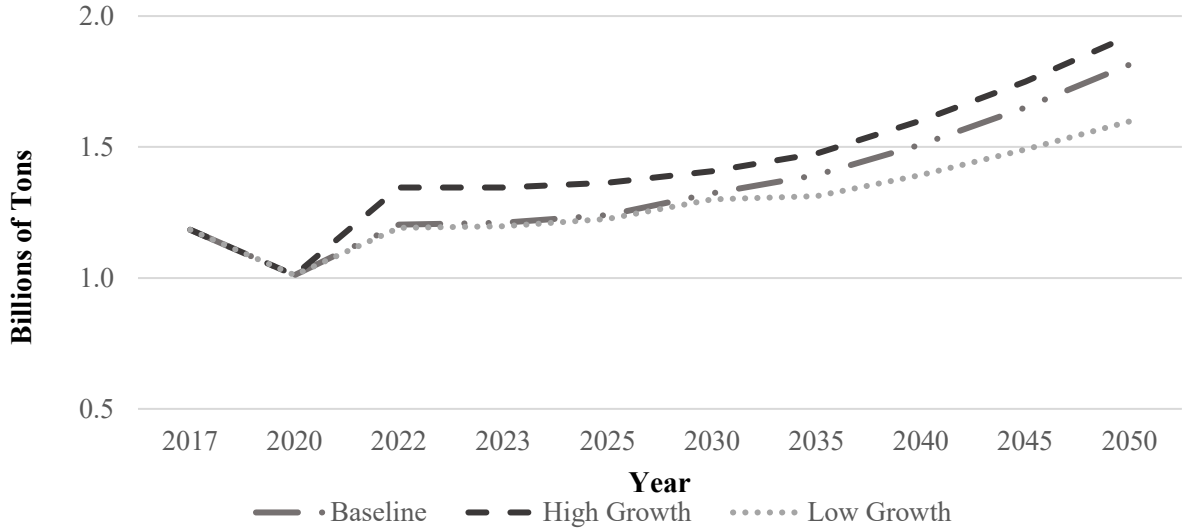



**Figure 25. Graph. Export Tonnage in the Baseline, High- and Low-Growth Scenarios, 2017–2050.**

*Source: FHWA.*

In the high-growth scenario, total import tonnage is expected to grow by 1.5 percent on average per year from 2017 to 2050, as opposed to a 1.3-percent CAGR in the baseline scenario. Consequently, import tonnage is forecasted to reach 1.9 billion tons in 2050, approximately 110 million tons higher than the baseline scenario forecast. In the low-growth scenario, total import tonnage is projected to grow by 0.9 percent on average per year from 2017 to 2050, resulting in 1.6 billion tons of imports in 2050, about 217 million tons less than the baseline scenario forecast (figure 26).

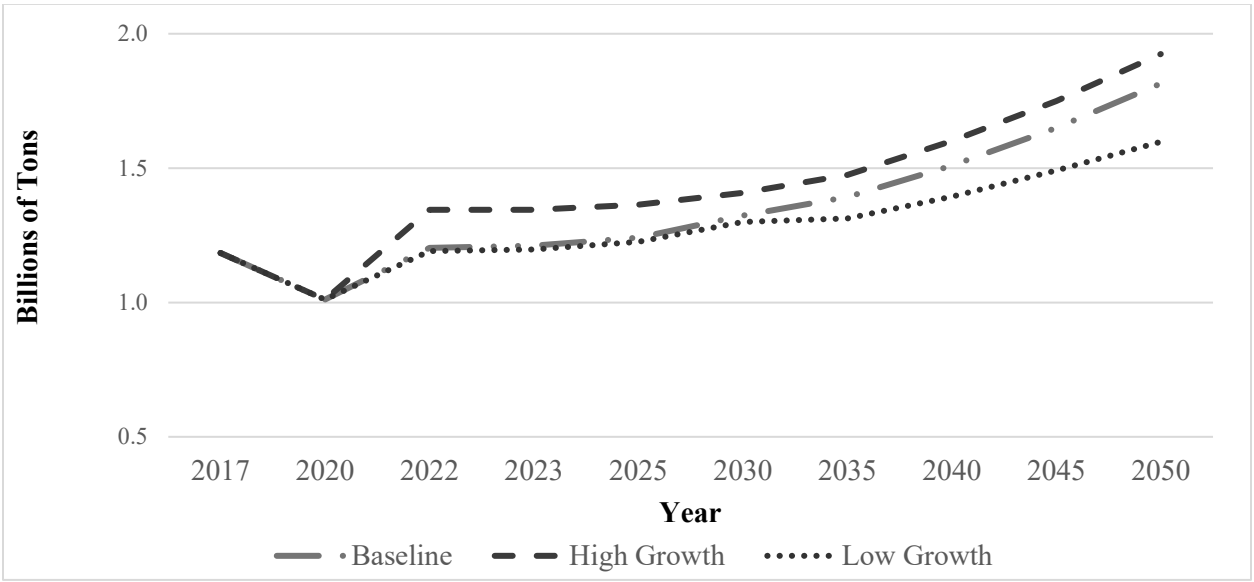



**Figure 26. Graph. Import Tonnage, Baseline and High- and Low-Growth Scenarios, 2017–2050.**

*Source: FHWA.*

The previous charts illustrate that the high- and low-growth scenarios are asymmetrical around the baseline scenario forecast. This characteristic is because the assumptions driving the high-growth scenario promote overall consumption and a stronger dollar, thus the higher demand for imports and domestically produced goods, which limits the amount that can be exported. In the low-growth case, reduced demand from lower manufacturing and a weaker dollar eases the need for imports while reducing the attractiveness and availability of goods for export. Therefore, the impacts of a changing macroeconomic scenario on imports and exports are not necessarily equal. Figure 27 shows the variations in import and export tonnages from the baseline and high- and low-growth scenarios.

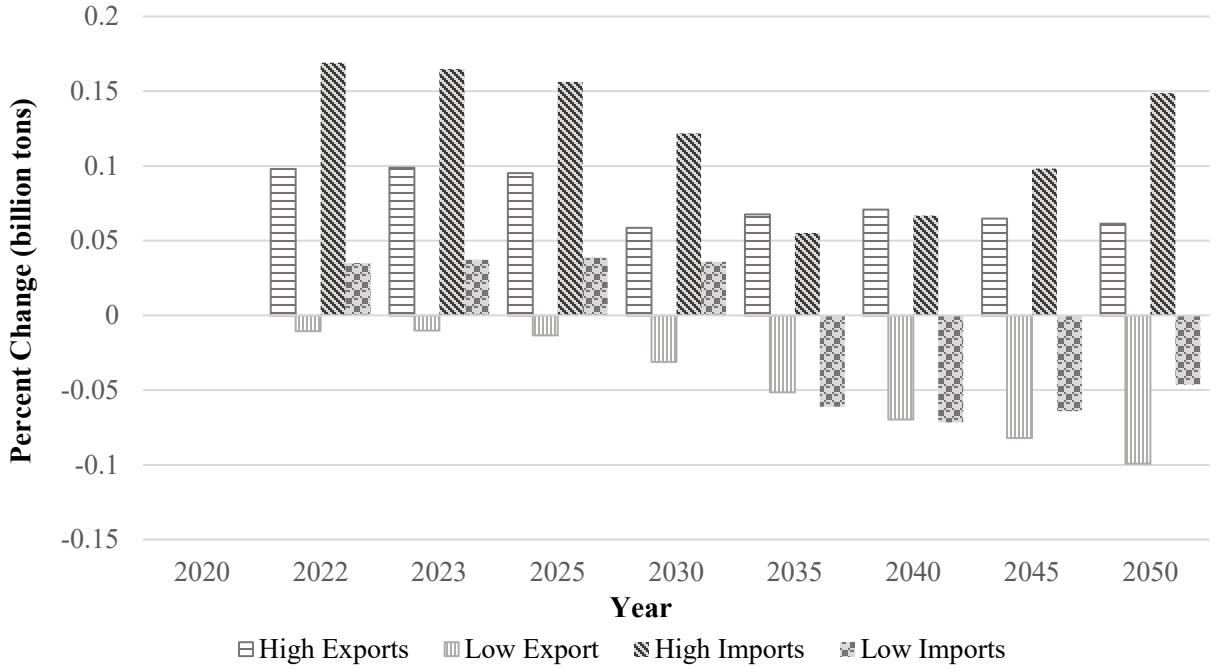



**Figure 27. Chart. Variations in Import and Export Tonnage from Baseline and High- and Low-Growth Scenarios, 2017–2050.**

*Source: FHWA.*

Table 10, table 11 , and table 12 summarize the forecasts across all scenarios by SCTG group from 2017 to 2050 by domestic, exported, and imported flows, respectively. In no instance does the high-growth scenario or the low-growth scenario result in a change of direction; growth or high growth is always higher than base growth, and low growth is always lower than base growth. For example, low-tonnage, high-value commodities such as pharmaceuticals, precision instruments, and transportation equipment retain their relative rankings in terms of fastest growth over the study time horizon, regardless of scenario. The only difference is that the application of high- and low-growth macroeconomic assumptions affects the relative magnitude of growth rates for all SCTG categories.

**Table 10. Tonnage Growth in Freight Analysis Framework Version 5 Baseline, High-, and Low--Growth Scenarios, 2017–2050**

| SCTG | Description | 2017 Tons (million) | 2050 Tons (million) | | | CAGR 2017–2050 (%) | | |
|---|---|---|---|---|---|---|---|---|
| | | | Base | High | Low | Base | High | Low |
| 1 | Live animals and fish | 89 | 290 | 315 | 276 | 3.7 | 3.9 | 3.5 |
| 2 | Cereal grains | 1,211 | 1,230 | 1,292 | 1,157 | 0.0 | 0.2 | −0.1 |
| 3 | Other agricultural products | 648 | 709 | 752 | 678 | 0.3 | 0.5 | 0.1 |
| 4 | Animal feed | 403 | 752 | 791 | 708 | 1.9 | 2.1 | 1.7 |
| 5 | Meat/seafood | 91 | 135 | 140 | 129 | 1.2 | 1.3 | 1.1 |
| 6 | Milled grain products | 132 | 245 | 255 | 234 | 1.9 | 2.0 | 1.7 |
| 7 | Other foodstuffs | 629 | 967 | 1,016 | 923 | 1.3 | 1.5 | 1.2 |
| 8 | Alcoholic beverages | 113 | 204 | 212 | 186 | 1.8 | 1.9 | 1.5 |
| 9 | Tobacco products | 5 | 3 | 4 | 3 | −0.9 | −0.8 | −1.2 |
| 10 | Building stone | 16 | 28 | 31 | 24 | 1.7 | 1.9 | 1.1 |
| 11 | Natural sands | 613 | 920 | 997 | 745 | 1.2 | 1.5 | 0.6 |
| 12 | Gravel | 1,882 | 2,961 | 3,223 | 2,458 | 1.4 | 1.6 | 0.8 |
| 13 | Nonmetallic minerals | 249 | 387 | 428 | 322 | 1.4 | 1.7 | 0.8 |
| 14 | Metallic ores | 54 | 38 | 42 | 34 | −1.0 | −-0.7 | −1.4 |
| 15 | Coal | 790 | 96 | 116 | 78 | −6.2 | −5.7 | −6.8 |
| 16 | Crude petroleum | 508 | 536 | 659 | 406 | 0.2 | 0.8 | −0.7 |
| 17 | Gasoline | 1,367 | 1,023 | 1,061 | 956 | −0.9 | −0.8 | −1.1 |
| 18 | Fuel oils | 875 | 778 | 806 | 726 | −0.4 | −0.2 | −0.6 |
| 19 | Coal, n.e.c. | 2,538 | 4,126 | 4,371 | 3,677 | 1.5 | 1.7 | 1.1 |
| 20 | Basic chemicals | 396 | 1,318 | 1,385 | 1,136 | 3.7 | 3.9 | 3.2 |
| 21 | Pharmaceuticals | 19 | 60 | 61 | 53 | 3.6 | 3.7 | 3.2 |
| 22 | Fertilizers | 164 | 436 | 456 | 369 | 3.0 | 3.2 | 2.5 |
| 23 | Chemical products | 126 | 330 | 339 | 287 | 3.0 | 3.1 | 2.5 |
| 24 | Plastics/rubber | 228 | 592 | 610 | 546 | 2.9 | 3.0 | 2.7 |
| 25 | Logs | 471 | 755 | 928 | 735 | 1.4 | 2.1 | 1.4 |
| 26 | Wood products | 364 | 666 | 680 | 649 | 1.8 | 1.9 | 1.8 |
| 27 | Newsprint/paper | 130 | 192 | 207 | 181 | 1.2 | 1.4 | 1.0 |
| 28 | Paper articles | 81 | 142 | 152 | 134 | 1.7 | 1.9 | 1.5 |
| 29 | Printed products | 29 | 30 | 34 | 27 | 0.0 | 0.4 | −0.2 |
| 30 | Textiles/leather | 41 | 79 | 83 | 72 | 2.0 | 2.2 | 1.7 |
| 31 | Nonmetal mineral products | 1,227 | 1,845 | 1,945 | 1,709 | 1.2 | 1.4 | 1.0 |

| SCTG | Description | 2017 Tons (million) | 2050 Tons (million) | | | CAGR 2017–2050 (%) | | |
|---|---|---|---|---|---|---|---|---|
| | | | Base | High | Low | Base | High | Low |
| 32 | Base metals | 320 | 398 | 418 | 388 | 0.7 | 0.8 | 0.6 |
| 33 | Articles of base metal | 129 | 179 | 187 | 175 | 1.0 | 1.1 | 0.9 |
| 34 | Machinery | 94 | 162 | 165 | 158 | 1.7 | 1.7 | 1.6 |
| 35 | Electronics | 60 | 118 | 120 | 117 | 2.1 | 2.1 | 2.0 |
| 36 | Motorized vehicles | 159 | 278 | 283 | 274 | 1.7 | 1.8 | 1.7 |
| 37 | Transport equipment | 6 | 8 | 8 | 8 | 0.8 | 0.8 | 0.7 |
| 38 | Precision instruments | 8 | 20 | 20 | 19 | 2.9 | 3.0 | 2.8 |
| 39 | Furniture | 52 | 94 | 96 | 91 | 1.8 | 1.9 | 1.7 |
| 40 | Miscellaneous manufacturing products | 98 | 279 | 285 | 269 | 3.2 | 3.3 | 3.1 |
| 41 | Waste/scrap | 642 | 703 | 724 | 650 | 0.3 | 0.4 | 0.0 |
| 43 | Mixed freight | 424 | 803 | 826 | 761 | 2.0 | 2.0 | 1.8 |

CAGR = compound annual growth rate; n.e.c. = not elsewhere classified; SCTG = Standard Classification of Transported Goods.

**Table 11. Growth in Import Tons in Baseline, High- and Low-Growth Scenarios, 2017–2050**

| SCTG | Description | 2017 Tons (million) | 2050 Tons (million) | | | CAGR 2017–2050 (%) | | |
|---|---|---|---|---|---|---|---|---|
| | | | Base | High | Low | Base | High | Low |
| 1 | Live animals/fish | 1.0 | 1.4 | 1.4 | 1.3 | 1.1 | 1.2 | 1.0 |
| 2 | Cereal grains | 7.6 | 11.4 | 11.8 | 10.8 | 1.2 | 1.4 | 1.1 |
| 3 | Other agricultural products | 29.1 | 59.7 | 62.3 | 57.9 | 2.2 | 2.3 | 2.1 |
| 4 | Animal feed | 7.0 | 14.1 | 14.9 | 13.3 | 2.2 | 2.3 | 2.0 |
| 5 | Meat/seafood | 5.9 | 11.2 | 11.5 | 10.7 | 2.0 | 2.1 | 1.8 |
| 6 | Milled grain products | 5.8 | 20.8 | 21.4 | 19.7 | 4.0 | 4.0 | 3.8 |
| 7 | Other foodstuffs | 29.2 | 61.9 | 64.1 | 59.0 | 2.3 | 2.4 | 2.2 |
| 8 | Alcoholic beverages | 11.9 | 21.0 | 21.6 | 19.0 | 1.7 | 1.8 | 1.4 |
| 9 | Tobacco products | 0.1 | 0.2 | 0.2 | 0.2 | 1.1 | 1.2 | 0.8 |
| 10 | Building stone | 0.2 | 0.3 | 0.3 | 0.2 | 1.3 | 1.6 | 0.8 |
| 11 | Natural sands | 2.5 | 8.8 | 10.1 | 7.5 | 3.8 | 4.3 | 3.3 |
| 12 | Gravel | 23.6 | 81.0 | 86.6 | 64.6 | 3.8 | 4.0 | 3.1 |
| 13 | Nonmetallic minerals | 35.5 | 105.0 | 113.5 | 88.7 | 3.3 | 3.6 | 2.8 |
| 14 | Metallic ores | 13.8 | 29.3 | 31.3 | 24.1 | 2.3 | 2.5 | 1.7 |
| 15 | Coal | 7.3 | 6.1 | 6.4 | 5.2 | −0.5 | −0.4 | −1.0 |
| 16 | Crude petroleum | 438.1 | 483.5 | 530.7 | 371.3 | 0.3 | 0.6 | −0.5 |

| SCTG | Description | 2017 Tons (million) | 2050 Tons (million) | | | CAGR 2017–2050 (%) | | |
|---|---|---|---|---|---|---|---|---|
| | | | Base | High | Low | Base | High | Low |
| 17 | Gasoline | 41.5 | 36.2 | 38.1 | 33.9 | −0.4 | −0.3 | −0.6 |
| 18 | Fuel oils | 60.7 | 46.8 | 48.6 | 43.7 | −0.8 | −0.7 | −1.0 |
| 19 | Coal, n.e.c. | 68.9 | 47.5 | 50.5 | 43.1 | −1.1 | −0.9 | −1.4 |
| 20 | Basic chemicals | 30.5 | 37.7 | 39.3 | 32.2 | 0.7 | 0.8 | 0.2 |
| 21 | Pharmaceuticals | 3.6 | 7.8 | 7.9 | 6.6 | 2.3 | 2.4 | 1.8 |
| 22 | Fertilizers | 31.3 | 103.0 | 110.1 | 89.2 | 3.7 | 3.9 | 3.2 |
| 23 | Chemical products | 7.2 | 14.0 | 14.4 | 11.9 | 2.0 | 2.1 | 1.6 |
| 24 | Plastics/rubber | 26.2 | 45.6 | 47.1 | 42.2 | 1.7 | 1.8 | 1.5 |
| 25 | Logs | 1.0 | 1.0 | 1.2 | 1.0 | 0.0 | 0.4 | −0.1 |
| 26 | Wood products | 28.4 | 42.7 | 43.6 | 41.8 | 1.3 | 1.3 | 1.2 |
| 27 | Newsprint/paper | 16.1 | 28.1 | 30.0 | 26.7 | 1.7 | 1.9 | 1.5 |
| 28 | Paper articles | 2.6 | 5.1 | 5.4 | 4.8 | 2.0 | 2.2 | 1.9 |
| 29 | Printed products | 1.3 | 1.6 | 1.8 | 1.4 | 0.7 | 1.1 | 0.4 |
| 30 | Textiles/leather | 17.0 | 45.0 | 46.8 | 41.0 | 3.0 | 3.1 | 2.7 |
| 31 | Nonmetal mineral products | 33.8 | 39.2 | 42.0 | 36.9 | 0.5 | 0.7 | 0.3 |
| 32 | Base metals | 45.0 | 69.3 | 73.3 | 67.9 | 1.3 | 1.5 | 1.3 |
| 33 | Articles of base metal | 23.3 | 40.1 | 42.0 | 39.3 | 1.7 | 1.8 | 1.6 |
| 34 | Machinery | 29.3 | 72.6 | 74.1 | 70.6 | 2.8 | 2.9 | 2.7 |
| 35 | Electronics | 16.9 | 41.6 | 42.4 | 41.1 | 2.8 | 2.8 | 2.7 |
| 36 | Motorized vehicles | 33.8 | 73.3 | 74.8 | 72.5 | 2.4 | 2.4 | 2.3 |
| 37 | Transport equipment | 1.1 | 2.0 | 2.1 | 2.0 | 2.0 | 2.0 | 1.9 |
| 38 | Precision instruments | 1.9 | 5.5 | 5.7 | 5.4 | 3.3 | 3.3 | 3.2 |
| 39 | Furniture | 15.6 | 36.5 | 37.2 | 35.5 | 2.6 | 2.7 | 2.5 |
| 40 | Miscellaneous manufacturing products | 7.3 | 16.6 | 16.9 | 15.9 | 2.5 | 2.6 | 2.4 |
| 41 | Waste/scrap | 12.7 | 22.6 | 23.2 | 20.9 | 1.7 | 1.8 | 1.5 |
| 43 | Mixed freight | 8.0 | 17.5 | 18.0 | 16.7 | 2.4 | 2.5 | 2.2 |

CAGR = compound annual growth rate; n.e.c. = not elsewhere classified; SCTG = Standard Classification of Transported Goods.

**Table 12. Growth in Export Tons in Baseline, High-, and Low-Growth Scenarios, 2017–2050**

| SCTG | Description | 2017 Tons (million) | 2050 Tons (million) | | | CAGR 2017–2050 (%) | | |
|---|---|---|---|---|---|---|---|---|
| | | | Base | High | Low | Base | High | Low |
| 1 | Live animals/fish | 0.4 | 0.9 | 1.0 | 0.9 | 2.4 | 2.5 | 2.3 |
| 2 | Cereal grains | 103.4 | 152.1 | 158.5 | 146.9 | 1.2 | 1.3 | 1.1 |
| 3 | Other agricultural products | 74.9 | 132.0 | 138.5 | 126.9 | 1.7 | 1.9 | 1.6 |
| 4 | Animal feed | 42.0 | 94.7 | 98.5 | 88.7 | 2.5 | 2.6 | 2.3 |
| 5 | Meat/seafood | 10.5 | 19.8 | 20.4 | 19.0 | 2.0 | 2.0 | 1.8 |
| 6 | Milled grain products | 4.1 | 5.6 | 5.8 | 5.3 | 1.0 | 1.1 | 0.8 |
| 7 | Other foodstuffs | 26.5 | 56.6 | 58.8 | 53.9 | 2.3 | 2.5 | 2.2 |
| 8 | Alcoholic beverages | 2.7 | 8.6 | 8.8 | 7.8 | 3.5 | 3.6 | 3.2 |
| 9 | Tobacco products | 0.1 | 0.1 | 0.1 | 0.1 | 0.5 | 0.5 | 0.1 |
| 10 | Building stone | 0.1 | 0.2 | 0.2 | 0.2 | 2.5 | 2.7 | 2.0 |
| 11 | Natural sands | 9.0 | 29.0 | 31.0 | 24.0 | 3.6 | 3.8 | 3.0 |
| 12 | Gravel | 0.9 | 2.2 | 2.4 | 1.8 | 2.9 | 3.1 | 2.3 |
| 13 | Nonmetallic minerals | 10.9 | 14.1 | 15.5 | 11.3 | 0.8 | 1.1 | 0.1 |
| 14 | Metallic ores | 25.5 | 90.0 | 101.7 | 76.9 | 3.9 | 4.3 | 3.4 |
| 15 | Coal | 119.2 | 73.6 | 79.8 | 60.8 | −1.5 | −1.2 | −2.0 |
| 16 | Crude petroleum | 63.5 | 163.1 | 196.6 | 111.0 | 2.9 | 3.5 | 1.7 |
| 17 | Gasoline | 68.1 | 136.4 | 141.8 | 127.5 | 2.1 | 2.2 | 1.9 |
| 18 | Fuel oils | 117.3 | 202.5 | 210.1 | 189.9 | 1.7 | 1.8 | 1.5 |
| 19 | Coal, n.e.c. | 71.7 | 159.1 | 167.8 | 140.3 | 2.4 | 2.6 | 2.1 |
| 20 | Basic chemicals | 56.3 | 113.1 | 118.4 | 97.9 | 2.1 | 2.3 | 1.7 |
| 21 | Pharmaceuticals | 1.7 | 4.0 | 4.1 | 3.4 | 2.7 | 2.8 | 2.2 |
| 22 | Fertilizers | 13.9 | 21.3 | 22.7 | 18.7 | 1.3 | 1.5 | 0.9 |
| 23 | Chemical products | 13.9 | 25.7 | 26.4 | 21.9 | 1.9 | 1.9 | 1.4 |
| 24 | Plastics/rubber | 28.1 | 92.6 | 95.3 | 84.9 | 3.7 | 3.8 | 3.4 |
| 25 | Logs | 10.1 | 13.4 | 15.1 | 13.0 | 0.9 | 1.2 | 0.8 |
| 26 | Wood products | 15.0 | 29.0 | 29.6 | 28.0 | 2.0 | 2.1 | 1.9 |
| 27 | Newsprint/paper | 23.8 | 47.6 | 50.3 | 45.2 | 2.1 | 2.3 | 2.0 |
| 28 | Paper articles | 2.7 | 5.0 | 5.3 | 4.8 | 1.9 | 2.1 | 1.8 |
| 29 | Printed products | 0.9 | 1.3 | 1.5 | 1.2 | 1.3 | 1.7 | 1.0 |
| 30 | Textiles/leather | 5.7 | 14.7 | 15.2 | 13.3 | 2.9 | 3.0 | 2.6 |
| 31 | Nonmetal mineral products | 14.7 | 21.1 | 22.4 | 19.9 | 1.1 | 1.3 | 0.9 |

| SCTG | Description | 2017 Tons (million) | 2050 Tons (million) | | | CAGR 2017–2050 (%) | | |
|---|---|---|---|---|---|---|---|---|
| | | | Base | High | Low | Base | High | Low |
| 32 | Base metals | 13.6 | 19.0 | 20.0 | 18.6 | 1.0 | 1.2 | 1.0 |
| 33 | Articles of base metal | 9.3 | 20.2 | 21.0 | 19.8 | 2.4 | 2.5 | 2.3 |
| 34 | Machinery | 9.8 | 15.9 | 16.2 | 15.4 | 1.5 | 1.5 | 1.4 |
| 35 | Electronics | 6.4 | 13.2 | 13.4 | 13.0 | 2.2 | 2.3 | 2.2 |
| 36 | Motorized vehicles | 13.5 | 30.1 | 30.7 | 29.5 | 2.4 | 2.5 | 2.4 |
| 37 | Transport equipment | 2.1 | 3.9 | 4.0 | 3.8 | 1.8 | 1.9 | 1.8 |
| 38 | Precision instruments | 1.1 | 1.8 | 1.8 | 1.7 | 1.4 | 1.4 | 1.3 |
| 39 | Furniture | 1.7 | 4.6 | 4.7 | 4.4 | 3.0 | 3.0 | 2.9 |
| 40 | Miscellaneous manufacturing products | 2.3 | 2.8 | 2.9 | 2.7 | 0.6 | 0.7 | 0.5 |
| 41 | Waste/scrap | 48.5 | 124.9 | 129.2 | 115.1 | 2.9 | 3.0 | 2.7 |
| 43 | Mixed freight | 12.2 | 28.4 | 29.2 | 27.1 | 2.6 | 2.7 | 2.5 |

CAGR = compound annual growth rate; n.e.c. = not elsewhere classified; SCTG = Standard Classification of Transported Goods.

# CHAPTER 4. FORECASTING METHODOLOGY SUMMARY

Development of the FAF5 forecasts database includes modeling domestic freight flows and international trade separately. Domestic flow forecasts include flows of freight moved between domestic origin and destination, while import forecasts contain flows of freight moved from foreign origin to domestic destination, and export freight forecasts include freight moved from domestic origin to foreign destination.

Domestic flows are forecasted using the Business Market Insights (BMI) database that includes detailed information on industrial output and numbers of employees by industry classified by six-digit North American Industry Classification System (NAICS) code and at the county level. BMI growth factors are applied to each FAF geography and by SCTG2 code. The next step of the process involves the use of consumption growth from the business transactions matrix (BTM) that has the latest set of input/output tables prepared by the U.S. Bureau of Economic Analysis (BEA). Purchasing and consumption growth is applied for each CFS/FAF region by SCTG2 commodity to estimate the growth in commodity tons using growth factors from production (shipments) and consumption (purchases). The last step in domestic flows forecasting includes adjustment of the resulting freight flows so that the volumes correspond with the national control totals for FAF5 region level and SCTG2 commodity level.

BMI and BTM are used to forecast growth in U.S. imports and exports by CFS/FAF region for all commodities by FHWA-defined U.S. gateway. Forecasts to and from eight international regions are made using forecast growth rates from the Global Trade Atlas® (GTA), a multilateral international commodity trade forecasting model. The GTA forecast system models U.S. imports and exports in the context of all other countries' economic performance and trade competitiveness at the commodity level according to the International Standard Industrial Classification (ISIC). The GTA data for the United States is separated into six coasts, including the North Atlantic Coast, South Atlantic Coast, North Pacific Coast, South Pacific Coast, Gulf Coast and Great Lakes Region. Each CFS/FAF Region is assigned to one of the corresponding zones, and SCTG2 commodities are matched with ISIC commodity level to estimate growth by SCTG2 commodity. Finally, adjustment of import and export totals are made with national control totals. The process is described in detail in the appendix.

# APPENDIX. FORECASTING METHODOLOGY

This appendix provides an overview of the forecasting methodology, including the steps taken to produce the domestic and international trade forecasts. Proprietary tools and databases of IHS Markit are referenced in the discussion.

Economic forecasting models used to produce the FAF5 forecast are built and maintained with a common framework and perspective that provides a comprehensiveness, consistency, and level of detail that are unique for freight transportation forecasting. Most importantly, the detailed freight flow forecasts are derived in a manner consistent with the path of the economy at the national, regional, and sub-State levels.

The initial calibration in the forecasting process involves two steps. The first step is to construct the desired level of geography in the BMI and the BTM forecast databases relative to the 2017 FAF5 base-year data. The creation of the FAF5 regions in these two models is a process of aggregation, grouping the county-level data from BMI and BTM into the FAF5 regional market definitions and summing the values.

The second step during this initial stage entailed the development of the crosswalk between the NAICS and SCTG commodity classification. This development was done through a review of existing commodity classification concordance files, which detail the relationships between different combinations of NAICS, SCTG, and Standard Transportation Commodity Classification codes at various levels of detail. The crosswalk between industry and commodity classifications is important because it provides the bridge from the value and weight of the physical commodities and products shipped through the transportation system to the industry activity measured by economists on an industry establishment level (typically using the value of output or purchases and the associated employment).

A detailed mapping of six-digit NAICS codes to corresponding SCTG codes was developed. The process started with the mapping applied during the FAF4 forecast process and meticulously updated the concordance table to reflect additions and changes to code definitions. The CFS microdata file, which also contains NAICS-SCTG relationships, was employed as a reference where an accurate six-digit NAICS-SCTG mapping could not be determined.

For international movements, a crosswalk was developed linking SCTG to the Harmonized System commodity and ISIC industry sector classifications used in the Global Trade Atlas (GTA) model. This process provided a bridge between the international trade forecasts and the international and cross-border movements in FAF5. The detailed mapping from ISIC to SCTG two-digit-level codes is provided in table 16.

## U.S. BENCHMARK DEVELOPMENT

The development of the 2017 benchmark for a baseline forecast of commodity tonnage was carried out as described in the following section.

First, using the BMI, for each commodity-specific shipment, the growth forecast was applied from each CFS origin region to each CFS destination region. County data were aggregated to the

CFS region to get the growth forecast at that level. The total domestic shipment volumes are projected through the forecast horizon by using the forecast information from the BMI, converted to annual growth rates, which are correlated to national totals from the U.S. Macroeconomic Model. The freight forecast modeling uses the U.S macroeconomic, U.S regional, and U.S industry employment outlooks to forecast employment, number of establishments, and output (sales) at the county, State, and national levels. Final output from BMI-driven forecasts are region-to-region shipment forecasts.

Next, using the BTM, specific purchasing and consumption growth by CFS/FAF region and commodity was applied. The BTM provides information on inter-industry purchases, which are conceptually the purchases of intermediate inputs, or factors of production that go into products (and services) for final consumption. From the BTM, a region-to-region purchase forecast is generated, which represents the total receipts of shipments by region and by commodity, as well as the shipments from producers by region. The primary data source for the BTM is the latest set of input/output tables prepared by the United States. BEA that have the detail by industry sector relating each sector's production and consumption to all other sectors in the economy. Purchasing and consumption growth was applied for each CFS or FAF region by SCTG2 commodity to estimate the growth in tons by using growth factors from production (shipments) and consumption (purchases).

Finally, the results were summarized and compared with the national-level controls, and the resulting freight flows were adjusted so that the volumes correspond with the national control levels for each of the following:

- CFS/FAF region and commodity category, so that shipments match purchases.
- Commodity, so that national control totals are satisfied.

## INTERNATIONAL TRADE FORECASTS

For international trade forecasts, the methodology steps include the following:

1. Growth was forecast for U.S. imports and exports by CFS/FAF region for all commodities by FHWA-defined U.S. gateways and world regions. Import forecasts relied on data for BTM interindustry purchases, and export forecasts relied on BMI commodity shipment data. Forecast growth rates from the GTA were applied.

   The GTA forecast uses historical trade, production, and consumption data from a combination of country and international agency sources. Country macroeconomic model forecasts are inputs to this system, as are international industry sector (ISIC-classified) production and consumption forecasts, similar to, within the United States, how BMI and BTM are used but at the international country-to-country level. The GTA forecast system models U.S. imports and exports in the context of all other countries' economic performance and trade competitiveness. The GTA forecasts combine this information with historical commodity trade-pattern data, plus analysis, and the industry sector and commodity production and consumption forecasts to produce bilateral trade forecasts by commodity and transport mode. GTA data for the United States is separated into six coasts, including North Atlantic Coast, South Atlantic Coast, North Pacific Coast, South Pacific Coast, Gulf Coast

and Great Lakes Region. Each CFS/FAF region is assigned to one of the corresponding zones.

2. Establish the U.S. national import and export control numbers for each SCTG2 commodity by FHWA-defined U.S. gateway and world region by using GTA commodity forecasts.

3. Ratably adjust the import and export forecasts in step 1 with national controls for each in step 2.

The following sections provide more detail on the domestic and international freight forecasting methodologies, the conversion of forecasts to real dollars, the development of alternative scenarios, and descriptions of applied FAF5 tools and products used in the forecasting process.

## DOMESTIC FREIGHT FORECAST METHODOLOGY

The first step in creating the forecast of the FAF5 data set is to extract the data on county-level employment and the U.S. dollar value of output by the six-digit NAICS code from the BMI database. This database covers years 2020, 2022, 2023 and 5-year increments from 2025 to 2050. The BMI database is described in detail in Underlying Forecast Models and Data Sources Section.

The employment data from the BMI is then matched to the SCTG categories and aggregated to the 2-digit SCTG level to conform to the FAF5 2017 baseline data. The concordance table identifying the relationships between NAICS and SCTG coding systems is used in this processing. Extensive cross-referencing was required to ensure that all detailed NAICS industry categories in BMI are assigned to a SCTG commodity code, and that all SCTG commodity category codes in the FAF5 data are assigned to a NAICS industry sector classification. Data from BMI was used to determine forecast factors, such as by NAICS industry category determined by SCTG commodity category.

Concurrent with the extension of the BMI output and employment forecasts to 2050, county-level data were aggregated to match the geographic market region definitions used in the 2017 FAF5 base-year data set. The counties were mapped to the FAF5 geographic regions by using the definitional assignments. The output and employment data were converted to growth rates. The results were cross-checked and verified against the growth rates for the individual constituent counties.

The independent forecast variables include data from the BTM database, which is described in detail in Underlying Forecast Models and Data Sources Section. The BTM input/output (I/O) tables required a similar methodology for translation of the NAICS industry classification codes to SCTG commodity category codes and the county-level geography to the FAF5 geographic market regions. Again, minor adjustments to the NAICS-to-SCTG relationships were necessary to ensure that all SCTG categories were assigned to NAICS industry categories, for example from domestic forecasts of the following:

- NAICS 212321, construction sand and gravel mining—39 percent to natural sands (SCTG2 11) and 61 percent to gravel and crushed stone (SCTG2 12).
- NAICS 331110, iron and steel mills and ferroalloy manufacturing—51 percent to base metals (SCTG2 32), 47 percent to articles of base metal (SCTG2 33), and 2 percent to transportation equipment (SCTG2 37).
- NAICS 324110, petroleum refineries—60 percent to SCTG2 17, gasoline; 30 percent to SCTG2 18, fuel oils, and 10 percent to SCTG2 19, coal and petroleum products, n.e.c.

The total domestic shipment volumes were then projected to the forecast horizon by using the forecast information from the BMI, converted to annual growth rates for each year in a forecast period (from 2018 to 2050). The results were included in a table that shows, for each forecast year, the shipment tonnage for each CFS region-to-region SCTG commodity flow.

The BTM I/O with NAICS commodities and counties data were matched with the 2017 base-year FAF5 data, so that for each region and SCTG commodity combination there is a complete set of purchased (consumed) goods associated with SCTG commodity volumes. The base-year 2017 purchase volumes were then forecasted for each year of the forecast period by using the matched forecasted growth rates from the BTM.

At this point, a national-level freight forecast, based on the most recent U.S. economic data from the IHS Markit U.S. Macroeconomic Model, was used to establish aggregate-level benchmark freight volumes for each SCTG commodity category. The total 2017 base-year FAF5 freight flows, by SCTG commodity, were then constrained to national growth for each SCTG at the national level forecasts of output and consumption.

When these national-level benchmark values were established, the last step was to reconcile and rebalance the original BMI-based region-to-region shipment forecast and the BTM-based region-to-region purchases forecast. This iterative process yields the detailed regional geographic market-to-regional geographic market commodity flow volumes, which were adjusted to and constrained by the national benchmarks. A series of tables was then created for analyzing the forecast changes in annual growth rates and was reviewed for validation.

## INTERNATIONAL FREIGHT FORECAST METHODOLOGY

The procedure for forecasting the international components of the FAF5 data is similar in nature to that used for the domestic flows, but growth drivers for international business transactions and the additional gateway or port market definitional dimension also had to be incorporated. The process for producing the international forecasts treats the import and export portions of the international data separately because the treatment of suppliers and consumers is asymmetrical with respect to the level of detail available on each end of the transaction (i.e., much more detail is available on the U.S. end of the shipment).

The base-year 2017 FAF5 data were maintained throughout the processing in separate files for domestic, import, and export freight flows. Unlike the domestic data, the international records also contain the gateway or port market identifying where flows enter or exit the United States. The originating foreign geographic market for imports and the foreign destination geographic

market for exports were identified by the foreign region in the base-year 2017 FAF5 database and in the forecasts.

Individual commodity growth rates of U.S. imports and U.S. exports, taken from the GTA model, were applied to the FAF5 base-year international data to obtain forecast flows by the gateway/foreign geographic regional market/SCTG2 commodity combination. The processes and methodologies underlying GTA are described in detail in Underlying Forecast Models and Data Sources Section, including consideration of the impacts of the 2020 disruptions to trade.

To apply the GTA to the FAF5 2017 base-year data set, the Harmonized Tariff Schedule commodity classifications of the GTA were translated to SCTG2 commodity categories. The relationship between GTA and SCTG2 commodity codes are given in table 15. Additionally, the geographic country and regional market areas used in the GTA are translated to match those used in FAF5.

With the necessary commodity and geographic regional market mappings complete, export volume growth is forecasted by regional market and commodity by using BMI export data and GTA foreign import purchase data. For the U.S. international import volume growth, also by geographic regional market and SCTG commodity category, the shipment-level import freight flow forecast is a function of the GTA import forecast and the demand for purchases forecasted in the BTM.

Consistent with the domestic forecasts, national-level constraints by SCTG2 commodity category are applied in an iterative process. Import shipment-level forecasts are constrained to national totals to SCTG2 commodity level by purchases, and export flows are constrained to national level to SCTG2 level by purchases that are controlled by shipments. Once the national-level constraint is derived by using the GTA, a similar process is completed for each port/SCTG2 commodity pair. The resulting file yields total tonnage for each forecast year for each regional market-gateway/region-SCTG2 commodity combination.

After employing quality controls, the output of this process includes international forecasts formatted with annual growth changes for each SCTG2 commodity, gateway and SCTG2, and foreign geographic region market and SCTG2 commodity category.

## REAL VALUE (CONSTANT DOLLAR) FORECAST METHODOLOGY

The goal of this exercise is to provide a constant dollar estimate of value that reflects not only changes in freight volume, but also potential changes in relative prices among freight commodities over time, exclusive of the effects of inflation.

FAF 5 forecast methodology for constructing a constant dollar forecast involves using producer price indices by industry, first deriving price by commodity (value/volume). The next step is to assign an appropriate price index by SCTG2 commodity and to forecast each price through 2050. Because NAICS defines the price indices, the same NAICS-to-SCTG2 crosswalks employed in the tonnage forecast process are applied. The price indices are “constant dollar” concepts; thus, constant dollar value is the forecasted tonnage multiplied by the forecasted constant dollar price over the entire time horizon.

## UNDERLYING FORECAST MODELS AND DATA SOURCES

The following sections of this report summarize the databases and services used in constructing the FAF5 forecast database: the U.S. Macroeconomic Model, BMI, BTM, GTA forecast, and other U.S. national and regional economic forecasts, used either directly or as inputs to other models.

Forecasting starts with the use of national drivers from the U.S. Macroeconomic Model. The drivers are used to establish national control totals by commodity by using the industrial production indices from the Macroeconomic Model. The Federal Reserve Board publishes historical data on industrial production by sector as an index that measures levels of production compared with the base year of 2017. The U.S. Macroeconomic Model used for FAF5 forecasts estimates these indices. Domestic freight shipping activity is fundamentally driven by production that is quantified in terms of changes by these industrial production index measures at the national level.

The BMI database contains a consistent set of historical statistical estimates and forecasts by industry sector and by geographic region. The statistics include the number of business establishments, employees, and output (sales) by industry. BMI industry categories are classified using the NAICS codes, aggregated to various levels of detail. The BMI model uses the U.S macroeconomic, U.S regional, and U.S industry and employment outlook to forecast employment, number of establishments, and sales at county, State, and national levels. These forecasts are mapped to each SCTG2 commodity to produce the specific shipment growth to each CFS/FAF region origin from each destination region.

The total domestic shipment volumes are projected to the forecast horizon by using the forecast information from the BMI, converted to annual growth rates. The model uses the U.S macroeconomic, U.S regional, and U.S industry production and employment outlooks to forecast growth at county, State, and national levels. The final output from the use of the BMI is a set of region-to-region shipment forecasts. Production output growth is applied to tons from FAF baseline data at origin region and commodity.

U.S. Regional Forecast Service models used for the FAF5 forecasting process model each area (States, the District of Columbia, metropolitan areas) individually and then link the model into the national system. Regional growth is forecasted as a proportion of the U.S. totals, but the regional models address internal regional growth dynamics and differential business cycle responses that allow for the differences in composition and performance of each region's economy. This approach is referred to as "top-down bottom-up." Forecasts of economic growth from the regional service models are applied to each FAF region.

### Model of the U.S. Economy

The main economic model of the U.S. economy that is applied for FAF5 forecasting integrates modern economic theory and behavior in an analytical tool. The theoretical structure of the U.S. Macroeconomic Model strives to incorporate the best insights of many theoretical approaches to the business cycle: Keynesian, neoclassical, monetarist, supply-side, and rational expectations. It

embodies major properties of the neoclassical growth models developed by Robert Solow, thus ensuring that short-run cyclical developments will converge to robust long-run equilibrium.

A modern model of output, prices, and financial conditions is melded with the growth model to present the detailed, short-run dynamics of the economy. In specific goods markets, the interactions of a set of supply and demand relations jointly determine spending, production, and price levels. Typically, prices, income, wealth, expectations, and financial conditions drive the level of inflation-adjusted demand. The capacity to supply goods and services is keyed to a production function combining the basic inputs of labor hours, energy usage, and the capital stocks of business equipment and structures, and government infrastructure. Expenditures on research and development that produce technological progress drive the "total factor productivity" of this composite of tangible inputs. Productivity growth is calculated by the difference between the growth inputs of labor, capital, and energy and growth in output.

The macroeconomic model applied for FAF5 forecasts captures the full simultaneity of the U.S. economy, forecasting over 1,400 concepts spanning final demands, aggregate supply, prices, incomes, international trade, industrial detail, interest rates, and financial flows. The following forecast factors are included:

- The GDP section and components refers to GDP and its subcategories, such as private consumption and fixed investment. Related concepts, such as capital stock and depreciation, are also included.
- The Prices section includes consumer price, producer, and wholesale price indices, as well as GDP deflators.
- The Fiscal, Monetary, and Financial Indicators section provides a detailed series on government finances, including various subcategories of government expenditure and government revenue/taxes, as well as the fiscal balance and government debt. It also contains data on monetary aggregates, interest rates, and stock market indices.
- The Population, Labor, Wages, and Employment section lists the concepts for population, employment and unemployment, wages and labor costs, and labor productivity.
- The External section has trade data, foreign debt, and international reserves (also known as official reserves or foreign reserves).

**U.S. Regional Economic Forecasting Models**

The approach to State and metropolitan area economic forecasting models represents a significant departure from most previous multiregional modeling and forecasting efforts. Most other regional models are constructed as proportions of the United States. In the FAF5 forecast modeling system, however, each area is modeled individually and then linked into a national system. Thus, the models do not forecast regional growth as simple proportions of U.S. totals but focus on internal growth dynamics and differential business cycle response. In contrast with pure-share (top-down) models, the modeling approach used is referred to as "top-down, bottom up."

The basic objective is to project how regional activity varies, given an economic environment as laid out by the macroeconomic and industry forecasts. To do this, the models strive to address

why States react differently from one another over the business cycle and why States grow or decline relative to each other over the longer run.

These issues are addressed using information about detailed industrial mix, interindustry and interregional relationships, productivity and relative costs, and migration trends.

The State and metropolitan statistical area (MSA) models are econometric and have a quarterly periodicity. Another general characteristic of the models is that they are policy sensitive, and they respond to changes in tax rates, government spending, utility costs, and the like. There are a few reasons for this sensitivity in the model design, including the following:

- Each State is modeled individually, with different model structures specified according to the characteristics of the State.
- National policy is explicitly captured.
- The comparative advantage of one State over another is explicitly modeled using relative cost variables.

***Regional Economic Modeling***

The major linkages among the models occur in the economic base and the export sectors. These sectors are identified as primarily agriculture, mining, the government, and most manufacturing industries. In a few States, banking, insurance, or services (hotel) sectors are also classified as significant export sectors. For the most part, these industries serve national rather than local markets or are not dependent on the local market. On the other hand, the income generated from these sectors provides one of the major stimuli to the local economy. The local growth and decline of these sectors typically contribute substantially to the region's economic health.

The local economy is composed of construction, transportation, utilities and communications, finance, insurance, and real estate, wholesale and retail trade, services, and State and local government. The major driving forces in this part of the economy are local in nature. Export sectors are those earning income from export sales, including the portion of agriculture, mining, manufacturing, and service sector output sold as exports. The income generated by the export sectors circulates and multiplies through the local economy and generates regional employment.

In the demographic sector of the regional models, economic conditions drive net migration. The principal assumption here is that people follow jobs and higher incomes rather than vice versa. This assumption does not mean that nonpecuniary determinants of migration do not exist, but these are either fixed (climate and landscape) or vary only slowly (urbanization) or are special in nature (the ability to sell homes and retire elsewhere). The important model performance criterion is to capture the correct direction of causality. Demographic factors are most important on the regional economy's consumption side. They are a significant factor in housing, retail sales, and the automotive sector, and the relationships are captured in the models. Population is also an important long-term determinant of the size of the workforce and such sectors as State and local government.

Manufacturing, for example, is a prime determinant of utilities and transportation employment. In highly industrialized States, such as California, Texas, and Ohio, it influences almost every

nonmanufacturing support sector. In certain western States, such as California; on the other hand, it is agriculture or mining that are important export sectors. The appropriate export sector is explicitly represented in the equation, and in this way, the secondary effects of a new plant, a new mine, or increased acreage are directly captured in the nonmanufacturing sectors. Because nonmanufacturing has explicit feedbacks unto itself, the third- and fourth-order effects are also captured. It is a dynamic and policy-sensitive equation structure.

### *Labor Cost Impacts on Regional Economy Forecast*

When real wages are high, rising rapidly, or both, the tendency of business, government, and other organizations is to hold employment down as much as possible. The reverse holds true when real wages are low or falling rapidly. In the manufacturing sector, productivity-adjusted wage costs were shown to be one of the principal determinants of business location decisions. In the nonmanufacturing support sectors, this relationship is reflected in the level rather than the location of employment. Thus, employment is inversely proportional to real wage costs. Real wages enter many of the nonmanufacturing employment equations. For forecast purposes, this wage rate is related to the appropriate national variable and the growth rate of the sector itself.

### *National Conditions' Impacts on Regional Economy Forecast*

In the regional models, the national economy is reflected in three areas in the nonmanufacturing sectors. First, certain macroeconomic conditions affect local activity significantly, even nonmanufacturing. The best example of this effect is credit availability. Tight credit conditions with higher interest rates have an adverse impact on local construction activity, sales of automobiles, and sales of other durable equipment. Thus, when interest rates rise, employment in construction and in wholesale and retail trade is adversely affected. The opposite holds true during periods, such as in 2020, of easy money and low interest rates.

The second type of national variables in the regional model includes factors that reflect nationwide trends, for example, the trend towards an increasingly larger services sector. Capturing this secular trend is sometimes difficult when one uses only local variables in the nonmanufacturing equations. Thus, the usual assortment of local variables, such as income, populations, wages, and costs, are sometimes supplemented by the ratio of sector employment to total employment at the national level, which is not a "shift-share" relationship. It is used to supplement, not supplant, local activity variables. The elasticity on the national series is uniformly lower than the elasticity on the local variables, and it is reflecting gradual long-term changes in the nation's employment structure. The local variables remain the main drivers of the local economy.

### *Components of Demographic Change that Impact Regional Economy Forecast*

Main components of demographic change that have a large impact on regional economy forecast are:

- Births
- Deaths
- Net migration.

A few decades ago, natural increase accounted for 68 percent of population growth nationwide, but in a number of fast-growing States in the South and West, net migration accounted for over half the gain, making interstate mobility an important determinant of State population growth. Additionally, in the last 10 years, migration patterns have become even greater influences at the State level through both interstate population flows and fluctuations in international migration. Econometric analysis of net migration based on economic determinants differentiates its forecasts from the Census Bureau's trended State projections. In line with the 2020 Census population data, IHS Markit U.S. demographic projections address the dramatic changes seen in mortality, household formation, and birth rates following the start of 2020. Population forecasts vary with the long-term growth in the economy.

**Business Market Insights**

The BMI database, formerly the Business Demographics Model, contains a consistent set of historical statistical estimates and forecasts by industry sector and by geographic region. The statistics include the number of business establishments, employees, and sales by industry. Industry aggregation levels include two-, three-, four-, five-, and six-digit classifications in the NAICS codes. The model uses the U.S macro, U.S regional, and U.S industry employment outlooks to forecast employment, number of establishments, and sales at county, State, and national levels. All business demographics-modeled databases are designed to be consistent with the latest business activity that is published by government agencies, including U.S. Census, U.S. Bureau of Labor Statistics (BLS), and U.S. Department of Agriculture (USDA).

The following business demographic concepts are included in BMI (Those marked with an asterisk are nonstandard and are not used in the FAF5 forecasts.):

- Number of employees
    - Total
    - By industry
    - By occupation group*
    - By geographic area
    - By business size*
- Number of business locations
    - By industry
    - By business size*
    - By geographic area
- Industry segments
    - 4-digit NAICS code
    - 5-digit NAICS code
    - 6-digit NAICS code
- Business size segments
    - 1 to 4 employees
    - 5 to 9 employees
    - 10 to 19 employees
    - 20 to 49 employees
    - 50 to 99 employees
    - 100 to 249 employees
    - 250 to 499 employees
    - 500 to 999 employees
    - 1000 employees or more
- Geographic segments
    - Nation
    - Census regions
    - States
    - Metropolitan areas
    - Counties
    - Zone Improvement Plan Codes

The following discussion describes the data and estimation techniques used in BMI.

### *BMI Input Data and Approach*

The BMI production starts with updating historical data based on the latest government-reported statistics and then building the forecast by breaking down U.S. macroeconomic aggregate industry growth paths to more detailed industry levels at the county level.

The data a government agency collects is treated as an "actual" measurement of the economic activity in a given geographic area. In fact, this observation really is an estimate of activity. The government surveys a percentage of employers in the region and then imputes the value for the region from this sample. As with any estimate, these "actual" observations may deviate from the "truth." However, as the size of the geographic area increases, so too does the accuracy of the estimate (due to the law of averages). Therefore, the sum of these county-level forecasts will always add up to a measurement or an estimate of State- and national-level activity.

Several data sources are used as a basis for the first-round model of county employment and establishments. County Business Pattern (CBP) data provide a series of county-level employment and establishments through 2016 at the 6-digit NAICS level of detail. These data served as starting observations of "actual" activity for most sectors of the economy. The last year when records were not suppressed significantly at the county level was 2016. Available CBP data for years 2017 to 2019 and 2016 data were used to uncover hidden county-level data. Forecasts from 2020 to 2050 are produced for the BMI and were used in the forecasting process.

The CBP does not include coverage of the governmental or agricultural sectors. To supplement the CBP data, government sector data were obtained from the BLS Quarterly Census of Employment and Wages, and the agricultural sector data were obtained from the USDA Census of Agriculture. Data from the BLS form the basis of national- and State-level macroeconomic forecasting coverage by industry. These forecasts are used as the national- and State-level constraints on the county-level forecasts. The counties add up to the FAF regions and States, and the States sum to the Nation.

### *Estimation Techniques*

The BMI modeling methodology is presented in two parts: the modeling of employment and the number of establishments and a description of the estimation of output.

The underlying technique of county-level estimation is a "top-down bottom-up" model. "Top-down bottom-up" methodology relies on using all the information available at any given time. First, county-level data were used to determine the trend of data in a particular county. Both trending and sharing techniques were used to create an independent forecast of employment and the number of establishments.

To start, a first-round forecast was estimated using CBP county-level data. Employment and the number of establishments for each industry (as defined by government four-digit SIC and six-digit NAICS codes) were estimated using a five-year moving average of historical growth rates. (From this point, any description of procedures to estimate employment also applies to

establishments.) This forecast is independent of any information at the State, MSA, or national level and returned a unique growth path for the over-3,000 U.S. counties.

Next, a second-level forecast was calculated using estimates provided from the first round. For the period 2000 to 2050, employment in each county for every NAICS code was recalculated as a percentage of the first-round estimated total for that industry sector. The resulting series represents the relative movement of employment in the county relative to that at the State level and to employment in other counties in the State. In other words: Is employment in industry X in county Y growing faster, slower, or in step with its counterpart at the State level or in the next county? Next, an estimate of employment levels was made by apportioning the forecasted State-level employment for that industry to each county based on its share of first-round estimated employment.

At this point, data for more than 300 MSAs in the United States were introduced. In an iterative procedure, the county-level forecasts were adjusted until the estimates solved for both the State and MSA. A brief description of this procedure follows. Estimates calculated by allocating State-level data to the counties were summed to either the MSA to which the county belongs or to a "rest of State" variable. Counties that comprise each MSA were aggregated into a summed MSA variable. From this, each county's share of MSA employment was calculated, and this share was used to allocate MSA employment to the counties. All MSAs in a State were then summed and subtracted from the sum of the counties for the State. This value, the remainder of employment in each State but not in an MSA, then was allocated to the "rest of State" counties based on their share of the "rest of State" variable calculated above. This process continued iteratively until the selected criteria were met.

***Output (As Value of Sales)***

Output (as value of sales) was measured in current dollars and is available at two-, three-, or four-digit NAICS code categories. The database includes the history and forecasts of constant dollar output and the corresponding price indices for each industry sector. Nominal dollar outputs were obtained as identities.

Constant dollar output was estimated as a function of total demand from the input/output block, cyclical variables, and a time trend. The functional form that was used imposed a unitary elasticity on the demand term, which embodies most of the explanatory power in the relationship. Additional nondemand terms were included in the equations to explain the parts of the pattern that are not well accounted for by the input/output model and its demand indicators: cyclicality and technological change.

National output by industry was transformed to regional measures by using region-specific productivity measures from the FAF5 regional models used. In addition, the share of employment by industry was used to allocate output to subregional geographies.

Historic data sources used include the U.S. Economic Census, USDA, Census of Mining, Annual Survey of Manufactures, Census of Transportation, Federal Communications Commission Statistics of Common Carriers, and Census of Services.

### *Business Transactions Matrix*

Information on interindustry purchases comes from the BTM.

### *Input Data*

The primary data source for the BTM is the latest set of input/output tables prepared by the U.S. (BEA). These data are released every five years as the benchmark input-output accounts of the United States. The industrial breakdown generally follows a standard six-digit NAICS detail for manufacturing sectors and a four-digit or three-digit NAICS detail for nonmanufacturing sectors.

### *Estimation Method*

A modified RAS (Richard A Stone) algorithm is applied in economics to reconcile input-output coefficients to forecast changes in the input-output coefficients over time. The modified RAS method requires two sets of data: the direct coefficient matrix of an input-output table for an initial year t and a column vector of sectoral gross outputs in year t+1. Given these sets of data, an iterative adjustment procedure was applied to the direct coefficient matrix, which yields an adjusted coefficient matrix for year t+1 that is consistent with the ratio of intermediate input to output and the gross output measures of that year.

### *Output*

When the input-output matrix forecast estimation was complete, purchases by industry and county were determined. National use factors (defined as purchases by industry j from industry i per employee in industry j) were calculated, and then multiplied by the number of employees in industry j by county from the BMI, resulting in an estimation of purchases by industry j from industry i in each county.

## Global Trade Atlas and Global Trade Atlas Forecast

The GTA database contains historical and forecasted bilateral trade data broken down by country (or region), commodity, trade concept (value or volume, mode), and direction of trade (exports and imports). The GTA database covers all global trade broken down into 248 countries and regions. In addition, U.S. seaborne trade volume is broken down into six coastal areas. These coastal areas include the North Atlantic Coast, South Atlantic Coast, North Pacific Coast, South Pacific Coast, Gulf Coast, and Great Lakes Region. These trade volumes are further disaggregated into 270 commodity categories, mapped to SITC and HS commodity codes and to 16 value and volume concepts, which include the following:

- Total trade real value
- Total trade nominal value
    - Airborne trade nominal value
    - Overland/other trade nominal value
    - Seaborne trade nominal value
- Total trade metric tons

- Airborne trade metric tons
- Overland/other trade metric tons
- Seaborne trade metric tons
    - Dry bulk metric tons
    - Liquid bulk (tanker) metric tons
    - General cargo/neo bulk metric tons
    - Container metric tons
        - 20-foot containers
        - 40-foot containers
        - 20-foot-container equivalent unit

***Input—Trade Data Sources***

GTA uses historical data from a combination of country and international agency sources and combines this information with IHS Markit data, analysis, and forecasts to produce bilateral trade forecasts by commodity and mode. The primary external data sources are the individual customs agencies or the national statistical agencies reporting national merchandise trade statistics. In the United States, the source is the Foreign Trade Division of the U.S. Census Bureau reporting data collected by the U.S. Department of Homeland Security, Customs and Border Protection. In Canada, the trade data come from Statistics Canada, and so forth, country by country globally. These commodity trade data are also supplemented with other sources that provide commodity-specific and some other supplemental or alternative perspectives on import and export flows. Among these external sources are the following examples by category:

- International organizations and agencies, such as Eurostat, Organization for Economic Cooperation and Development, International Energy Agency, International Coffee Organization, and others
- National statistics agencies such as the National Bureau of Statistics of China and Australian Bureau of Statistics
- National customs agencies
- Commodity-specific national organizations and agencies, such as the U.S. EIA and National Cotton Council of America

The global trade forecasting models also rely on comprehensive macroeconomic country history and forecast databases. Among the data used are population, GDP, GDP deflators, industrial output, foreign exchange rates, and export prices by country.

***Estimation Methods—Modeling International Commodity Trade***

The basic structure of the model for the trade flow of a commodity is that a country's imports from another country are driven by the importing country's demand forces, enabled by the exporting country's capacity of exporting (supplying) the commodity, and affected by the exporting country's export prices and importing country's import costs for the commodity. Export capacity for a commodity is estimated based on the country's capacity to produce this commodity, the country's own demand for the commodity, and the country's ability to export the

commodity (e.g., the quality and cost of products facing competition in global markets). Import costs are determined by export prices, import tariffs, each importing country's foreign exchange rates, and import price elasticities by commodity.

The models are constructed in real-value terms and disaggregated to the country and commodity levels to capture bilateral commodity trade patterns. The models used data in real value terms because only in real terms do the levels of imports and exports exhibit clear responses to changes in demand, supply, and prices. Individual forecasts are produced for each country's imports and exports with each of its trade partners. There is also a gravity modeling element to the models, where the distance between two countries is included in the estimates determining the scale of trade between two countries. To capture trade pattern switching, multistage switch modeling is applied in trade forecasting, and principal components analysis and artificial intelligence techniques are applied in modeling scenarios.

**Table 13. FAF5 Domestic Regions**

| Code | FAF5 Region | State | State or Remainder of State That Includes Part of This CMA[1] | Type of Region[2] |
|---|---|---|---|---|
| 011 | Birmingham-Hoover-Talladega, AL CFS Area | AL | | C |
| 012 | Mobile-Daphne-Fairhope, AL CFS Area | AL | | C |
| 019 | Remainder of Alabama | AL | | R |
| 020 | Alaska | AK | | S |
| 041 | Phoenix-Mesa-Scottsdale, AZ CFS Area | AZ | | M |
| 042 | Tucson-Nogales, AZ CFS Area | AZ | | C |
| 049 | Remainder of Arizona | AZ | | R |
| 050 | Arkansas | AR | | S |
| 061 | Los Angeles-Long Beach, CA CFS Area | CA | | C |
| 062 | Sacramento-Roseville, CA CFS Area | CA | | C |
| 063 | San Diego-Carlsbad, CA CFS Area | CA | | M |
| 064 | San Jose-San Francisco-Oakland, CA CFS Area | CA | | C |
| 065 | Fresno-Madera, CA CFS Area | CA | | C |
| 069 | Remainder of California | CA | | R |
| 081 | Denver-Aurora, CO CFS Area | CO | | C |
| 089 | Remainder of Colorado | CO | | R |
| 091 | Hartford-West Hartford-East Hartford, CT CFS Area | CT | | M |

| Code | FAF5 Region | State | State or Remainder of State That Includes Part of This CMA[1] | Type of Region[2] |
|---|---|---|---|---|
| 092 | New York-Newark, NY-NJ-CT-PA CFS Area (Connecticut part) | CT | NY, NJ, PA | C |
| 099 | Remainder of Connecticut | CT | | R |
| 101 | Philadelphia-Reading-Camden, PA-NJ-DE-MD CFS Area (Delaware part) | DE | PA, NJ, MD | C |
| 109 | Remainder of Delaware | DE | | R |
| 111 | Washington-Arlington-Alexandria, DC-VA-MD-WV CFS Area (District of Columbia part) | DC | VA, MD, WV | SM |
| 121 | Jacksonville-St. Marys-Palatka, FL-GA CFS Area (Florida part) | FL | GA | C |
| 122 | Miami-Fort Lauderdale-Port St. Lucie, FL CFS Area | FL | | C |
| 123 | Orlando-Deltona-Daytona Beach, FL CFS Area | FL | | C |
| 124 | Tampa-St. Petersburg-Clearwater, FL CFS Area | FL | | M |
| 129 | Remainder of Florida | FL | | R |
| 131 | Atlanta-Athens-Clarke County-Sandy Springs, GA CFS Area | GA | | C |
| 132 | Savannah-Hinesville-Statesboro, GA CFS Area | GA | | C |
| 139 | Remainder of Georgia | GA | | R |
| 151 | Urban Honolulu, HI CFS Area | HI | | M |
| 159 | Remainder of Hawaii | HI | | R |
| 160 | Idaho | ID | | S |
| 171 | Chicago-Naperville, IL-IN-WI CFS Area (Illinois part) | IL | IN, WI | C |
| 172 | St. Louis-St. Charles-Farmington, MO-IL CFS Area (Illinois part) | IL | MO | C |
| 179 | Remainder of Illinois | IL | | R |
| 181 | Chicago-Naperville, IL-IN-WI CFS Area (Indiana part) | IN | IL, WI | C |
| 182 | Indianapolis-Carmel-Muncie, IN CFS Area | IN | | C |

| Code | FAF5 Region | State | State or Remainder of State That Includes Part of This CMA[1] | Type of Region[2] |
|---|---|---|---|---|
| 183 | Fort Wayne-Huntington-Auburn, IN CFS Area | IN | | C |
| 189 | Remainder of Indiana | IN | | R |
| 190 | Iowa | IA | | S |
| 201 | Kansas City-Overland Park-Kansas City, MO-KS CFS Area (Kansas part) | KS | MO | C |
| 202 | Wichita-Arkansas City-Winfield, KS CFS Area | KS | | C |
| 209 | Remainder of Kansas | KS | | R |
| 211 | Cincinnati-Wilmington-Maysville, OH-KY-IN CFS Area (Kentucky part) | KY | OH, IN | C |
| 212 | Louisville/Jefferson County-Elizabethtown-Madison, KY-IN CFS Area (Kentucky part) | KY | IN | C |
| 219 | Remainder of Kentucky | KY | | R |
| 221 | Baton Rouge, LA CFS Area | LA | | M |
| 222 | Lake Charles-Jennings, LA CFS Area | LA | | M |
| 223 | New Orleans-Metairie-Hammond, LA-MS CFS Area (LA Louisiana part) | LA | MS | C |
| 229 | Remainder of Louisiana | LA | | R |
| 230 | Maine | ME | | S |
| 241 | Baltimore-Columbia-Towson, MD CFS Area | MD | | M |
| 242 | Washington-Arlington-Alexandria, DC-VA-MD-WV CFS Area (Maryland part) | MD | DC, VA, WV | M |
| 249 | Remainder of Maryland | MD | | R |
| 251 | Boston-Worcester-Providence, MA-RI-NH-CT CFS Area (Massachusetts part) | MA | RI, NH, CT | C |
| 259 | Remainder of Massachusetts | MA | | R |
| 261 | Detroit-Warren-Ann Arbor, MI CFS Area | MI | | C |
| 262 | Grand Rapids-Wyoming-Muskegon, MI CFS Area | MI | | C |
| 269 | Remainder of Michigan | MI | | R |

| Code | FAF5 Region | State | State or Remainder of State That Includes Part of This CMA[1] | Type of Region[2] |
|---|---|---|---|---|
| 271 | Minneapolis-St. Paul, MN-WI CFS Area (Minnesota part) | MN | WI | C |
| 279 | Remainder of Minnesota | MN | | R |
| 280 | Mississippi | MS | | S |
| 291 | Kansas City-Overland Park-Kansas City, MO-KS CFS Area (Missouri part) | MO | KS | C |
| 292 | St. Louis-St. Charles-Farmington, MO-IL CFS Area (Missouri part) | MO | IL | C |
| 299 | Remainder of Missouri | MO | | R |
| 300 | Montana | MT | | S |
| 311 | Omaha-Council Bluffs-Fremont, NE-IA CFS Area (Nebraska part) | NE | IA | C |
| 319 | Remainder of Nebraska | NE | | R |
| 321 | Las Vegas-Henderson, NV-AZ CFS Area (Nevada part) | NV | AZ | C |
| 329 | Remainder of Nevada | NV | | R |
| 331 | Boston-Worcester-Providence, MA-RI-NH-CT CFS Area (New Hampshire Part) | NH | MA, RI, CT | C |
| 339 | Remainder of New Hampshire | NH | | R |
| 341 | New York-Newark, NY-NJ-CT-PA CFS Area (New Jersey part) | NJ | NY, CT, PA | C |
| 342 | Philadelphia-Reading-Camden, PA-NJ-DE-MD CFS Area (New Jersey Part) | NJ | PA, DE, MD | C |
| 350 | New Mexico | NM | | S |
| 361 | Albany-Schenectady, NY CFS Area | NY | | C |
| 362 | Buffalo-Cheektowaga, NY CFS Area | NY | | C |
| 363 | New York-Newark, NY-NJ-CT-PA CFS Area (New York part) | NY | NJ, CT, PA | |
| 364 | Rochester-Batavia-Seneca Falls, NY CFS Area | NY | | C |
| 369 | Remainder of New York | NY | | R |
| 371 | Charlotte-Concord, NC-SC CFS Area (North Carolina part) | NC | SC | C |

| Code | FAF5 Region | State | State or Remainder of State That Includes Part of This CMA[1] | Type of Region[2] |
|---|---|---|---|---|
| 372 | Greensboro-Winston-Salem-High Point, NC CFS Area | NC | | C |
| 373 | Raleigh-Durham-Chapel Hill, NC CFS Area | NC | | C |
| 379 | Remainder of North Carolina | NC | | R |
| 380 | North Dakota | ND | | S |
| 391 | Cincinnati-Wilmington-Maysville, OH-KY-IN CFS Area (Ohio part) | OH | KY, IN | C |
| 392 | Cleveland-Akron-Canton, OH CFS Area | OH | | C |
| 393 | Columbus-Marion-Zanesville, OH CFS Area | OH | | C |
| 394 | Dayton-Springfield-Sidney, OH CFS Area | OH | | C |
| 399 | Remainder of Ohio | OH | | R |
| 401 | Oklahoma City-Shawnee, OK CFS Area | OK | | C |
| 402 | Tulsa-Muskogee-Bartlesville, OK CFS Area | OK | | C |
| 409 | Remainder of Oklahoma | OK | | R |
| 411 | Portland-Vancouver-Salem, OR-WA CFS Area (Oregon part) | OR | WA | C |
| 419 | Remainder of Oregon | OR | | R |
| 421 | Philadelphia-Reading-Camden, PA-NJ-DE-MD CFS Area (Pennsylvania part) | PA | NJ, DE, MD | C |
| 422 | Pittsburgh-New Castle-Weirton, PA-OH-WV CFS Area (Pennsylvania part) | PA | OH, WV | C |
| 423 | New York-Newark, NY-NJ-CT-PA CFS Area (Pennsylvania part) | PA | NY, NJ, CT | C |
| 429 | Remainder of Pennsylvania | PA | | R |
| 441 | Boston-Worcester-Providence, MA-RI-NH-CT CFS Area (Rhode Island part) | RI | MA, NH, CT | SM |
| 451 | Charleston-North Charleston, SC CFS Area | SC | | M |
| 452 | Greenville-Spartanburg-Anderson, SC CFS Area | SC | | C |
| 459 | Remainder of South Carolina | SC | | R |
| 460 | South Dakota | SD | | S |

| Code | FAF5 Region | State | State or Remainder of State That Includes Part of This CMA[1] | Type of Region[2] |
|---|---|---|---|---|
| 471 | Memphis-Forrest City, TN-MS-AR CFS Area (Tennessee part) | TN | MS, AR | C |
| 472 | Nashville-Davidson-Murfreesboro, TN CFS Area | TN | | C |
| 473 | Knoxville-Morristown-Sevierville, TN CFS Area | TN | | C |
| 479 | Remainder of Tennessee | TN | | R |
| 481 | Austin-Round Rock, TX CFS Area | TX | | M |
| 482 | Beaumont-Port Arthur, TX CFS Area | TX | | M |
| 483 | Corpus Christi-Kingsville-Alice, TX CFS Area | TX | | C |
| 484 | Dallas-Fort Worth, TX-OK CFS Area (Texas part) | TX | OK | C |
| 485 | El Paso-Las Cruces, TX-NM CFS Area (Texas part) | TX | NM | C |
| 486 | Houston-The Woodlands, TX CFS Area | TX | | C |
| 487 | Laredo, TX CFS Area | TX | | M |
| 488 | San Antonio-New Braunfels, TX CFS Area | TX | | M |
| 489 | Remainder of Texas | TX | | R |
| 491 | Salt Lake City-Provo-Orem, UT CFS Area | UT | | C |
| 499 | Remainder of Utah | UT | | R |
| 500 | Vermont | VT | | S |
| 511 | Richmond, VA CFS Area | VA | | M |
| 512 | Virginia Beach-Norfolk, VA-NC CFS Area (Virginia part) | VA | NC | C |
| 513 | Washington-Arlington-Alexandria, DC-VA-MD-WV CFS Area (Virginia part) | VA | DC, MD, WV | M |
| 519 | Remainder of Virginia | VA | | R |
| 531 | Seattle-Tacoma, WA CFS Area | WA | | C |
| 532 | Portland-Vancouver-Salem, OR-WA CFS Area (Washington part) | WA | OR | |
| 539 | Remainder of Washington | WA | | R |
| 540 | West Virginia | WV | | S |

| Code | FAF5 Region | State | State or Remainder of State That Includes Part of This CMA[1] | Type of Region[2] |
|---|---|---|---|---|
| 551 | Milwaukee-Racine-Waukesha, WI CFS Area | WI | | C |
| 559 | Remainder of Wisconsin | WI | | R |
| 560 | Wyoming | WY | | S |

[1]When census metropolitan areas (CMA) cross States, the major subareas of a CMA are defined for the FAF as separate regions, one for each State. Small subareas of a CMA are included with the State or Rest of State region identified in this field.

2C = combined statistical area (CSA)
M = metropolitan statistical area (MSA);
R = rest of State (everything in a State that is not part of a CSA or MSA);
S = State that does not include a CSA or MSA;
SM = whole State is part of MSA.
FAF5 = Freight Analysis Framework Version 5.

**Table 14. FAF5 Foreign Region**

| Code | FAF Region |
|---|---|
| 801 | Canada |
| 802 | Mexico |
| 803 | Rest of Americas |
| 804 | Europe |
| 805 | Africa |
| 806 | Southwestern and Central Asia |
| 807 | Eastern Asia |
| 808 | Southeastern Asia and Oceania |

FAF = Freight Analysis Framework; FAF5 = Freight Analysis Framework Version 5.

**Table 15. NAICS Drivers from BMI Forecast by Standard Classification of Transported Goods, Two-Digit Level (SCTG2)**

| SCTG2 Code | FAF5 Commodity Name | NAICS | NAICS Description |
|---|---|---|---|
| 1 | Live animals and fish | 114111 | Finfish fishing |
| 1 | Live animals and fish | 114112 | Shellfish fishing |
| 1 | Live animals and fish | 114210 | Hunting and trapping |
| 1 | Live animals and fish | 112000 | Animal production and aquaculture |
| 1 | Live animals and fish | 424520 | Livestock merchant wholesalers |
| 1 | Live animals and fish | 493110 | General warehousing and storage |
| 1 | Live animals and fish | 493120 | Refrigerated warehousing and storage |
| 1 | Live animals and fish | 493130 | Farm product warehousing and storage |
| 1 | Live animals and fish | 493190 | Other warehousing and storage |
| 2 | Cereal grains | 111000 | Crop production |
| 2 | Cereal grains | 424510 | Grain and field bean merchant wholesalers |
| 2 | Cereal grains | 454310 | Fuel dealers |
| 2 | Cereal grains | 493110 | General warehousing and storage |
| 2 | Cereal grains | 493120 | Refrigerated warehousing and storage |
| 2 | Cereal grains | 493130 | Farm product warehousing and storage |
| 2 | Cereal grains | 493190 | Other warehousing and storage |
| 3 | Other agricultural products | 111000 | Crop production |
| 3 | Other agricultural products | 113210 | Forest nurseries and gathering of forest products |
| 3 | Other agricultural products | 114119 | Other marine fishing |
| 3 | Other agricultural products | 311423 | Dried and dehydrated food manufacturing |
| 3 | Other agricultural products | 424510 | Grain and field bean merchant wholesalers |
| 3 | Other agricultural products | 424590 | Other farm product raw material merchant wholesalers |
| 3 | Other agricultural products | 454310 | Fuel dealers |
| 3 | Other agricultural products | 493110 | General warehousing and storage |
| 3 | Other agricultural products | 493120 | Refrigerated warehousing and storage |
| 3 | Other agricultural products | 493130 | Farm product warehousing and storage |
| 3 | Other agricultural products | 493190 | Other warehousing and storage |
| 4 | Animal feed | 111000 | Crop production |
| 4 | Animal feed | 112000 | Animal production and aquaculture |
| 4 | Animal feed | 114111 | Finfish fishing |
| 4 | Animal feed | 114112 | Shellfish fishing |
| 4 | Animal feed | 114119 | Other marine fishing |

| SCTG2 Code | FAF5 Commodity Name | NAICS | NAICS Description |
|---|---|---|---|
| 4 | Animal feed | 311111 | Dog and cat food manufacturing |
| 4 | Animal feed | 311119 | Other animal food manufacturing |
| 4 | Animal feed | 312120 | Breweries |
| 4 | Animal feed | 325193 | Ethyl alcohol manufacturing |
| 4 | Animal feed | 454310 | Fuel dealers |
| 4 | Animal feed | 493110 | General warehousing and storage |
| 4 | Animal feed | 493120 | Refrigerated warehousing and storage |
| 4 | Animal feed | 493130 | Farm product warehousing and storage |
| 4 | Animal feed | 493190 | Other warehousing and storage |
| 5 | Meat, fish, and seafood | 114111 | Finfish fishing |
| 5 | Meat, fish, and seafood | 114112 | Shellfish fishing |
| 5 | Meat, fish, and seafood | 114119 | Other marine fishing |
| 5 | Meat, fish, and seafood | 311611 | Animal (except poultry) slaughtering |
| 5 | Meat, fish, and seafood | 311612 | Meat processed from carcasses |
| 5 | Meat, fish, and seafood | 311615 | Poultry processing |
| 5 | Meat, fish, and seafood | 311710 | Seafood product preparation and packaging |
| 5 | Meat, fish, and seafood | 493110 | General warehousing and storage |
| 5 | Meat, fish, and seafood | 493120 | Refrigerated warehousing and storage |
| 5 | Meat, fish, and seafood | 493130 | Farm product warehousing and storage |
| 5 | Meat, fish, and seafood | 493190 | Other warehousing and storage |
| 6 | Milled grain products | 311211 | Flour milling |
| 6 | Milled grain products | 311212 | Rice milling |
| 6 | Milled grain products | 311213 | Malt manufacturing |
| 6 | Milled grain products | 311221 | Wet corn milling |
| 6 | Milled grain products | 311230 | Breakfast cereal manufacturing |
| 6 | Milled grain products | 311412 | Frozen specialty food manufacturing |
| 6 | Milled grain products | 311422 | Specialty canning |
| 6 | Milled grain products | 311811 | Retail bakeries |
| 6 | Milled grain products | 311812 | Commercial bakeries |
| 6 | Milled grain products | 311813 | Frozen cakes, pies, and other pastries manufacturing |
| 6 | Milled grain products | 311821 | Cookie and cracker manufacturing |
| 6 | Milled grain products | 311824 | Dry pasta, dough, and flour mixes manufacturing from purchased flour |
| 6 | Milled grain products | 311830 | Tortilla manufacturing |

| SCTG2 Code | FAF5 Commodity Name | NAICS | NAICS Description |
|---|---|---|---|
| 6 | Milled grain products | 311919 | Other snack food manufacturing |
| 6 | Milled grain products | 311991 | Perishable prepared food manufacturing |
| 6 | Milled grain products | 493110 | General warehousing and storage |
| 6 | Milled grain products | 493120 | Refrigerated warehousing and storage |
| 6 | Milled grain products | 493130 | Farm product warehousing and storage |
| 6 | Milled grain products | 493190 | Other warehousing and storage |
| 7 | Other prepared foodstuffs | 112000 | Animal production and aquaculture |
| 7 | Other prepared foodstuffs | 114111 | Finfish fishing |
| 7 | Other prepared foodstuffs | 114112 | Shellfish fishing |
| 7 | Other prepared foodstuffs | 311221 | Wet corn milling |
| 7 | Other prepared foodstuffs | 311224 | Soybean and other oilseed processing |
| 7 | Other prepared foodstuffs | 311225 | Fats and oils refining and blending |
| 7 | Other prepared foodstuffs | 311313 | Beet sugar manufacturing |
| 7 | Other prepared foodstuffs | 311314 | Cane sugar manufacturing |
| 7 | Other prepared foodstuffs | 311340 | Nonchocolate confectionery manufacturing |
| 7 | Other prepared foodstuffs | 311351 | Chocolate and confectionery manufacturing from cacao beans |
| 7 | Other prepared foodstuffs | 311352 | Confectionery manufacturing from purchased chocolate |
| 7 | Other prepared foodstuffs | 311411 | Frozen fruit, juice, and vegetable manufacturing |
| 7 | Other prepared foodstuffs | 311412 | Frozen specialty food manufacturing |
| 7 | Other prepared foodstuffs | 311421 | Fruit and vegetable canning |
| 7 | Other prepared foodstuffs | 311422 | Specialty canning |
| 7 | Other prepared foodstuffs | 311423 | Dried and dehydrated food manufacturing |
| 7 | Other prepared foodstuffs | 311511 | Fluid milk manufacturing |
| 7 | Other prepared foodstuffs | 311512 | Creamery butter manufacturing |
| 7 | Other prepared foodstuffs | 311513 | Cheese manufacturing |
| 7 | Other prepared foodstuffs | 311514 | Dry, condensed, and evaporated dairy product manufacturing |
| 7 | Other prepared foodstuffs | 311520 | Ice cream and frozen dessert manufacturing |
| 7 | Other prepared foodstuffs | 311613 | Rendering and meat byproduct processing |
| 7 | Other prepared foodstuffs | 311710 | Seafood product preparation and packaging |
| 7 | Other prepared foodstuffs | 311911 | Roasted nuts and peanut butter manufacturing |
| 7 | Other prepared foodstuffs | 311919 | Other snack food manufacturing |

| SCTG2 Code | FAF5 Commodity Name | NAICS | NAICS Description |
|---|---|---|---|
| 7 | Other prepared foodstuffs | 311920 | Coffee and tea manufacturing |
| 7 | Other prepared foodstuffs | 311930 | Flavoring syrup and concentrate manufacturing |
| 7 | Other prepared foodstuffs | 311941 | Mayonnaise, dressing, and other prepared sauce manufacturing |
| 7 | Other prepared foodstuffs | 311942 | Spice and extract manufacturing |
| 7 | Other prepared foodstuffs | 311991 | Perishable prepared food manufacturing |
| 7 | Other prepared foodstuffs | 311999 | All other miscellaneous food manufacturing |
| 7 | Other prepared foodstuffs | 312111 | Soft drink manufacturing |
| 7 | Other prepared foodstuffs | 312112 | Bottled water manufacturing |
| 7 | Other prepared foodstuffs | 312113 | Ice manufacturing |
| 7 | Other prepared foodstuffs | 493110 | General warehousing and storage |
| 7 | Other prepared foodstuffs | 493120 | Refrigerated warehousing and storage |
| 7 | Other prepared foodstuffs | 493130 | Farm product warehousing and storage |
| 7 | Other prepared foodstuffs | 493190 | Other warehousing and storage |
| 8 | Alcoholic beverages | 312120 | Breweries |
| 8 | Alcoholic beverages | 312130 | Wineries |
| 8 | Alcoholic beverages | 312140 | Distilleries |
| 8 | Alcoholic beverages | 424810 | Beer and ale merchant wholesalers |
| 8 | Alcoholic beverages | 424820 | Wine and distilled alcoholic beverage merchant wholesalers |
| 8 | Alcoholic beverages | 454110 | Electronic shopping and mail-order houses |
| 8 | Alcoholic beverages | 493110 | General warehousing and storage |
| 8 | Alcoholic beverages | 493120 | Refrigerated warehousing and storage |
| 8 | Alcoholic beverages | 493130 | Farm product warehousing and storage |
| 8 | Alcoholic beverages | 493190 | Other warehousing and storage |
| 9 | Tobacco products | 312230 | Tobacco manufacturing |
| 9 | Tobacco products | 424940 | Tobacco and tobacco product merchant wholesalers |
| 9 | Tobacco products | 454310 | Fuel dealers |
| 9 | Tobacco products | 454110 | Electronic shopping and mail-order houses |
| 10 | Monumental or building stone | 212311 | Dimension stone mining and quarrying |
| 11 | Natural sands | 212321 | Construction sand and gravel mining |
| 11 | Natural sands | 212322 | Industrial sand mining |
| 11 | Natural sands | 493110 | General warehousing and storage |
| 11 | Natural sands | 493190 | Other warehousing and storage |

| SCTG2 Code | FAF5 Commodity Name | NAICS | NAICS Description |
|---|---|---|---|
| 12 | Gravel and crushed stone | 212312 | Crushed and broken limestone mining and quarrying |
| 12 | Gravel and crushed stone | 212313 | Crushed and broken granite mining and quarrying |
| 12 | Gravel and crushed stone | 212319 | Other crushed and broken stone mining and quarrying |
| 12 | Gravel and crushed stone | 212321 | Construction sand and gravel mining |
| 12 | Gravel and crushed stone | 493110 | General warehousing and storage |
| 12 | Gravel and crushed stone | 493190 | Other warehousing and storage |
| 13 | Nonmetallic minerals, n.e.c. | 212311 | Dimension stone mining and quarrying |
| 13 | Nonmetallic minerals, n.e.c. | 212313 | Crushed and broken granite mining and quarrying |
| 13 | Nonmetallic minerals, n.e.c. | 212319 | Other crushed and broken stone mining and quarrying |
| 13 | Nonmetallic minerals, n.e.c. | 212324 | Kaolin and ball clay mining |
| 13 | Nonmetallic minerals, n.e.c. | 212325 | Clay and ceramic and refractory minerals mining |
| 13 | Nonmetallic minerals, n.e.c. | 212391 | Potash, soda, and borate mineral mining |
| 13 | Nonmetallic minerals, n.e.c. | 212392 | Phosphate rock mining |
| 13 | Nonmetallic minerals, n.e.c. | 212393 | Other chemical and fertilizer mineral mining |
| 13 | Nonmetallic minerals, n.e.c. | 212399 | All other nonmetallic mineral mining |
| 13 | Nonmetallic minerals, n.e.c. | 493110 | General warehousing and storage |
| 13 | Nonmetallic minerals, n.e.c. | 493190 | Other warehousing and storage |
| 14 | Metallic ores and concentrates | 212210 | Iron ore mining |
| 14 | Metallic ores and concentrates | 212221 | Gold ore mining |
| 14 | Metallic ores and concentrates | 212222 | Silver ore mining |
| 14 | Metallic ores and concentrates | 212291 | Uranium-radium-vanadium ore mining |
| 14 | Metallic ores and concentrates | 212299 | All other metal ore mining |
| 14 | Metallic ores and concentrates | 331313 | Alumina refining and primary aluminum production |
| 14 | Metallic ores and concentrates | 493110 | General warehousing and storage |
| 14 | Metallic ores and concentrates | 493190 | Other warehousing and storage |
| 14 | Metallic ores and concentrates | 212230 | Copper, nickel, lead, and zinc mining |
| 15 | Coal | 212111 | Bituminous coal and lignite surface mining |
| 15 | Coal | 212112 | Bituminous coal underground mining |
| 15 | Coal | 212113 | Anthracite mining |
| 15 | Coal | 454310 | Fuel dealers |

| SCTG2 Code | FAF5 Commodity Name | NAICS | NAICS Description |
|---|---|---|---|
| 16 | Crude petroleum oil | 211111 | Crude petroleum and natural gas extraction |
| 17 | Gasoline and aviation turbine fuel | 324110 | Petroleum refineries |
| 17 | Gasoline | 325193 | Ethyl alcohol manufacturing |
| 17 | Gasoline | 454310 | Fuel dealers |
| 17 | Gasoline | 493110 | General warehousing and storage |
| 17 | Gasoline | 493190 | Other warehousing and storage |
| 18 | Fuel oils | 324110 | Petroleum refineries |
| 18 | Fuel oils | 454310 | Fuel dealers |
| 18 | Fuel oils | 493110 | General warehousing and storage |
| 18 | Fuel oils | 493190 | Other warehousing and storage |
| 19 | Coal and petroleum products, n.e.c. | 211112 | Natural gas liquid extraction |
| 19 | Coal and petroleum products, n.e.c. | 324110 | Petroleum refineries |
| 19 | Coal and petroleum products, n.e.c. | 324121 | Asphalt paving mixture and block manufacturing |
| 19 | Coal and petroleum products, n.e.c. | 324191 | Petroleum lubricating oil and grease manufacturing |
| 19 | Coal and petroleum products, n.e.c. | 324199 | All other petroleum and coal products manufacturing |
| 19 | Coal and petroleum products, n.e.c. | 325110 | Petrochemical manufacturing |
| 19 | Coal and petroleum products, n.e.c. | 325180 | Other basic inorganic chemical manufacturing |
| 19 | Coal and petroleum products, n.e.c. | 325194 | Cyclic crude, intermediate, and gum and wood chemical manufacturing |
| 19 | Coal and petroleum products, n.e.c. | 325998 | All other miscellaneous chemical product and preparation manufacturing |
| 19 | Coal and petroleum products, n.e.c. | 454310 | Fuel dealers |
| 19 | Coal and petroleum products, n.e.c. | 493110 | General warehousing and storage |
| 19 | Coal and petroleum products, n.e.c. | 493190 | Other warehousing and storage |
| 20 | Basic chemicals | 325110 | Petrochemical manufacturing |
| 20 | Basic chemicals | 325120 | Industrial gas manufacturing |
| 20 | Basic chemicals | 325130 | Synthetic dye and pigment manufacturing |
| 20 | Basic chemicals | 325180 | Other basic inorganic chemical manufacturing |
| 20 | Basic chemicals | 325199 | All other basic organic chemical manufacturing |
| 20 | Basic chemicals | 454310 | Fuel dealers |
| 20 | Basic chemicals | 493110 | General warehousing and storage |

| SCTG2 Code | FAF5 Commodity Name | NAICS | NAICS Description |
|---|---|---|---|
| 20 | Basic chemicals | 493190 | Other warehousing and storage |
| 21 | Pharmaceutical products | 325411 | Medicinal and botanical manufacturing |
| 21 | Pharmaceutical products | 325412 | Pharmaceutical preparation manufacturing |
| 21 | Pharmaceutical products | 325413 | In vitro diagnostic substance manufacturing |
| 21 | Pharmaceutical products | 325414 | Biological product (except diagnostic) manufacturing |
| 21 | Pharmaceutical products | 339112 | Surgical and medical instrument manufacturing |
| 21 | Pharmaceutical products | 339114 | Dental equipment and supplies manufacturing |
| 21 | Pharmaceutical products | 339116 | Dental laboratories |
| 21 | Pharmaceuticals | 493110 | General warehousing and storage |
| 21 | Pharmaceuticals | 493120 | Refrigerated warehousing and storage |
| 21 | Pharmaceuticals | 493190 | Other warehousing and storage |
| 22 | Fertilizers | 212391 | Potash, soda, and borate mineral mining |
| 22 | Fertilizers | 212392 | Phosphate rock mining |
| 22 | Fertilizers | 212393 | Other chemical and fertilizer mineral mining |
| 22 | Fertilizers | 325180 | Other basic inorganic chemical manufacturing |
| 22 | Fertilizers | 325311 | Nitrogenous fertilizer manufacturing |
| 22 | Fertilizers | 325312 | Phosphatic fertilizer manufacturing |
| 22 | Fertilizers | 325314 | Fertilizer (mixing only) manufacturing |
| 22 | Fertilizers | 493110 | General warehousing and storage |
| 22 | Fertilizers | 493130 | Farm product warehousing and storage |
| 22 | Fertilizers | 493190 | Other warehousing and storage |
| 23 | Chemical products and preparations, n.e.c. | 325194 | Cyclic crude, intermediate, and gum and wood chemical manufacturing |
| 23 | Chemical products and preparations, n.e.c. | 325199 | All other basic organic chemical manufacturing |
| 23 | Chemical products and preparations, n.e.c. | 325320 | Pesticide and other agricultural chemical manufacturing |
| 23 | Chemical products and preparations, n.e.c. | 325510 | Paint and coating manufacturing |
| 23 | Chemical products and preparations, n.e.c. | 325520 | Adhesive manufacturing |
| 23 | Chemical products and preparations, n.e.c. | 325611 | Soap and other detergent manufacturing |

| SCTG2 Code | FAF5 Commodity Name | NAICS | NAICS Description |
|---|---|---|---|
| 23 | Chemical products and preparations, n.e.c. | 325612 | Polish and other sanitation good manufacturing |
| 23 | Chemical products and preparations, n.e.c. | 325613 | Surface active agent manufacturing |
| 23 | Chemical products and preparations, n.e.c. | 325620 | Toilet preparation manufacturing |
| 23 | Chemical products and preparations, n.e.c. | 325910 | Printing ink manufacturing |
| 23 | Chemical products and preparations, n.e.c. | 325920 | Explosives manufacturing |
| 23 | Chemical products and preparations, n.e.c. | 325992 | Photographic film, paper, plate, and chemical manufacturing |
| 23 | Chemical products and preparations, n.e.c. | 325998 | All other miscellaneous chemical product and preparation manufacturing |
| 23 | Chemical products and preparations, n.e.c. | 333316 | Photographic and photocopying equipment manufacturing |
| 23 | Chemical products and preparations, n.e.c. | 339114 | Dental equipment and supplies manufacturing |
| 23 | Chemical products and preparations, n.e.c. | 339116 | Dental laboratories |
| 23 | Chemical products and preparations, n.e.c. | 424690 | Other chemical and allied products merchant wholesalers |
| 23 | Chemical products and preparations, n.e.c. | 424610 | Plastics materials and basic forms and shapes merchant wholesalers |
| 23 | Chemical products and preparations, n.e.c. | 454310 | Fuel dealers |
| 23 | Chemical products and preparations, n.e.c. | 493110 | General warehousing and storage |
| 23 | Chemical products and preparations, n.e.c. | 493120 | Refrigerated warehousing and storage |
| 23 | Chemical products and preparations, n.e.c. | 493130 | Farm product warehousing and storage |
| 23 | Chemical products and preparations, n.e.c. | 493190 | Other warehousing and storage |
| 24 | Plastics and rubber | 314120 | Curtain and linen mills |
| 24 | Plastics and rubber | 325211 | Plastics material and resin manufacturing |
| 24 | Plastics and rubber | 325212 | Synthetic rubber manufacturing |
| 24 | Plastics and rubber | 325220 | Artificial and synthetic fibers and filaments manufacturing |

| SCTG2 Code | FAF5 Commodity Name | NAICS | NAICS Description |
|---|---|---|---|
| 24 | Plastics and rubber | 325991 | Custom compounding of purchased resins |
| 24 | Plastics and rubber | 326111 | Plastics bag and pouch manufacturing |
| 24 | Plastics and rubber | 326112 | Plastics packaging film and sheet (including laminated) manufacturing |
| 24 | Plastics and rubber | 326113 | Unlaminated plastics film and sheet (except packaging) manufacturing |
| 24 | Plastics and rubber | 326121 | Unlaminated plastics profile shape manufacturing |
| 24 | Plastics and rubber | 326122 | Plastics pipe and pipe fitting manufacturing |
| 24 | Plastics and rubber | 326130 | Laminated plastics plate, sheet (except packaging), and shape manufacturing |
| 24 | Plastics and rubber | 326140 | Polystyrene foam product manufacturing |
| 24 | Plastics and rubber | 326150 | Urethane and other foam product (except polystyrene) manufacturing |
| 24 | Plastics and rubber | 326160 | Plastics bottle manufacturing |
| 24 | Plastics and rubber | 326191 | Plastics plumbing fixture manufacturing |
| 24 | Plastics and rubber | 326199 | All other plastics product manufacturing |
| 24 | Plastics and rubber | 326211 | Tire manufacturing (except retreading) |
| 24 | Plastics and rubber | 326212 | Tire retreading |
| 24 | Plastics and rubber | 326220 | Rubber and plastics hoses and belting manufacturing |
| 24 | Plastics and rubber | 326291 | Rubber product manufacturing for mechanical use |
| 24 | Plastics and rubber | 326299 | All other rubber product manufacturing |
| 24 | Plastics and rubber | 332911 | Industrial valve manufacturing |
| 24 | Plastics and rubber | 332912 | Fluid power valve and hose fitting manufacturing |
| 24 | Plastics and rubber | 332919 | Other metal valve and pipe fitting manufacturing |
| 24 | Plastics and rubber | 332996 | Fabricated pipe and pipe fitting manufacturing |
| 24 | Plastics and rubber | 337920 | Blind and shade manufacturing |
| 24 | Plastics and rubber | 339940 | Office supplies (except paper) manufacturing |
| 24 | Plastics and rubber | 339991 | Gasket, packing, and sealing device manufacturing |
| 24 | Plastics and rubber | 493110 | General warehousing and storage |
| 24 | Plastics and rubber | 493190 | Other warehousing and storage |

| SCTG2 Code | FAF5 Commodity Name | NAICS | NAICS Description |
|---|---|---|---|
| 25 | Logs and other wood in the rough | 113110 | Timber tract operations |
| 25 | Logs and other wood in the rough | 113310 | Logging |
| 25 | Logs and other wood in the rough | 493110 | General warehousing and storage |
| 25 | Logs and other wood in the rough | 493190 | Other warehousing and storage |
| 26 | Wood products | 113110 | Timber tract operations |
| 26 | Wood products | 113310 | Logging |
| 26 | Wood products | 321113 | Sawmills |
| 26 | Wood products | 321114 | Wood preservation |
| 26 | Wood products | 321211 | Hardwood veneer and plywood manufacturing |
| 26 | Wood products | 321212 | Softwood veneer and plywood manufacturing |
| 26 | Wood products | 321213 | Engineered wood member (except truss) manufacturing |
| 26 | Wood products | 321214 | Truss manufacturing |
| 26 | Wood products | 321219 | Reconstituted wood product manufacturing |
| 26 | Wood products | 321911 | Wood window and door manufacturing |
| 26 | Wood products | 321912 | Cut stock, resawing lumber, and planning |
| 26 | Wood products | 321918 | Other millwork (including flooring) |
| 26 | Wood products | 321920 | Wood container and pallet manufacturing |
| 26 | Wood products | 321999 | All other miscellaneous wood product manufacturing |
| 26 | Wood products | 325194 | Cyclic crude, intermediate, and gum and wood chemical manufacturing |
| 26 | Wood products | 337920 | Blind and shade manufacturing |
| 26 | Wood products | 339995 | Burial casket manufacturing |
| 26 | Wood products | 423320 | Brick, stone, and related construction material merchant wholesalers |
| 26 | Wood products | 423310 | Lumber, plywood, millwork, and wood panel merchant wholesalers |
| 26 | Wood products | 423390 | Other construction material merchant wholesalers |
| 26 | Wood products | 423330 | Roofing, siding, and insulation material merchant wholesalers |
| 26 | Wood products | 493110 | General warehousing and storage |
| 26 | Wood products | 493190 | Other warehousing and storage |
| 26 | Wood products | 454110 | Electronic shopping and mail-order houses |

| SCTG2 Code | FAF5 Commodity Name | NAICS | NAICS Description |
|---|---|---|---|
| 27 | Pulp, newsprint, paper, and paperboard | 322110 | Pulp mills |
| 27 | Pulp, newsprint, paper, and paperboard | 322121 | Paper (except newsprint) mills |
| 27 | Pulp, newsprint, paper, and paperboard | 322122 | Newsprint mills |
| 27 | Pulp, newsprint, paper, and paperboard | 322130 | Paperboard mills |
| 27 | Pulp, newsprint, paper, and paperboard | 322220 | Paper bag and coated and treated paper manufacturing |
| 27 | Pulp, newsprint, paper, and paperboard | 493110 | General warehousing and storage |
| 27 | Pulp, newsprint, paper, and paperboard | 493190 | Other warehousing and storage |
| 27 | Pulp, newsprint, paper, and paperboard | 511140 | Directory and mailing list publishers |
| 27 | Pulp, newsprint, paper, and paperboard | 511191 | Greeting card publishers |
| 27 | Pulp, newsprint, paper, and paperboard | 511199 | All other publishers |
| 27 | Pulp, newsprint, paper, and paperboard | 454110 | Electronic shopping and mail-order houses |
| 28 | Paper or paperboard articles | 322121 | Paper (except newsprint) mills |
| 28 | Paper or paperboard articles | 322130 | Paperboard mills |
| 28 | Paper or paperboard articles | 322211 | Corrugated and solid fiber box manufacturing |
| 28 | Paper or paperboard articles | 322212 | Folding paperboard box manufacturing |
| 28 | Paper or paperboard articles | 322219 | Other paperboard container manufacturing |
| 28 | Paper or paperboard articles | 322220 | Paper bag and coated and treated paper manufacturing |
| 28 | Paper or paperboard articles | 322230 | Stationery product manufacturing |
| 28 | Paper or paperboard articles | 322291 | Sanitary paper product manufacturing |
| 28 | Paper or paperboard articles | 322299 | All other converted paper product manufacturing |
| 28 | Paper or paperboard articles | 424130 | Industrial and personal service paper merchant wholesalers |
| 28 | Paper or paperboard articles | 424110 | Printing and writing paper merchant wholesalers |

| SCTG2 Code | FAF5 Commodity Name | NAICS | NAICS Description |
|---|---|---|---|
| 28 | Paper or paperboard articles | 424120 | Stationery and office supplies merchant wholesalers |
| 28 | Paper or paperboard articles | 493110 | General warehousing and storage |
| 28 | Paper or paperboard articles | 493190 | Other warehousing and storage |
| 28 | Paper or paperboard articles | 511140 | Directory and mailing list publishers |
| 28 | Paper or paperboard articles | 511191 | Greeting card publishers |
| 28 | Paper or paperboard articles | 511199 | All other publishers |
| 28 | Paper or paperboard articles | 454110 | Electronic shopping and mail-order houses |
| 29 | Printed products | 323111 | Commercial printing (except screen and books) |
| 29 | Printed products | 323113 | Commercial screen printing |
| 29 | Printed products | 323117 | Books printing |
| 29 | Printed products | 511110 | Newspaper publishers |
| 29 | Printed products | 511120 | Periodical publishers |
| 29 | Printed products | 511130 | Book publishers |
| 29 | Printed products | 493110 | General warehousing and storage |
| 29 | Printed products | 493190 | Other warehousing and storage |
| 29 | Printed products | 511140 | Directory and mailing list publishers |
| 29 | Printed products | 511191 | Greeting card publishers |
| 29 | Printed products | 511199 | All other publishers |
| 29 | Printed products | 454110 | Electronic shopping and mail-order houses |
| 30 | Textiles, leather, and articles of textiles or leather | 313110 | Fiber, yarn, and thread mills |
| 30 | Textiles, leather, and articles of textiles or leather | 313210 | Broad woven fabric mills |
| 30 | Textiles, leather, and articles of textiles or leather | 313220 | Narrow fabric mills and Schiffli machine embroidery |
| 30 | Textiles, leather, and articles of textiles or leather | 313230 | Nonwoven fabric mills |
| 30 | Textiles, leather, and articles of textiles or leather | 313240 | Knit fabric mills |
| 30 | Textiles, leather, and articles of textiles or leather | 313310 | Textile and fabric finishing mills |
| 30 | Textiles, leather, and articles of textiles or leather | 313320 | Fabric coating mills |
| 30 | Textiles, leather, and articles of textiles or leather | 314110 | Carpet and rug mills |

| SCTG2 Code | FAF5 Commodity Name | NAICS | NAICS Description |
|---|---|---|---|
| 30 | Textiles, leather, and articles of textiles or leather | 314120 | Curtain and linen mills |
| 30 | Textiles, leather, and articles of textiles or leather | 314910 | Textile bag and canvas mills |
| 30 | Textiles, leather, and articles of textiles or leather | 314994 | Rope, cordage, twine, tire cord, and tire fabric mills |
| 30 | Textiles, leather, and articles of textiles or leather | 314999 | All other miscellaneous textile product mills |
| 30 | Textiles, leather, and articles of textiles or leather | 315110 | Hosiery and sock mills |
| 30 | Textiles, leather, and articles of textiles or leather | 315190 | Other apparel knitting mills |
| 30 | Textiles, leather, and articles of textiles or leather | 315210 | Cut and sew apparel contractors |
| 30 | Textiles, leather, and articles of textiles or leather | 315220 | Men's and boys' cut and sew apparel manufacturing |
| 30 | Textiles, leather, and articles of textiles or leather | 315240 | Women's, girls', and infants' cut and sew apparel manufacturing |
| 30 | Textiles, leather, and articles of textiles or leather | 315280 | Other cut and sew apparel manufacturing |
| 30 | Textiles, leather, and articles of textiles or leather | 315990 | Apparel accessories and other apparel manufacturing |
| 30 | Textiles, leather, and articles of textiles or leather | 316110 | Leather and hide tanning and finishing |
| 30 | Textiles, leather, and articles of textiles or leather | 316210 | Footwear manufacturing |
| 30 | Textiles, leather, and articles of textiles or leather | 316992 | Women's handbag and purse manufacturing |
| 30 | Textiles, leather, and articles of textiles or leather | 316998 | All other leather good and allied product manufacturing |
| 30 | Textiles, leather, and articles of textiles or leather | 325220 | Artificial and synthetic fibers and filaments manufacturing |
| 30 | Textiles, leather, and articles of textiles or leather | 337920 | Blind and shade manufacturing |
| 30 | Textiles, leather, and articles of textiles or leather | 339991 | Gasket, packing, and sealing device manufacturing |
| 30 | Textiles, leather, and articles of textiles or leather | 424340 | Footwear merchant wholesalers |
| 30 | Textiles, leather, and articles of textiles or leather | 424320 | Men's and boys' clothing and furnishings merchant wholesalers |

| SCTG2 Code | FAF5 Commodity Name | NAICS | NAICS Description |
|---|---|---|---|
| 30 | Textiles, leather, and articles of textiles or leather | 424310 | Piece goods, notions, and other dry goods merchant wholesalers |
| 30 | Textiles, leather, and articles of textiles or leather | 424330 | Women's, children's, and infants' clothing and accessories merchant wholesalers |
| 30 | Textiles, leather, and articles of textiles or leather | 493110 | General warehousing and storage |
| 30 | Textiles, leather, and articles of textiles or leather | 493190 | Other warehousing and storage |
| 31 | Nonmetallic mineral products | 324122 | Asphalt shingle and coating materials manufacturing |
| 31 | Nonmetallic mineral products | 327110 | Pottery, ceramics, and plumbing fixture manufacturing |
| 31 | Nonmetallic mineral products | 327120 | Clay building material and refractories manufacturing |
| 31 | Nonmetallic mineral products | 327211 | Flat glass manufacturing |
| 31 | Nonmetallic mineral products | 327212 | Other pressed and blown glass and glassware manufacturing |
| 31 | Nonmetallic mineral products | 327213 | Glass container manufacturing |
| 31 | Nonmetallic mineral products | 327215 | Glass product manufacturing made of purchased glass |
| 31 | Nonmetallic mineral products | 327310 | Cement manufacturing |
| 31 | Nonmetallic mineral products | 327320 | Ready-mix concrete manufacturing |
| 31 | Nonmetallic mineral products | 327331 | Concrete block and brick manufacturing |
| 31 | Nonmetallic mineral products | 327332 | Concrete pipe manufacturing |
| 31 | Nonmetallic mineral products | 327390 | Other concrete product manufacturing |
| 31 | Nonmetallic mineral products | 327410 | Lime manufacturing |
| 31 | Nonmetallic mineral products | 327420 | Gypsum product manufacturing |
| 31 | Nonmetallic mineral products | 327910 | Abrasive product manufacturing |
| 31 | Nonmetallic mineral products | 327991 | Cut stone and stone product manufacturing |
| 31 | Nonmetallic mineral products | 327993 | Mineral wool manufacturing |
| 31 | Nonmetallic mineral products | 327999 | All other miscellaneous nonmetallic mineral product manufacturing |
| 31 | Nonmetallic mineral products | 327992 | Ground or treated mineral and earth manufacturing |
| 31 | Nonmetallic mineral products | 493110 | General warehousing and storage |
| 31 | Nonmetallic mineral products | 493190 | Other warehousing and storage |

| SCTG2 Code | FAF5 Commodity Name | NAICS | NAICS Description |
|---|---|---|---|
| 32 | Base metal in primary or semifinished forms and in finished basic shapes | 331110 | Iron and steel mills and ferroalloy manufacturing |
| 32 | Base metal | 331210 | Iron and steel pipe and tube manufacturing from purchased steel |
| 32 | Base metal | 331221 | Rolled steel shape manufacturing |
| 32 | Base metal | 331222 | Steel wire drawing |
| 32 | Base metal | 331313 | Alumina refining and primary aluminum production |
| 32 | Base metal | 331314 | Secondary smelting and alloying of aluminum |
| 32 | Base metal | 331315 | Aluminum sheet, plate, and foil manufacturing |
| 32 | Base metal | 331318 | Other aluminum rolling, drawing, and extruding |
| 32 | Base metal | 331420 | Copper rolling, drawing, extruding, and alloying |
| 32 | Base metal | 331491 | Nonferrous metal (except copper and aluminum) rolling, drawing, and extruding |
| 32 | Base metal | 331492 | Secondary smelting, refining, and alloying of nonferrous metal (except copper and aluminum) |
| 32 | Base metal | 331524 | Aluminum foundries (except die-casting) |
| 32 | Base metal | 331529 | Other nonferrous metal foundries (except die-casting) |
| 32 | Base metal | 332114 | Custom roll forming |
| 32 | Base metal | 332117 | Powder metallurgy part manufacturing |
| 32 | Base metal | 332119 | Metal crown, closure, and other metal stamping (except automotive) |
| 32 | Base metal | 332999 | All other miscellaneous fabricated metal product manufacturing |
| 32 | Base metal | 331410 | Nonferrous metal (except aluminum) smelting and refining |
| 32 | Base metal | 493110 | General warehousing and storage |
| 32 | Base metal | 493190 | Other warehousing and storage |
| 33 | Articles of base metal | 321991 | Manufactured home (mobile home) manufacturing |
| 33 | Articles of base metal | 327910 | Abrasive product manufacturing |

| SCTG2 Code | FAF5 Commodity Name | NAICS | NAICS Description |
|---|---|---|---|
| 33 | Articles of base metal | 331110 | Iron and steel mills and ferroalloy manufacturing |
| 33 | Articles of base metal | 331210 | Iron and steel pipe and tube manufacturing from purchased steel |
| 33 | Articles of base metal | 331221 | Rolled steel shape manufacturing |
| 33 | Articles of base metal | 331222 | Steel wire drawing |
| 33 | Articles of base metal | 331314 | Secondary smelting and alloying of aluminum |
| 33 | Articles of base metal | 331315 | Aluminum sheet, plate, and foil manufacturing |
| 33 | Articles of base metal | 331318 | Other aluminum rolling, drawing, and extruding |
| 33 | Articles of base metal | 331420 | Copper rolling, drawing, extruding, and alloying |
| 33 | Articles of base metal | 331491 | Nonferrous metal (except copper and aluminum) rolling, drawing, and extruding |
| 33 | Articles of base metal | 331492 | Secondary smelting, refining, and alloying of nonferrous metal (except copper and aluminum) |
| 33 | Articles of base metal | 331511 | Iron foundries |
| 33 | Articles of base metal | 331512 | Steel investment foundries |
| 33 | Articles of base metal | 331513 | Steel foundries (except investment) |
| 33 | Articles of base metal | 331523 | Nonferrous metal die-casting foundries |
| 33 | Articles of base metal | 331524 | Aluminum foundries (except die-casting) |
| 33 | Articles of base metal | 331529 | Other nonferrous metal foundries (except die-casting) |
| 33 | Articles of base metal | 332111 | Iron and steel forging |
| 33 | Articles of base metal | 332112 | Nonferrous forging |
| 33 | Articles of base metal | 332114 | Custom roll forming |
| 33 | Articles of base metal | 332117 | Powder metallurgy part manufacturing |
| 33 | Articles of base metal | 332119 | Metal crown, closure, and other metal stamping (except automotive) |
| 33 | Articles of base metal | 332215 | Metal kitchen cookware, utensil, cutlery, and flatware (except precious) manufacturing |
| 33 | Articles of base metal | 332216 | Saw blade and hand tool manufacturing |
| 33 | Articles of base metal | 332311 | Prefabricated metal building and component manufacturing |

| SCTG2 Code | FAF5 Commodity Name | NAICS | NAICS Description |
|---|---|---|---|
| 33 | Articles of base metal | 332312 | Fabricated structural metal manufacturing |
| 33 | Articles of base metal | 332313 | Plate work manufacturing |
| 33 | Articles of base metal | 332321 | Metal window and door manufacturing |
| 33 | Articles of base metal | 332322 | Sheet metal work manufacturing |
| 33 | Articles of base metal | 332323 | Ornamental and architectural metal work manufacturing |
| 33 | Articles of base metal | 332410 | Power boiler and heat exchanger manufacturing |
| 33 | Articles of base metal | 332420 | Metal tank (heavy gauge) manufacturing |
| 33 | Articles of base metal | 332431 | Metal can manufacturing |
| 33 | Articles of base metal | 332439 | Other metal container manufacturing |
| 33 | Articles of base metal | 332510 | Hardware manufacturing |
| 33 | Articles of base metal | 332613 | Spring manufacturing |
| 33 | Articles of base metal | 332618 | Other fabricated wire product manufacturing |
| 33 | Articles of base metal | 332710 | Machine shops |
| 33 | Articles of base metal | 332721 | Precision turned product manufacturing |
| 33 | Articles of base metal | 332722 | Bolt, nut, screw, rivet, and washer manufacturing |
| 33 | Articles of base metal | 332911 | Industrial valve manufacturing |
| 33 | Articles of base metal | 332912 | Fluid power valve and hose fitting manufacturing |
| 33 | Articles of base metal | 332913 | Plumbing fixture fitting and trim manufacturing |
| 33 | Articles of base metal | 332919 | Other metal valve and pipe fitting manufacturing |
| 33 | Articles of base metal | 332996 | Fabricated pipe and pipe fitting manufacturing |
| 33 | Articles of base metal | 332999 | All other miscellaneous fabricated metal product manufacturing |
| 33 | Articles of base metal | 333131 | Mining machinery and equipment manufacturing |
| 33 | Articles of base metal | 333514 | Special die and tool, die set, jig, and fixture manufacturing |
| 33 | Articles of base metal | 333515 | Cutting tool and machine tool accessory manufacturing |
| 33 | Articles of base metal | 332813 | Electroplating, plating, polishing, anodizing, and coloring |

| SCTG2 Code | FAF5 Commodity Name | NAICS | NAICS Description |
|---|---|---|---|
| 33 | Articles of base metal | 332812 | Metal coating, engraving (except jewelry and silverware), and allied services to manufacturers |
| 33 | Articles of base metal | 332811 | Metal heat treating |
| 33 | Articles of base metal | 493110 | General warehousing and storage |
| 33 | Articles of base metal | 493190 | Other warehousing and storage |
| 34 | Machinery | 332215 | Metal kitchen cookware, utensil, cutlery, and flatware (except precious) manufacturing |
| 34 | Machinery | 332313 | Plate work manufacturing |
| 34 | Machinery | 332410 | Power boiler and heat exchanger manufacturing |
| 34 | Machinery | 332510 | Hardware manufacturing |
| 34 | Machinery | 332911 | Industrial valve manufacturing |
| 34 | Machinery | 332912 | Fluid power valve and hose fitting manufacturing |
| 34 | Machinery | 332913 | Plumbing fixture fitting and trim manufacturing |
| 34 | Machinery | 332919 | Other metal valve and pipe fitting manufacturing |
| 34 | Machinery | 332991 | Ball and roller bearing manufacturing |
| 34 | Machinery | 332996 | Fabricated pipe and pipe fitting manufacturing |
| 34 | Machinery | 332999 | All other miscellaneous fabricated metal product manufacturing |
| 34 | Machinery | 333111 | Farm machinery and equipment manufacturing |
| 34 | Machinery | 333112 | Lawn and garden tractor and home lawn and garden equipment manufacturing |
| 34 | Machinery | 333120 | Construction machinery manufacturing |
| 34 | Machinery | 333131 | Mining machinery and equipment manufacturing |
| 34 | Machinery | 333132 | Oil and gas field machinery and equipment manufacturing |
| 34 | Machinery | 333241 | Food product machinery manufacturing |
| 34 | Machinery | 333242 | Semiconductor machinery manufacturing |
| 34 | Machinery | 333243 | Sawmill, woodworking, and paper machinery manufacturing |

| SCTG2 Code | FAF5 Commodity Name | NAICS | NAICS Description |
|---|---|---|---|
| 34 | Machinery | 333244 | Printing machinery and equipment manufacturing |
| 34 | Machinery | 333249 | Other industrial machinery manufacturing |
| 34 | Machinery | 333318 | Other commercial and service industry machinery manufacturing |
| 34 | Machinery | 333413 | Industrial and commercial fan and blower and air purification equipment manufacturing |
| 34 | Machinery | 333414 | Heating equipment (except warm air furnaces) manufacturing |
| 34 | Machinery | 333415 | Air-conditioning and warm air heating equipment and commercial and industrial refrigeration equipment manufacturing |
| 34 | Machinery | 333511 | Industrial mold manufacturing |
| 34 | Machinery | 333514 | Special die and tool, die set, jig, and fixture manufacturing |
| 34 | Machinery | 333515 | Cutting tool and machine tool accessory manufacturing |
| 34 | Machinery | 333517 | Machine tool manufacturing |
| 34 | Machinery | 333519 | Rolling mill and other metalworking machinery manufacturing |
| 34 | Machinery | 333611 | Turbine and turbine generator set units manufacturing |
| 34 | Machinery | 333612 | Speed changer, industrial high-speed drive, and gear manufacturing |
| 34 | Machinery | 333613 | Mechanical power transmission equipment manufacturing |
| 34 | Machinery | 333618 | Other engine equipment manufacturing |
| 34 | Machinery | 333912 | Air and gas compressor manufacturing |
| 34 | Machinery | 333921 | Elevator and moving stairway manufacturing |
| 34 | Machinery | 333922 | Conveyor and conveying equipment manufacturing |
| 34 | Machinery | 333923 | Overhead traveling crane, hoist, and monorail system manufacturing |
| 34 | Machinery | 333924 | Industrial truck, tractor, trailer, and stacker machinery manufacturing |
| 34 | Machinery | 333991 | Power-driven hand tool manufacturing |

| SCTG2 Code | FAF5 Commodity Name | NAICS | NAICS Description |
|---|---|---|---|
| 34 | Machinery | 333992 | Welding and soldering equipment manufacturing |
| 34 | Machinery | 333993 | Packaging machinery manufacturing |
| 34 | Machinery | 333994 | Industrial process furnace and oven manufacturing |
| 34 | Machinery | 333995 | Fluid power cylinder and actuator manufacturing |
| 34 | Machinery | 333996 | Fluid power pump and motor manufacturing |
| 34 | Machinery | 333997 | Scale and balance manufacturing |
| 34 | Machinery | 333999 | All other miscellaneous general purpose machinery manufacturing |
| 34 | Machinery | 336310 | Motor vehicle gasoline engine and engine parts manufacturing |
| 34 | Machinery | 336320 | Motor vehicle electrical and electronic equipment manufacturing |
| 34 | Machinery | 336330 | Motor vehicle steering and suspension components (except spring) manufacturing |
| 34 | Machinery | 336340 | Motor vehicle brake system manufacturing |
| 34 | Machinery | 336350 | Motor vehicle transmission and power train parts manufacturing |
| 34 | Machinery | 336360 | Motor vehicle seating and interior trim manufacturing |
| 34 | Machinery | 336370 | Motor vehicle metal stamping |
| 34 | Machinery | 336390 | Other motor vehicle parts manufacturing |
| 34 | Machinery | 336412 | Aircraft engine and engine parts manufacturing |
| 34 | Machinery | 339991 | Gasket, packing, and sealing device manufacturing |
| 34 | Machinery | 339999 | All other miscellaneous manufacturing |
| 34 | Machinery | 423610 | Electrical apparatus and equipment, wiring supplies, and related equipment merchant wholesalers |
| 34 | Machinery | 423620 | Household appliances, electric housewares, and consumer electronics merchant wholesalers |
| 34 | Machinery | 423690 | Other electronic parts and equipment merchant wholesalers |

| SCTG2 Code | FAF5 Commodity Name | NAICS | NAICS Description |
|---|---|---|---|
| 34 | Machinery | 423810 | Construction and mining (except oil well) machinery and equipment merchant wholesalers |
| 34 | Machinery | 423820 | Farm and garden machinery and equipment merchant wholesalers |
| 34 | Machinery | 423830 | Industrial machinery and equipment merchant wholesalers |
| 34 | Machinery | 423840 | Industrial supplies merchant wholesalers |
| 34 | Machinery | 423850 | Service establishment equipment and supplies merchant wholesalers |
| 34 | Machinery | 423860 | Transportation equipment and supplies (except motor vehicle) merchant wholesalers |
| 34 | Machinery | 493110 | General warehousing and storage |
| 34 | Machinery | 493190 | Other warehousing and storage |
| 34 | Machinery | 333914 | Measuring, dispensing, and other pumping equipment manufacturing |
| 35 | Electronic and other electrical equipment and components, and office equipment | 331420 | Copper rolling, drawing, extruding, and alloying |
| 35 | Electronic and other electrical equipment and components, and office equipment | 333318 | Other commercial and service industry machinery manufacturing |
| 35 | Electronic and other electrical equipment and components, and office equipment | 334111 | Electronic computer manufacturing |
| 35 | Electronic and other electrical equipment and components, and office equipment | 334112 | Computer storage device manufacturing |
| 35 | Electronic and other electrical equipment and components, and office equipment | 334118 | Computer terminal and other computer peripheral equipment manufacturing |
| 35 | Electronic and other electrical equipment and components, and office equipment | 334210 | Telephone apparatus manufacturing |
| 35 | Electronic and other electrical equipment and components, and office equipment | 334220 | Radio and television broadcasting and wireless communications equipment manufacturing |
| 35 | Electronic and other electrical equipment and components, and office equipment | 334290 | Other communications equipment manufacturing |

| SCTG2 Code | FAF5 Commodity Name | NAICS | NAICS Description |
|---|---|---|---|
| 35 | Electronic and other electrical equipment and components, and office equipment | 334310 | Audio and video equipment manufacturing |
| 35 | Electronic and other electrical equipment and components, and office equipment | 334412 | Bare printed circuit board manufacturing |
| 35 | Electronic and other electrical equipment and components, and office equipment | 334413 | Semiconductor and related device manufacturing |
| 35 | Electronic and other electrical equipment and components, and office equipment | 334416 | Capacitor, resistor, coil, transformer, and other inductor manufacturing |
| 35 | Electronic and other electrical equipment and components, and office equipment | 334417 | Electronic connector manufacturing |
| 35 | Electronic and other electrical equipment and components, and office equipment | 334418 | Printed circuit assembly (electronic assembly) manufacturing |
| 35 | Electronic and other electrical equipment and components, and office equipment | 334419 | Other electronic component manufacturing |
| 35 | Electronic and other electrical equipment and components, and office equipment | 334510 | Electromedical and electrotherapeutic apparatus manufacturing |
| 35 | Electronic and other electrical equipment and components, and office equipment | 334511 | Search, detection, navigation, guidance, aeronautical, and nautical system and instrument manufacturing |
| 35 | Electronic and other electrical equipment and components, and office equipment | 334514 | Totalizing fluid meter and counting device manufacturing |
| 35 | Electronic and other electrical equipment and components, and office equipment | 334519 | Other measuring and controlling device manufacturing |
| 35 | Electronic and other electrical equipment and components, and office equipment | 334613 | Blank magnetic and optical recording media manufacturing |
| 35 | Electronic and other electrical equipment and components, and office equipment | 334614 | Software and other prerecorded compact disc, tape, and record reproducing |
| 35 | Electronic and other electrical equipment and components, and office equipment | 335110 | Electric lamp bulb and part manufacturing |

| SCTG2 Code | FAF5 Commodity Name | NAICS | NAICS Description |
|---|---|---|---|
| 35 | Electronic and other electrical equipment and components, and office equipment | 335121 | Residential electric lighting fixture manufacturing |
| 35 | Electronic and other electrical equipment and components, and office equipment | 335122 | Commercial, industrial, and institutional electric lighting fixture manufacturing |
| 35 | Electronic and other electrical equipment and components, and office equipment | 335129 | Other lighting equipment manufacturing |
| 35 | Electronic and other electrical equipment and components, and office equipment | 335210 | Small electrical appliance manufacturing |
| 35 | Electronic and other electrical equipment and components, and office equipment | 335311 | Power, distribution, and specialty transformer manufacturing |
| 35 | Electronic and other electrical equipment and components, and office equipment | 335312 | Motor and generator manufacturing |
| 35 | Electronic and other electrical equipment and components, and office equipment | 335313 | Switchgear and switchboard apparatus manufacturing |
| 35 | Electronic and other electrical equipment and components, and office equipment | 335314 | Relay and industrial control manufacturing |
| 35 | Electronic and other electrical equipment and components, and office equipment | 335911 | Storage battery manufacturing |
| 35 | Electronic and other electrical equipment and components, and office equipment | 335912 | Primary battery manufacturing |
| 35 | Electronic and other electrical equipment and components, and office equipment | 335921 | Fiber optic cable manufacturing |
| 35 | Electronic and other electrical equipment and components, and office equipment | 335929 | Other communication and energy wire manufacturing |
| 35 | Electronic and other electrical equipment and components, and office equipment | 335931 | Current-carrying wiring device manufacturing |
| 35 | Electronic and other electrical equipment and components, and office equipment | 335932 | Noncurrent-carrying wiring device manufacturing |

| SCTG2 Code | FAF5 Commodity Name | NAICS | NAICS Description |
|---|---|---|---|
| 35 | Electronic and other electrical equipment and components, and office equipment | 335991 | Carbon and graphite product manufacturing |
| 35 | Electronic and other electrical equipment and components, and office equipment | 335999 | All other miscellaneous electrical equipment and component manufacturing |
| 35 | Electronic and other electrical equipment and components, and office equipment | 336320 | Motor vehicle electrical and electronic equipment manufacturing |
| 35 | Electronic and other electrical equipment and components, and office equipment | 339999 | All other miscellaneous manufacturing |
| 35 | Electronic and other electrical equipment and components, and office equipment | 425110 | Business to business electronic markets |
| 35 | Electronic and other electrical equipment and components, and office equipment | 425120 | Wholesale trade agents and brokers |
| 35 | Electronic and other electrical equipment and components, and office equipment | 493110 | General warehousing and storage |
| 35 | Electronic and other electrical equipment and components, and office equipment | 493190 | Other warehousing and storage |
| 35 | Electronic and other electrical equipment and components, and office equipment | 335220 | Major household appliance manufacturing |
| 36 | Motorized and other vehicles (including parts) | 314994 | Rope, cordage, twine, tire cord, and tire fabric mills |
| 36 | Motorized and other vehicles (including parts) | 333111 | Farm machinery and equipment manufacturing |
| 36 | Motorized and other vehicles (including parts) | 333112 | Lawn and garden tractor and home lawn and garden equipment manufacturing |
| 36 | Motorized and other vehicles (including parts) | 333120 | Construction machinery manufacturing |
| 36 | Motorized and other vehicles (including parts) | 333132 | Oil and gas field machinery and equipment manufacturing |
| 36 | Motorized and other vehicles (including parts) | 336111 | Automobile manufacturing |
| 36 | Motorized and other vehicles (including parts) | 336112 | Light truck and utility vehicle manufacturing |

| SCTG2 Code | FAF5 Commodity Name | NAICS | NAICS Description |
|---|---|---|---|
| 36 | Motorized and other vehicles (including parts) | 336120 | Heavy duty truck manufacturing |
| 36 | Motorized and other vehicles (including parts) | 336211 | Motor vehicle body manufacturing |
| 36 | Motorized and other vehicles (including parts) | 336212 | Truck trailer manufacturing |
| 36 | Motorized and other vehicles (including parts) | 336213 | Motor home manufacturing |
| 36 | Motorized and other vehicles (including parts) | 336214 | Travel trailer and camper manufacturing |
| 36 | Motorized and other vehicles (including parts) | 336320 | Motor vehicle electrical and electronic equipment manufacturing |
| 36 | Motorized and other vehicles (including parts) | 336330 | Motor vehicle steering and suspension components (except spring) manufacturing |
| 36 | Motorized and other vehicles (including parts) | 336340 | Motor vehicle brake system manufacturing |
| 36 | Motorized and other vehicles (including parts) | 336350 | Motor vehicle transmission and power train parts manufacturing |
| 36 | Motorized and other vehicles (including parts) | 336360 | Motor vehicle seating and interior trim manufacturing |
| 36 | Motorized and other vehicles (including parts) | 336370 | Motor vehicle metal stamping |
| 36 | Motorized and other vehicles (including parts) | 336390 | Other motor vehicle parts manufacturing |
| 36 | Motorized and other vehicles (including parts) | 336991 | Motorcycle, bicycle, and parts manufacturing |
| 36 | Motorized and other vehicles (including parts) | 336992 | Military armored vehicle, tank, and tank component manufacturing |
| 36 | Motorized and other vehicles (including parts) | 336999 | All other transportation equipment manufacturing |
| 36 | Motorized and other vehicles (including parts) | 423110 | Automobile and other motor vehicle merchant wholesalers |
| 36 | Motorized and other vehicles (including parts) | 423140 | Motor vehicle parts (used) merchant wholesalers |
| 36 | Motorized and other vehicles (including parts) | 423120 | Motor vehicle supplies and new parts merchant wholesalers |
| 36 | Motorized and other vehicles (including parts) | 423130 | Tire and tube merchant wholesalers |
| 36 | Motorized and other vehicles (including parts) | 454310 | Fuel dealers |

| SCTG2 Code | FAF5 Commodity Name | NAICS | NAICS Description |
|---|---|---|---|
| 36 | Motorized and other vehicles (including parts) | 493110 | General warehousing and storage |
| 36 | Motorized and other vehicles (including parts) | 493190 | Other warehousing and storage |
| 36 | Motorized and other vehicles (including parts) | 454110 | Electronic shopping and mail-order houses |
| 37 | Transportation equipment, n.e.c. | 331110 | Iron and steel mills and ferroalloy manufacturing |
| 37 | Transportation equipment, n.e.c. | 331210 | Iron and steel pipe and tube manufacturing from purchased steel |
| 37 | Transportation equipment, n.e.c. | 331221 | Rolled steel shape manufacturing |
| 37 | Transportation equipment, n.e.c. | 332999 | All other miscellaneous fabricated metal product manufacturing |
| 37 | Transportation equipment, n.e.c. | 333120 | Construction machinery manufacturing |
| 37 | Transportation equipment, n.e.c. | 334220 | Radio and television broadcasting and wireless communications equipment manufacturing |
| 37 | Transportation equipment, n.e.c. | 336411 | Aircraft manufacturing |
| 37 | Transportation equipment, n.e.c. | 336412 | Aircraft engine and engine parts manufacturing |
| 37 | Transportation equipment, n.e.c. | 336413 | Other aircraft parts and auxiliary equipment manufacturing |
| 37 | Transportation equipment, n.e.c. | 336414 | Guided missile and space vehicle manufacturing |
| 37 | Transportation equipment, n.e.c. | 336415 | Guided missile and space vehicle propulsion unit and propulsion unit parts manufacturing |
| 37 | Transportation equipment, n.e.c. | 336419 | Other guided missile and space vehicle parts and auxiliary equipment manufacturing |
| 37 | Transportation equipment, n.e.c.. | 336510 | Railroad rolling stock manufacturing |
| 37 | Transportation equipment, n.e.c. | 336611 | Ship building and repairing |
| 37 | Transportation equipment, n.e.c. | 336612 | Boat building |
| 37 | Transportation equipment, n.e.c. | 493110 | General warehousing and storage |
| 37 | Transportation equipment, n.e.c. | 493190 | Other warehousing and storage |
| 37 | Transportation equipment, n.e.c. | 454110 | Electronic shopping and mail-order houses |
| 38 | Precision instruments and apparatus | 325992 | Photographic film, paper, plate, and chemical manufacturing |
| 38 | Precision instruments and apparatus | 333314 | Optical instrument and lens manufacturing |
| 38 | Precision instruments and apparatus | 333316 | Photographic and photocopying equipment manufacturing |

| SCTG2 Code | FAF5 Commodity Name | NAICS | NAICS Description |
|---|---|---|---|
| 38 | Precision instruments and apparatus | 333515 | Cutting tool and machine tool accessory manufacturing |
| 38 | Precision instruments and apparatus | 334220 | Radio and television broadcasting and wireless communications equipment manufacturing |
| 38 | Precision instruments and apparatus | 334512 | Automatic environmental control manufacturing for residential, commercial, and appliance use |
| 38 | Precision instruments and apparatus | 334513 | Instruments and related products manufacturing for measuring, displaying, and controlling industrial process variables |
| 38 | Precision instruments and apparatus | 334515 | Instrument manufacturing for measuring and testing electricity and electrical signals |
| 38 | Precision instruments and apparatus | 334516 | Analytical laboratory instrument manufacturing |
| 38 | Precision instruments and apparatus | 334517 | Irradiation apparatus manufacturing |
| 38 | Precision instruments and apparatus | 339112 | Surgical and medical instrument manufacturing |
| 38 | Precision instruments and apparatus | 339113 | Surgical appliance and supplies manufacturing |
| 38 | Precision instruments and apparatus | 339114 | Dental equipment and supplies manufacturing |
| 38 | Precision instruments and apparatus | 339115 | Ophthalmic goods manufacturing |
| 38 | Precision instruments and apparatus | 339116 | Dental laboratories |
| 38 | Precision instruments and apparatus | 493110 | General warehousing and storage |
| 38 | Precision instruments and apparatus | 493190 | Other warehousing and storage |
| 38 | Precision instruments and apparatus | 454110 | Electronic shopping and mail-order houses |
| 39 | Furniture, mattresses and mattresses supports, lamps, lighting fittings, and illuminated signs | 321912 | Cut stock, resawing lumber, and planning |
| 39 | Furniture, mattresses and mattresses supports, lamps, lighting fittings, and illuminated signs | 321999 | All other miscellaneous wood product manufacturing |
| 39 | Furniture, mattresses and mattresses supports, lamps, lighting fittings, and illuminated signs | 332311 | Prefabricated metal building and component manufacturing |
| 39 | Furniture, mattresses and mattresses supports, lamps, lighting fittings, and illuminated signs | 332510 | Hardware manufacturing |

| SCTG2 Code | FAF5 Commodity Name | NAICS | NAICS Description |
|---|---|---|---|
| 39 | Furniture, mattresses and mattresses supports, lamps, lighting fittings, and illuminated signs | 332999 | All other miscellaneous fabricated metal product manufacturing |
| 39 | Furniture, mattresses and mattresses supports, lamps, lighting fittings, and illuminated signs | 335121 | Residential electric lighting fixture manufacturing |
| 39 | Furniture, mattresses and mattresses supports, lamps, lighting fittings, and illuminated signs | 335129 | Other lighting equipment manufacturing |
| 39 | Furniture, mattresses and mattresses supports, lamps, lighting fittings, and illuminated signs | 337110 | Wood kitchen cabinet and countertop manufacturing |
| 39 | Furniture, mattresses and mattresses supports, lamps, lighting fittings, and illuminated signs | 337121 | Upholstered household furniture manufacturing |
| 39 | Furniture, mattresses and mattresses supports, lamps, lighting fittings, and illuminated signs | 337122 | Non upholstered wood household furniture manufacturing |
| 39 | Furniture, mattresses and mattresses supports, lamps, lighting fittings, and illuminated signs | 337124 | Metal household furniture manufacturing |
| 39 | Furniture, mattresses and mattresses supports, lamps, lighting fittings, and illuminated signs | 337125 | Household furniture (except wood and metal) manufacturing |
| 39 | Furniture, mattresses and mattresses supports, lamps, lighting fittings, and illuminated signs | 337127 | Institutional furniture manufacturing |
| 39 | Furniture, mattresses and mattresses supports, lamps, lighting fittings, and illuminated signs | 337211 | Wood office furniture manufacturing |
| 39 | Furniture, mattresses and mattresses supports, lamps, lighting fittings, and illuminated signs | 337212 | Custom architectural woodwork and millwork manufacturing |
| 39 | Furniture, mattresses and mattresses supports, lamps, lighting fittings, and illuminated signs | 337214 | Office furniture (except wood) manufacturing |
| 39 | Furniture, mattresses and mattresses supports, lamps, lighting fittings, and illuminated signs | 337215 | Showcase, partition, shelving, and locker manufacturing |
| 39 | Furniture, mattresses and mattresses supports, lamps, lighting fittings, and illuminated signs | 337910 | Mattress manufacturing |

| SCTG2 Code | FAF5 Commodity Name | NAICS | NAICS Description |
|---|---|---|---|
| 39 | Furniture, mattresses and mattresses supports, lamps, lighting fittings, and illuminated signs | 339950 | Sign manufacturing |
| 39 | Furniture, mattresses and mattresses supports, lamps, lighting fittings, and illuminated signs | 339999 | All other miscellaneous manufacturing |
| 39 | Furniture, mattresses and mattresses supports, lamps, lighting fittings, and illuminated signs | 423210 | Furniture merchant wholesalers |
| 39 | Furniture, mattresses and mattresses supports, lamps, lighting fittings, and illuminated signs | 423220 | Home furnishing merchant wholesalers |
| 39 | Furniture, mattresses and mattresses supports, lamps, lighting fittings, and illuminated signs | 493110 | General warehousing and storage |
| 39 | Furniture, mattresses and mattresses supports, lamps, lighting fittings, and illuminated signs | 493190 | Other warehousing and storage |
| 39 | Furniture, mattresses and mattresses supports, lamps, lighting fittings, and illuminated signs | 454110 | Electronic shopping and mail-order houses |
| 40 | Miscellaneous manufactured products | 321992 | Prefabricated wood building manufacturing |
| 40 | Miscellaneous manufactured products | 326199 | All other plastics product manufacturing |
| 40 | Miscellaneous manufactured products | 331420 | Copper rolling, drawing, extruding, and alloying |
| 40 | Miscellaneous manufactured products | 331491 | Nonferrous metal (except copper and aluminum) rolling, drawing, and extruding |
| 40 | Miscellaneous manufactured products | 331492 | Secondary smelting, refining, and alloying of nonferrous metal (except copper and aluminum) |
| 40 | Miscellaneous manufactured products | 331524 | Aluminum foundries (except die-casting) |
| 40 | Miscellaneous manufactured products | 331529 | Other nonferrous metal foundries (except die-casting) |
| 40 | Miscellaneous manufactured products | 332114 | Custom roll forming |
| 40 | Miscellaneous manufactured products | 332117 | Powder metallurgy part manufacturing |

| SCTG2 Code | FAF5 Commodity Name | NAICS | NAICS Description |
|---|---|---|---|
| 40 | Miscellaneous manufactured products | 332215 | Metal kitchen cookware, utensil, cutlery, and flatware (except precious) manufacturing |
| 40 | Miscellaneous manufactured products | 332311 | Prefabricated metal building and component manufacturing |
| 40 | Miscellaneous manufactured products | 332510 | Hardware manufacturing |
| 40 | Miscellaneous manufactured products | 332710 | Machine shops |
| 40 | Miscellaneous manufactured products | 332992 | Small arms ammunition manufacturing |
| 40 | Miscellaneous manufactured products | 332993 | Ammunition (except small arms) manufacturing |
| 40 | Miscellaneous manufactured products | 332994 | Small arms, ordnance, and ordnance accessories manufacturing |
| 40 | Miscellaneous manufactured products | 332999 | All other miscellaneous fabricated metal product manufacturing |
| 40 | Miscellaneous manufactured products | 333318 | Other commercial and service industry machinery manufacturing |
| 40 | Miscellaneous manufactured products | 333995 | Fluid power cylinder and actuator manufacturing |
| 40 | Miscellaneous manufactured products | 333999 | All other miscellaneous general purpose machinery manufacturing |
| 40 | Miscellaneous manufactured products | 334519 | Other measuring and controlling device manufacturing |
| 40 | Miscellaneous manufactured products | 336214 | Travel trailer and camper manufacturing |
| 40 | Miscellaneous manufactured products | 336992 | Military armored vehicle, tank, and tank component manufacturing |
| 40 | Miscellaneous manufactured products | 339112 | Surgical and medical instrument manufacturing |
| 40 | Miscellaneous manufactured products | 339910 | Jewelry and silverware manufacturing |
| 40 | Miscellaneous manufactured products | 339920 | Sporting and athletic goods manufacturing |
| 40 | Miscellaneous manufactured products | 339930 | Doll, toy, and game manufacturing |
| 40 | Miscellaneous manufactured products | 339940 | Office supplies (except paper) manufacturing |

| SCTG2 Code | FAF5 Commodity Name | NAICS | NAICS Description |
|---|---|---|---|
| 40 | Miscellaneous manufactured products | 339992 | Musical instrument manufacturing |
| 40 | Miscellaneous manufactured products | 339993 | Fastener, button, needle, and pin manufacturing |
| 40 | Miscellaneous manufactured products | 339994 | Broom, brush, and mop manufacturing |
| 40 | Miscellaneous manufactured products | 339999 | All other miscellaneous manufacturing |
| 40 | Miscellaneous manufactured products | 493110 | General warehousing and storage |
| 40 | Miscellaneous manufactured products | 493190 | Other warehousing and storage |
| 41 | Waste and scrap | 314999 | All other miscellaneous textile product mills |
| 41 | Waste and scrap | 321113 | Sawmills |
| 41 | Waste and scrap | 324199 | All other petroleum and coal products manufacturing |
| 41 | Waste and scrap | 331313 | Alumina refining and primary aluminum production |
| 41 | Waste and scrap | 331420 | Copper rolling, drawing, extruding, and alloying |
| 41 | Waste and scrap | 423930 | Recyclable material merchant wholesalers |
| 41 | Waste and scrap | 493110 | General warehousing and storage |
| 41 | Waste and scrap | 493190 | Other warehousing and storage |
| 41 | Waste and scrap | 511140 | Directory and mailing list publishers |
| 43 | Mixed freight | 424910 | Farm supplies merchant wholesalers |
| 43 | Mixed freight | 424920 | Book, periodical, and newspaper merchant wholesalers |
| 43 | Mixed freight | 424930 | Flower, nursery stock, and florists' supplies merchant wholesalers |
| 43 | Mixed freight | 424950 | Paint, varnish, and supplies merchant wholesalers |
| 43 | Mixed freight | 424990 | Other miscellaneous nondurable goods merchant wholesalers |
| 43 | Mixed freight | 424450 | Confectionery merchant wholesalers |
| 43 | Mixed freight | 424430 | Dairy product (except dried or canned) merchant wholesalers |
| 43 | Mixed freight | 424460 | Fish and seafood merchant wholesalers |
| 43 | Mixed freight | 424480 | Fresh fruit and vegetable merchant wholesalers |

| SCTG2 Code | FAF5 Commodity Name | NAICS | NAICS Description |
|---|---|---|---|
| 43 | Mixed freight | 424410 | General line grocery merchant wholesalers |
| 43 | Mixed freight | 424470 | Meat and meat product merchant wholesalers |
| 43 | Mixed freight | 424490 | Other grocery and related products merchant wholesalers |
| 43 | Mixed freight | 424420 | Packaged frozen food merchant wholesalers |
| 43 | Mixed freight | 424440 | Poultry and poultry product merchant wholesalers |
| 43 | Mixed freight | 423710 | Hardware merchant wholesalers |
| 43 | Mixed freight | 423720 | Plumbing and heating equipment and supplies (hydronics) merchant wholesalers |
| 43 | Mixed freight | 423740 | Refrigeration equipment and supplies merchant wholesalers |
| 43 | Mixed freight | 423730 | Warm air heating and air-conditioning equipment and supplies merchant wholesalers |
| 43 | Mixed freight | 424210 | Drugs and druggists' sundries merchant wholesalers |
| 43 | Mixed freight | 423940 | Jewelry, watch, precious stone, and precious metal merchant wholesalers |
| 43 | Mixed freight | 423990 | Other miscellaneous durable goods merchant wholesalers |
| 43 | Mixed freight | 423910 | Sporting and recreational goods and supplies merchant wholesalers |
| 43 | Mixed freight | 423920 | Toy and hobby goods and supplies merchant wholesalers |
| 43 | Mixed freight | 423430 | Computer and computer peripheral equipment and software merchant wholesalers |
| 43 | Mixed freight | 423450 | Medical, dental, and hospital equipment and supplies merchant wholesalers |
| 43 | Mixed freight | 423420 | Office equipment merchant wholesalers |
| 43 | Mixed freight | 423460 | Ophthalmic goods merchant wholesalers |
| 43 | Mixed freight | 423440 | Other commercial equipment merchant wholesalers |
| 43 | Mixed freight | 423490 | Other professional equipment and supplies merchant wholesalers |
| 43 | Mixed freight | 423410 | Photographic equipment and supplies merchant wholesalers |

| SCTG2 Code | FAF5 Commodity Name | NAICS | NAICS Description |
|---|---|---|---|
| 43 | Mixed freight | 493110 | General warehousing and storage |
| 43 | Mixed freight | 493120 | Refrigerated warehousing and storage |
| 43 | Mixed freight | 493130 | Farm product warehousing and storage |
| 43 | Mixed freight | 493190 | Other warehousing and storage |

BMI = Business Market Insights; FAF5 = Freight Analysis Framework Version 5; NAICS = North American Industry Classification System; n.e.c. = not elsewhere classified.

**Table 16. Import/Export Drivers from Global Trade Atlas Forecast by Standard Classification of Transported Goods, Two-Digit Level (SCTG2)**

| SCTG2 Code | FAF5 Commodity Name | Commodity Code | GTA Forecast Commodity Description |
|---|---|---|---|
| 1 | Live animals and fish | C1ID | Live animals |
| 2 | Cereal grains (including seed) | C1A | Other grain |
| | | C1A1 | Wheat |
| | | C1A2 | Rice |
| | | C1A3 | Corn (maize) |
| 3 | Other agricultural products, except for animal feed | C1B1 | Soybeans |
| | | C1B2 | Sunflower, sesamum, colza and mustard seeds |
| | | C1C1 | Bananas |
| | | C1C2 | Lemons, grapefruit, and other citrus fruits |
| | | C1C21 | Oranges and mandarins |
| | | C1C3 | Apples, pears and plums, fresh |
| | | C1C31 | Grapes and cherries, fresh |
| | | C1C32 | Kiwi fruit, guavas, mangos and durians, fresh |
| | | C1C33 | Pineapples, avocados and papayas, fresh or dried |
| | | C1C34 | Apricots and peaches, fresh |
| | | C1C35 | Strawberries, raspberries, blueberries, etc., fresh |
| | | C1C36 | Melons, watermelons and fruits, n.e.c., fresh |
| | | C1C4 | Cauliflower, broccoli, cabbages and lettuce, fresh or chilled |
| | | C1C41 | Cucumbers, eggplants and tomatoes, fresh or chilled |
| | | C1C42 | Potatoes, carrots, beets and radishes, fresh or chilled |
| | | C1C5 | Vegetables, n.e.c., fresh or chilled |
| | | C1C6 | Fruits and vegetables, frozen |
| | | C1D | Fruits and vegetables, prepared or preserved |
| | | C1D1 | Fruit, dried |
| | | C1D2 | Leguminous and other vegetables, dried |
| | | C1G | Cotton |
| | | C1I | Crude agricultural materials, n.e.c. (share) |
| | | C1IA | Fresh cut flowers, foliage |
| | | C1IB | Eggs, fresh, preserved or cooked |
| | | C1IC | Seeds, bulbs, live plant cuttings and plants |
| | | C314 | Tobacco, unmanufactured |

| SCTG2 Code | FAF5 Commodity Name | Commodity Code | GTA Forecast Commodity Description |
|---|---|---|---|
| 4 | Animal feed and products of animal origin, n.e.c. | C311D | Agriculture and food processing residue and waste, n.e.c. |
| | | C311D1 | Hay, fodder, bran, oil cake, etc. |
| | | C311D2 | Meat and fish products, not for human consumption; dog and cat food, etc. |
| 5 | Meat, fish, and seafood, and their preparations | C1I | Crude agricultural materials, n.e.c. (share) |
| | | C311A3 | Fish and seafood, fresh/chilled |
| | | C311A4 | Fish and seafood, frozen |
| | | C311AA | Beef, fresh or chilled |
| | | C311AB | Chicken and turkey meat, fresh or chilled |
| | | C311AC | Meat, n.e.c., fresh or chilled |
| | | C311AD | Pork, fresh or chilled |
| | | C311AE | Beef, frozen |
| | | C311AF | Chicken and turkey meat, frozen |
| | | C311AG | Meat, n.e.c., frozen |
| | | C311AH | Pork, frozen |
| | | C311B1 | Fish and seafood, prepared or preserved |
| | | C311B3 | Meat, prepared or preserved |
| 6 | Milled grain products and preparations, and bakery products | C311F3 | Flour, bread, and other cereal preparations |
| 7 | Other prepared foodstuffs, and fats and oils | C1B | Oil seeds and oleaginous fruits, n.e.c. |
| | | C311A5 | Milk not concentrated, yogurt and ice cream |
| | | C311A6 | Butter and cheese |
| | | C311B4 | Milk, concentrated; whey; eggs, dried |
| | | C311C | Sugar, beet or cane |
| | | C311C1 | Molasses and other sugars |
| | | C311C2 | Jams, jellies, and honey |
| | | C311E | Animal and vegetable oils, n.e.c. |
| | | C311E1 | Corn and soybean oil |
| | | C311E2 | Palm, coconut, and palm kernel oil |
| | | C311F | Other food |
| | | C311F1 | Coffee |
| | | C311F2 | Cocoa and cocoa preparations |
| | | C313 | Nonalcoholic beverages, beer, and cider (share) |

| SCTG2 Code | FAF5 Commodity Name | Commodity Code | GTA Forecast Commodity Description |
|---|---|---|---|
| 8 | Alcoholic beverages | C313 | Nonalcoholic beverages, beer, and cider (share) |
| | | C313A | Grape alcoholic beverages, excluding wine |
| | | C313B | Wine |
| | | C313C | Whiskies, rum, gin, liqueurs, etc. |
| 9 | Tobacco products | C314A | Cigarettes and cigars |
| 10 | Monumental or building stone | C2A3 | Granite and marble, crude or in rectangular blocks |
| | | C369 | Building stone, worked and nonmetallic mineral products, n.e.c. |
| 11 | Natural sands | C2A2 | Sands, pebbles, gravel, and crushed stone |
| 12 | Gravel and crushed stone | C2A | Stone, clay, and other crude minerals (share) |
| | | C2A2 | Sands, pebbles, gravel, and crushed stone (share) |
| 13 | Nonmetallic minerals, n.e.c. | C2A | Stone, clay, and other crude minerals (share) |
| 14 | Metallic ores and concentrates | C2C | Ores, nonferrous, excluding manganese |
| | | C2C1 | Ores, iron and manganese |
| 15 | Coal | C2D | Coal |
| 16 | Crude petroleum oil | C2E | Crude petroleum |
| 17 | Gasoline and aviation turbine fuel | C353 | Petroleum refineries (share) |
| 18 | Fuel oils | C353 | Petroleum refineries (share) |
| 19 | Coal and petroleum products, n.e.c. | C2F | Natural gas |
| | | C354A | Briquettes and coke |
| | | C354B | Mineral tars and distillation products; petroleum jelly |
| | | C354B1 | Pitch coke, petroleum coke, bitumen, etc. |
| 20 | Basic chemicals | C3511A | Organic chemicals |
| | | C3511B | Inorganic chemical compounds |
| | | C3511C | Chemical elements |
| 21 | Pharmaceutical products | C3522 | Pharmaceutical goods excluding antibiotics |
| | | C3522A | Antibiotics |
| 22 | Fertilizers | C2B | Crude fertilizers |
| | | C3512 | Fertilizers and pesticides |
| 23 | Chemical products and preparations, n.e.c. | C3521 | Paints, varnishes, and lacquers |
| | | C3523 | Soap and detergents |
| | | C3523A | Dental hygiene, hair, and shaving preparations |

| SCTG2 Code | FAF5 Commodity Name | Commodity Code | GTA Forecast Commodity Description |
|---|---|---|---|
| | | C3523B | Essential oils, perfumes, and beauty preparations |
| | | C3529 | Chemical products, n.e.c. |
| 24 | Plastics and rubber | C1F | Natural rubber, gums and resins |
| | | C3513 | Plastics in primary forms and synthetic rubber |
| | | C3514 | Synthetic fibers |
| | | C355 | Rubber products |
| | | C355A | Tires (pneumatic), new |
| | | C356 | Plastics in nonprimary forms and plastic products, n.e.c. |
| | | C356A | Plastic builders' ware, floor coverings, etc. |
| | | C356B | Plastic tubes, pipes, plates, and film |
| 25 | Logs and other wood in the rough | C1E | Wood of coniferous species |
| | | C1E1 | Wood of non coniferous species |
| | | C1E2 | Wood, n.e.c. and cork |
| 26 | Wood products | C1E3 | Wood and cork waste, sawdust, charcoal (share) |
| | | C331 | Builders' joinery and carpentry of wood; wooden containers |
| | | C331A | Veneer, plywood, particle board, etc. |
| | | C331B | Wood products, n.e.c. |
| 27 | Pulp, newsprint, paper, and paperboard | C341B | Pulp |
| | | C341D | Newsprint and uncoated paper and paperboard, excluding printing paper (share) |
| 28 | Paper or paperboard articles | C341C | Paper and paperboard packing and other articles |
| | | C341D | Newsprint and uncoated paper and paperboard, excluding printing paper (share) |
| | | C341F | Paper stationery excluding printing paper |
| | | C341G | Printing and writing paper |
| | | C341H | Other paper and paperboard |
| 29 | Printed products | C342 | Postcards, calendars, and other printed materials |
| | | C342A | Books, periodicals, and maps |
| 30 | Textiles, leather, and articles of textiles or leather | C1H | Other raw textile materials |
| | | C321A | Textile fabrics, woven, excluding narrow or special fabrics |
| | | C321B | Textile yarn |
| | | C321C | Knitted or crocheted fabrics; textile fabrics, n.e.c. and related products |

| SCTG2 Code | FAF5 Commodity Name | Commodity Code | GTA Forecast Commodity Description |
|---|---|---|---|
| | | C321D | Household linens, blankets, curtains, and pillows |
| | | C321E | Floor coverings and made-up textile articles, n.e.c. |
| | | C322 | Wearing apparel, n.e.c. |
| | | C322A | Overcoats of textile fabrics |
| | | C322B | Shirts, blouses, pullovers, etc. |
| | | C322C | Suits, jackets, dresses, etc., of textile fabrics |
| | | C322D | Wearing apparel of leather, plastics and rubber |
| | | C323 | Leather and products |
| | | C324 | Footwear, leather, and textile |
| | | C324A | Footwear, rubber, plastic, and sports |
| | | C324B | Footwear, n.e.s. and footwear parts |
| 31 | Nonmetallic mineral products | C362 | Glass and products |
| | | C369A | Cement and lime |
| | | C369B | Nonrefractory clay and ceramic products |
| | | C369C | Refractory ceramic products |
| | | C369D | Articles of concrete, cement and plaster |
| 32 | Base metal in primary or semifinished forms and in finished basic shapes | C371A | Basic iron and steel |
| | | C371B | Flat-rolled products of iron and steel |
| | | C371C | Iron and steel, n.e.c. |
| | | C372 | Other nonferrous metals |
| | | C372A | Aluminum |
| | | C372B | Copper plates, sheets, foil, powders, tubes, and pipes |
| | | C372C | Copper, refined and unrefined; copper anodes, bars, rods, and wire |
| 33 | Articles of base metal | C381 | Metal products |
| | | C381A | Cutlery, nonelectric cooking appliances, scissors, and blades |
| | | C381B | Metal structures, reservoirs, and tanks |
| | | C381C | Metal tools, nails, bolts, etc. |
| 34 | Machinery | C3821A | Boilers, engines and turbines, excluding aircraft and vehicle engines |
| | | C3822 | Agricultural machinery, n.e.c. |
| | | C3822A | Track-laying tractors; bulldozers, graders and levelers, self-propelled |
| | | C3822B | Wheeled tractors; soil preparation and cultivation machinery |

| SCTG2 Code | FAF5 Commodity Name | Commodity Code | GTA Forecast Commodity Description |
|---|---|---|---|
| | | C3823 | Metal working machinery, engines and parts |
| | | C3823A | Machine tools |
| | | C3824 | Food processing machinery |
| | | C3824A | Machinery for pulp, paper, and printing industries |
| | | C3824B | Special industrial machinery, n.e.c. |
| | | C3826A | Machinery and equipment for mining and construction, n.e.c. |
| | | C3826B | Metallurgical machinery and equipment |
| | | C3829 | General industrial machinery, n.e.c. |
| | | C3829A | Filtering machinery, air pumps, fans, etc. |
| | | C3829B | Pumps for liquids |
| | | C3829C | Pump parts |
| | | C3829D | Bearings and gears |
| | | C3829E | Heating and cooling equipment, n.e.c. |
| | | C3829F | Industrial ovens, furnaces, and furnace burners |
| 35 | Electronic and other electrical equipment and components, and office equipment | C3821B | Electric engines, generators, and transformers |
| | | C3825A | Office machines and parts |
| | | C3825C | Computers |
| | | C3825D | Computer equipment and parts |
| | | C3831 | Electricity distribution and control apparatus |
| | | C3831A | Insulated wire and cable; accumulators and batteries |
| | | C3832A | Radio and TV |
| | | C3832B | Electronic valves, tubes, semiconductors, and other electronic components |
| | | C3832C | Other communications equipment |
| | | C3832D | Telephones, microphones, etc. |
| | | C3833 | Electrical appliances and housewares |
| | | C3833A | Refrigerators and dishwashing machines, household-type |
| | | C3839A | Electromechanical and pneumatic hand tools |
| 36 | Motorized and other vehicles (including parts) | C3843A | Motor vehicles |
| | | C3843B | Parts of motor vehicles |
| | | C3844 | Motorcycles and bicycles |
| | | C3849A | Trailers and semi-trailers |

| SCTG2 Code | FAF5 Commodity Name | Commodity Code | GTA Forecast Commodity Description |
|---|---|---|---|
| 37 | Transportation equipment, n.e.c. | C3841 | Ships, boats, yachts, and other floating structures |
| | | C3842 | Locomotives and other self-propelled railroad equipment |
| | | C3842A | Railroad equipment, not self-propelled and parts |
| | | C3845 | Aircraft and parts |
| | | C3849 | Transport equipment and parts, n.e.c. |
| 38 | Precision instruments and apparatus | C3839B | Electrical equipment, n.e.c. |
| | | C3851 | Medical instruments, appliances, and diagnostic apparatus |
| | | C3851A | Optical and measuring equipment, meters, and counters |
| | | C3852 | Photographic and optical goods |
| 39 | Furniture, mattresses and mattresses supports, lamps, lighting fittings, and illuminated signs | C332 | Furniture |
| | | C3839 | Electric lamps and lighting equipment |
| 40 | Miscellaneous manufactured products | C3853 | Watches and clocks |
| | | C390 | Other manufacturing |
| | | C3901 | Toys, games, and decorations |
| | | C3902 | Musical instruments and parts |
| | | C399 | Goods not classified by kind |
| | | C3991 | Precious metals |
| 41 | Waste and scrap | C1E3 | Wood and cork waste, sawdust, charcoal (share) |
| | | C2G | Scrap metal |
| | | C311D3 | Worn clothing; cotton, silk, wool, and leather waste |
| | | C341A | Wastepaper of mechanical or chemical pulp |
| | | C341A1 | Wastepaper, n.e.s. |
| | | C3515 | Waste and scrap of rubber, synthetic fibers and plastics |
| 43 | Mixed freight | * | Sum of containerized imports and exports |

FAF5 = Freight Analysis Framework Version 5; GTA = Global Trade Atlas; n.e.c. = not elsewhere classified; n.e.s. = not elsewhere specified.

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