

Machinery

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Change from 2017 to 2018:

- **U.S. total exports of machinery: Increased by \$7.1 billion (5.2 percent) to \$143.3 billion**
- **U.S. general imports of machinery: Increased by \$18.3 billion (9.3 percent) to \$214.7 billion**

U.S. total exports and imports of machinery both grew in value from 2017 to 2018. U.S. total exports of machinery increased in value by \$7.1 billion (5.2 percent) to \$143.3 billion, with China, Canada, Japan, and Mexico accounting for the largest increases in exports.¹ U.S. exports of machinery increased to all main U.S. trading partners from 2017 to 2018, with the exception of South Korea (table MT.1). U.S. exports of machinery increased in value across most product groups during this period, with exports of centrifuges and filtering and purifying equipment, semiconductor manufacturing equipment, and farm and garden equipment driving the increase. The only U.S. product group that experienced a decrease in exports in 2018 was boilers, turbines, and related machinery (table MT.2).

The value of U.S. imports of machinery increased by \$18.3 billion (9.3 percent) to \$214.7 billion from 2017 to 2018, led by increases in imports from China, Mexico, Germany, and Canada (table MT.1). U.S. imports of machinery increased in value across most product groups, with household appliances, air-conditioning equipment and parts, taps, cocks, valves, and farm and garden machinery representing more than half of the growth in U.S. imports of machinery (table MT.2). In contrast, U.S. imports of two machinery product groups—welding and soldering equipment, and boilers, turbines, and related machinery—experienced the largest decreases in 2018.

¹ Unless otherwise noted, the export data used in this investigation are for domestic exports. For more information on trade terminology, please refer to USITC, “Special Topic: Trade Metrics,” *Shifts in U.S. Merchandise Trade, 2014, 2015*, https://www.usitc.gov/research_and_analysis/trade_shifts_2014/trade_metrics.htm.

Table MT.1 Machinery: U.S. exports and general imports, by selected trading partners, 2014–18

Country/item	Million \$					Absolute change, 2017 to 2018	% change, 2017 to 2018
	2014	2015	2016	2017	2018		
U.S. exports of domestic merchandise:							
China	9,600	9,485	8,976	9,730	11,230	1,500	15.4
Mexico	18,254	18,101	17,072	17,497	18,219	723	4.1
Canada	25,865	23,344	20,599	21,599	22,834	1,234	5.7
Germany	3,874	3,935	3,911	4,375	4,537	162	3.7
Japan	3,825	4,306	3,743	5,130	5,927	797	15.5
South Korea	6,510	5,919	5,307	8,340	7,058	-1,282	-15.4
Italy	1,047	1,104	962	1,086	1,218	132	12.1
Taiwan	4,289	4,873	5,258	4,683	4,285	-398	-8.5
United Kingdom	3,652	3,445	3,381	3,503	3,851	347	9.9
Netherlands	2,157	2,128	2,066	2,253	2,592	339	15.0
All other	48,261	43,357	37,494	37,081	38,998	1,917	5.2
Total domestic exports	127,333	119,997	108,766	115,278	120,749	5,471	4.7
Foreign exports	18,647	18,862	19,416	20,926	22,530	1,604	7.7
Total U.S. exports (domestic and foreign)	145,981	138,859	128,183	136,204	143,279	7,075	5.2
U.S. general imports:							
China	48,144	50,512	48,408	52,980	59,405	6,425	12.1
Mexico	29,054	30,105	29,888	31,391	33,736	2,346	7.5
Canada	13,696	12,920	12,173	13,541	14,512	970	7.2
Germany	17,882	17,675	17,298	19,085	20,934	1,849	9.7
Japan	18,827	17,381	17,308	18,689	18,924	235	1.3
South Korea	7,110	7,583	7,082	7,902	8,231	329	4.2
Italy	7,215	7,042	6,804	7,574	8,427	853	11.3
Taiwan	4,389	4,445	4,125	4,612	5,128	516	11.2
United Kingdom	4,239	4,144	3,730	3,833	4,233	401	10.5
Netherlands	4,277	2,906	2,484	3,233	3,970	736	22.8
All other	30,697	31,213	30,189	33,481	37,158	3,677	11.0
Total general imports	185,529	185,926	179,487	196,320	214,658	18,338	9.3

Source: Compiled from official statistics of the U.S. Department of Commerce.

Note: Import values are based on U.S. customs value; export values are based on free alongside ship value, U.S. port of export. Calculations are based on unrounded data. The countries are sorted by those with the largest total U.S. trade (U.S. general imports plus U.S. domestic exports) in these products in the most recent year.

U.S. Exports

U.S. exports of machinery increased in value across most product groups from 2017 to 2018, with the largest increases in exports of centrifuges and filtering and purifying equipment (up \$930 million, or 13.1 percent); semiconductor manufacturing equipment (\$912 million, 4.3 percent); and farm and garden equipment (\$635 million, 6.6 percent) (table MT.2).² The only product group in which U.S. exports decreased from 2017 to 2018 was the boilers, turbines, and related machinery product group.³

² USITC DataWeb/USDOC, digests MT005, MT009, and MT019A (accessed July 12, 2019).

³ USITC DataWeb/USDOC, digest MT022 (accessed July 12, 2019).

Table MT.2 Machinery: leading changes in U.S. exports and imports, 2014–18

Industry/commodity group (USITC code)	Million \$					Absolute change, 2017 to 2018	% change, 2018 from 2017
	2014	2015	2016	2017	2018		
U.S. domestic exports:							
Increases:							
Centrifuges and filtering and purifying equipment (MT005)	7,569	7,437	6,648	7,113	8,044	930	13.1
Semiconductor manufacturing equipment (MT019A)	14,555	15,894	16,639	21,364	22,276	912	4.3
Farm and garden machinery and equipment (MT009)	10,732	9,412	8,381	9,581	10,216	635	6.6
Decreases:							
Boilers, turbines, and related machinery (MT022)	1,670	1,748	1,660	1,252	914	-339	-27.1
All other	92,807	85,506	75,439	75,968	79,300	3,332	4.4
Total	127,333	119,997	108,766	115,278	120,749	5,471	4.7
U.S. general imports:							
Increases:							
Household appliances, including commercial applications (MT004)	24,322	26,240	25,817	27,569	29,574	2,006	7.3
Air-conditioning equipment and parts (MT002)	16,859	16,826	17,149	18,830	20,752	1,922	10.2
Taps, cocks, valves, and similar devices (MT020)	15,335	14,882	13,447	14,516	16,274	1,759	12.1
Farm and garden machinery and equipment (MT009)	9,134	8,592	7,697	7,829	9,253	1,424	18.2
Decreases:							
Welding and soldering equipment (MT028)	1,340	1,448	1,556	2,022	1,745	-276	-13.7
Boilers, turbines, and related machinery (MT022)	1,446	1,608	1,381	1,362	1,260	-103	-7.5
All other	117,093	116,330	112,440	124,192	135,799	11,607	9.3
Total	185,529	185,926	179,487	196,320	214,658	18,338	9.3

Source: Compiled from official statistics of the U.S. Department of Commerce.

Note: Import values are based on U.S. customs value; export values are based on free alongside ship value, U.S. port of export. Calculations are based on unrounded data.

U.S. exports of centrifuges and filtering and purifying equipment increased by \$930 million (13.1 percent) in 2018, largely driven by growth in shipments of catalytic converters, as well as filtering or purifying machinery and apparatus for liquids and gases (table MT.2). Auto manufacturers are the

primary users of catalytic converters, and the largest increases of U.S. total exports were to countries with large auto industries that produce autos for sale in the U.S. market, such as Mexico, Japan, and China.⁴ Demand in the oil and gas, chemicals, power generation, and water management sectors worldwide drove the increases in total U.S. exports of filtering or purifying machinery and apparatus for liquids and gases.⁵

The increase in U.S. exports of filtering or purifying machinery and apparatus for liquids and gases reflected growth in two sectors in particular. In 2018, the oil and gas industries in North America and the Asia-Pacific region experienced a rise in capital spending over previous years, mainly because of increased equipment maintenance across the industry, as well as an increase in short-cycle investment.⁶ The water management industries in Canada, China, Japan, and Mexico also drove demand for centrifuges and purifying equipment, as demand for fresh water, water treatment and reuse, desalination, and flood control equipment increased in these countries in 2018.⁷

U.S. exports of semiconductor manufacturing equipment increased by \$912 million (4.3 percent) in 2018, largely driven by growth in sales to the Asia-Pacific region (table MT.2).⁸ This growth in exports represents a continuation—albeit at a slower rate—of the large increases in spending experienced in 2017. In recent years, many U.S. and foreign electronics makers have established manufacturing facilities in countries such as China, Malaysia, and Singapore due to the availability of low-cost skilled labor, fueling the region’s demand for U.S. semiconductor manufacturing equipment.⁹ South Korea remained the top market for global sales of semiconductor equipment, followed by China, Taiwan, and Japan.¹⁰

Worldwide sales in major semiconductor equipment categories increased, including test equipment, wafer manufacturing, processing, assembly, and packaging equipment.¹¹ Two categories of products experienced the largest increases in U.S. exports: (1) machines used for the manufacture of boules¹² or wafers, semiconductors, electronic integrated circuits, or flat panel displays, and (2) instruments for inspecting semiconductor wafers or devices.¹³ Despite the growth in U.S. exports of semiconductor manufacturing equipment between 2017 and 2018, the trend shows a slowdown in the growth of these

⁴ Official statistics of the U.S. Department of Commerce; Markets and Markets, “Catalytic Converter Market Worth \$73.1 Billion by 2025” (accessed September 15, 2019).

⁵ Flowserve, “Form 10-K,” February 13, 2019, 29.

⁶ In the oil and gas industry, short-cycle investment refers to a scenario in which capital employed in drilling wells can be recouped over a briefer period than in conventional fields. Flowserve, “Form 10-K,” February 13, 2019, 30.

⁷ Flowserve, “Form 10-K,” February 13, 2019, 31, 41.

⁸ CFRA, “Industry Surveys: Semiconductors and Semiconductor Equipment,” May 2019, 22.

⁹ CFRA, “Industry Surveys: Semiconductors and Semiconductor Equipment,” May 2019, 22.

¹⁰ SEMI, “2018: Records Shattered across the Board,” April 2019.

¹¹ A thin, circular crystalline silicon wafer is the basic component in the manufacture of semiconductor devices. Wafers are cut from a silicon column made from melted sand, to which a seed crystal is added. Wafers manufactured today typically have a diameter of 300 millimeters (mm) (12 inches) or 200 mm (8 inches). CFRA, “Industry Surveys: Semiconductors and Semiconductor Equipment,” May 2019, 32; SEMI, “2018: Records Shattered across the Board,” April 2019.

¹² A boule is the silicon column from which a wafer is cut. Virginia Semiconductor, “What Is a Silicon Wafer Used For?” October 2017.

¹³ USITC DataWeb/USDOC, HTS 8486.10.00, 9030.82.00 (accessed October 7, 2019).

exports compared to the period from 2016 to 2017.¹⁴ The slower growth can be partially explained by the contraction of new equipment markets in Taiwan and South Korea, where annual sales decreased by 12 percent and 1 percent, respectively, from 2017 to 2018.¹⁵

U.S. exports of farm and garden machinery and equipment continued the upward trend that started in 2016–17, although at a slower rate (table MT.2).¹⁶ These exports grew by \$635 million (6.6 percent) in 2018, mainly in the tractors and combines segments, and to a lesser extent in the sprayers, hay tools, and grain storage equipment segments.¹⁷ U.S. exports of the following products increased the most significantly: combine harvester-threshers; tractors suitable for agricultural use, of an engine power exceeding 37 kilowatts but not exceeding 75 kilowatts; tractors of an engine power of 130 kilowatts or more; and harvesting or threshing machinery.¹⁸ Starting in 2017, farm equipment markets in some regions began to recover following years of declines in commodity prices and farmer incomes, which had depressed demand for farm equipment worldwide.¹⁹ In 2018, this recovery continued, although at a slower rate than in 2017, leading to continued growth in U.S. exports of farm equipment.

Demand for farm equipment increased in North America (including Canada and Mexico) during 2018 compared to 2017. Net sales growth was driven by the row-crop segment as farmers replaced their equipment, as well as by continued growth in demand in the lower-horsepower tractors segment.²⁰ Canada remained the top U.S. export market for farm and garden machinery, with U.S. exports increasing slightly (0.4 percent) to \$6.7 billion in 2018. Mexico remained the second-largest U.S. export market, with U.S. exports increasing 8 percent to \$6.4 billion.²¹ Australia remained the third-largest market for U.S. exports of farm and garden machinery, which grew by 2 percent to \$1 billion in 2018.²² China passed Germany to become the fourth-largest market for U.S. exports, which rose 26 percent to \$667 million in 2018.²³

U.S. exports of boilers, turbines, and related machinery fell by \$339 million (27.1 percent), mainly driven by a decline in exports of nuclear fuel elements due to a decrease in the number of nuclear power plants being constructed (table MT.2).²⁴ Overall, U.S. exports of nuclear fuel elements dropped by 65 percent to \$149 million.²⁵ The largest decreases of total exports of boilers, turbines, and related machinery occurred in U.S. exports to China and Taiwan, primarily in products related to fuel elements for nuclear reactors and parts of steam turbines and auxiliary plants. U.S. exports of boilers, turbines, and related machinery to China plunged by 78 percent to \$43 million.²⁶ Many of these products are large, expensive

¹⁴ From 2016 to 2017, U.S. exports of semiconductor manufacturing equipment increased by \$4.7 billion (28.4 percent). USITC, “Machinery,” 2017.

¹⁵ SEMI, “2018 Global Semiconductor Equipment Sales Jump,” April 2019.

¹⁶ U.S. exports of farm and garden machinery grew by \$1.1 billion (13.2 percent) in 2017, after several years of decline. USITC, “Machinery,” 2017.

¹⁷ AGCO, “Form 10-K,” March 1, 2019, 22.

¹⁸ USITC DataWeb/USDOC, HTS 8433.51.00, 8701.93.10, 8701.95.10, 8433.90.50 (accessed October 7, 2019).

¹⁹ AGCO, “Form 10-K,” March 1, 2019, 24–25.

²⁰ AGCO, “Form 10-K,” March 1, 2019, 22.

²¹ USITC DataWeb/USDOC, digest MT009 (accessed July 12, 2019).

²² USITC DataWeb/USDOC, digest MT009 (accessed July 12, 2019).

²³ USITC DataWeb/USDOC, digest MT009 (accessed July 12, 2019).

²⁴ Flowserve, “Form 10-K,” February 13, 2019, 30.

²⁵ USITC DataWeb/USDOC, HTS 8401.30.00 (accessed October 7, 2019).

²⁶ USITC DataWeb/USDOC, digest MT022 (accessed July 12, 2019).

items purchased for a particular project, and orders for one project can lead to significant fluctuations in annual shipments.²⁷ Similarly, exports to Taiwan decreased by 42 percent to \$51 million in 2018.²⁸

U.S. Imports

U.S. imports of machinery increased in value across most product groups from 2017 to 2018. More than half of the growth in U.S. imports of machinery resulted from increases in imports of the following product groups: household appliances (up \$2 billion, or 7.3 percent); air-conditioning equipment and parts (\$1.9 billion, 10.2 percent); taps, cocks, and valves (\$1.8 billion, 12.1 percent); and farm and garden machinery (\$1.4 billion, 18.2 percent) (table MT.2).²⁹ Rising consumer spending and increases in new home construction mostly drove the overall growth in imports in these categories. At the same time, U.S. imports of machinery decreased across two product groups: welding and soldering equipment (down \$276 million, or 13.7 percent) and boilers, turbines, and related machinery (\$103 million, 7.5 percent).³⁰

U.S. imports of household appliances (including for commercial applications) grew by \$2 billion (7.3 percent) in 2018, driven by rising consumer spending and an continued strength in new home construction (table MT.2). The products that accounted for the largest increases in the value of imports were vacuum cleaners and refrigeration equipment. The primary sources of the increased imports of household appliances were China (up \$1.9 billion, or 16 percent), Mexico (\$302 million, 5 percent), Germany (\$154 million, 22 percent), and Malaysia (\$61 million, 8 percent). In general, the increase in U.S. imports of large appliances can be attributed to improved U.S. economic performance and continued strength in the housing market. In 2018, 1.32 million new privately owned housing units were authorized in the United States, compared to 1.28 million units in 2017.³¹ In terms of new home construction, there were 1.1 million housing starts in 2018, compared to 1.2 million in 2017.³² Finally, average annual real expenditures on personal consumption of goods and services increased by 2.6 percent year-on-year in 2018.³³

Similarly, new home construction and consumer spending contributed to an increase in U.S. imports of air-conditioning equipment and parts, which rose \$1.9 billion (10.2 percent) (table MT.2).³⁴ Imports of

²⁷ EIA, "Construction Cost Data for Electric Generators," August 2018.

²⁸ USITC DataWeb/USDOC, digest MT022 (accessed July 12, 2019).

²⁹ USITC DataWeb/USDOC, digests MT004, MT002, MT020 (accessed July 12, 2019).

³⁰ USITC DataWeb/USDOC, digest MT028 (accessed July 12, 2019).

³¹ U.S. Census Bureau, "New Privately Owned Housing Units," 2019.

³² A housing start is the point at which excavation for the foundation or footings of a residential structure begins. For a multifamily structure, all units are counted as started when the excavations begins for the whole structure. Housing starts are calculated by the Census Bureau based on a survey of permit holders. National Association of Home Builders, "What Are Housing Starts?" (accessed August 19, 2019); Federal Housing Finance Agency, *2018 Report to Congress*, June 2019, 115.

³³ Annual average real personal consumption expenditures came to \$12.9 trillion in 2018, compared to \$12.6 trillion in 2017. (Both figures are for chained 2012 dollars.) U.S. Federal Reserve, "Real Personal Consumption Expenditures," June 28, 2019. Personal consumption expenditures are the primary measure of consumer spending on goods and services in the U.S. economy. They account for about two-thirds of domestic final spending, and thus are the primary engine that drives future economic growth. USDOC, BEA, *Concepts and Methods of the U.S. National Income*, November 2017, 5-1.

³⁴ U.S. Census Bureau, "New Privately Owned Housing Units," 2019.

air and vacuum pumps, air compressors, and small air conditioners increased the most by value. The primary sources of the increase in U.S. imports of air-conditioning equipment and parts were China (up by \$759 million, 13 percent) and Mexico (up by \$511 million, 9 percent). Besides air-conditioning equipment and parts used in residential and commercial construction, imports of air-conditioning parts for automobiles saw substantial increases from 2017 to 2018. For example, imports of air compressors—specifically superchargers and turbochargers used in automobiles—increased 17 percent to \$985 million in 2018.³⁵

U.S. imports of taps, cocks, and valves rose \$1.8 billion (12.1 percent), mostly due to increased demand in the flow control segments of the oil and gas and chemical industries (table MT.2). (For discussion of trade shifts in the oil, gas, and chemical industries, see the Energy-related Products and Chemicals and Related Products chapters of this report.)³⁶ The primary sources of the rise in imports of taps, cocks, and valves were China (up by \$810 million, 21 percent) and Mexico (up by \$170 million, 7 percent).

U.S. imports of farm and garden machinery increased by \$1.4 billion (18.2 percent), mainly driven by an increase in retail sales in North America in the row-crop and tractors segments as farmers replaced their equipment (table MT.2). (For a broad discussion of the trade shifts in the agricultural industries, see the Agricultural Products chapter.)³⁷ Total imports of other products like mowers for lawns, parks, or sports grounds also increased. The primary sources of the increase in imports of farm and garden machinery were China (up by \$243 million, 24 percent) and Canada (up by \$203 million, 18 percent).

U.S. imports of welding and soldering equipment fell by \$276 million (13.7 percent) in 2018, largely due to a substantial decrease of \$300 million (47 percent) in imports of fully or partly automatic machines for resistance welding of metal (HTS 10-digit statistical reporting number 8515.21.0000) (table MT.2). There was a one-time spike in imports of resistance welding machines in 2017, and in 2018 imports returned to more typical levels.

U.S. imports of boilers, turbines, and related machinery dropped by \$103 million (7.5 percent) in 2018 (table MT.2). Many of these products are large, expensive items purchased for a particular project, and orders for one project can lead to significant fluctuations in annual import values.³⁸ Imports increased in 2017, apparently due to the delivery of a large order of boilers from Canada, and then declined in 2018 after the completion of this delivery.³⁹

³⁵ Air compressors, turbochargers, and superchargers are reported under HTS subheading 8414.80.05.

³⁶ Flowserve, “Form 10-K,” February 13, 2019, 30.

³⁷ AGCO, a leading manufacturer and distributor of agricultural equipment, reported that between 2017 and 2018 its industry-unit retail sales of tractors rose by about 2 percent, while unit retail sales of combines rose by about 10 percent in North America. AGCO’s performance in the agricultural equipment market is often cited as an indicator of the industry as a whole. AGCO, “Form 10-K,” March 1, 2019, 22.

³⁸ EIA, “Construction Cost Data for Electric Generators,” August 2018.

³⁹ IHS Markit, Global Trade Atlas database (accessed July 2, 2019); Trade Data Services, Import Genius database (accessed July 2, 2019).

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