



SEMICONDUCTOR  
INDUSTRY  
ASSOCIATION

2018 2019 2020 2021 2022

FACTBOOK

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# SEMICONDUCTOR INDUSTRY ASSOCIATION

## FACTBOOK

### Introduction

The data included in the 2020 SIA Factbook helps demonstrate the strength and promise of the U.S. semiconductor industry and why it is critical for policymakers to enact measures that boost growth and promote innovation.

The U.S. semiconductor industry is a key driver of America's economic strength, global competitiveness, and technology leadership.

Semiconductors enable the systems and products that we use to work, communicate, travel, entertain, harness energy, treat illness, and make new scientific discoveries. Semiconductors make possible the global trillion dollar electronics industry. Semiconductors were invented in America, and the U.S. still leads the world in cutting-edge manufacturing and design.

In the semiconductor industry and across the broader tech sector, innovation is made possible through the hard work and ingenuity of the industry's scientists and engineers and is supplemented by smart public policy from the federal government. At SIA, a common theme of the policies we support is that all of them are intended to maintain and accelerate technological advancements. The federal government plays a vital role in furthering these initiatives.

To help promote innovation and ensure America's continued technology leadership, policymakers should do the following:

1. **Expand access to global markets** to fuel semiconductor industry growth.
2. **Increase federal investments in semiconductor research** to discover the next generation of semiconductor technologies.
3. **Incentivize semiconductor manufacturing in the U.S.** to strengthen the defense industrial base, support economic growth and advanced manufacturing, and improve supply chain security.
4. **Minimize burdens on export of commercial semiconductors** by ensuring U.S. export control policies are effective, multilateral, and narrowly tailored.
5. **Strengthen America's technology workforce** by promoting policies that attract and retain highly skilled workers and investing in STEM education.
6. **Promote innovation** by protecting valuable IP.
7. **Keep the U.S. tax system globally competitive** to enhance America's competitiveness, boost U.S. design and manufacturing, and promote American innovation.
8. **Support sustainability** with regulations that meet the needs of the semiconductor industry.
9. **Combat counterfeit semiconductors** through enforcement and reducing the supply of counterfeits.
10. **Foster growth of new technologies** by creating a more favorable policy environment for developing and deploying promising technologies.
11. **Enhance supply chain security and manage risk.**



# FACTBOOK

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# Section 1

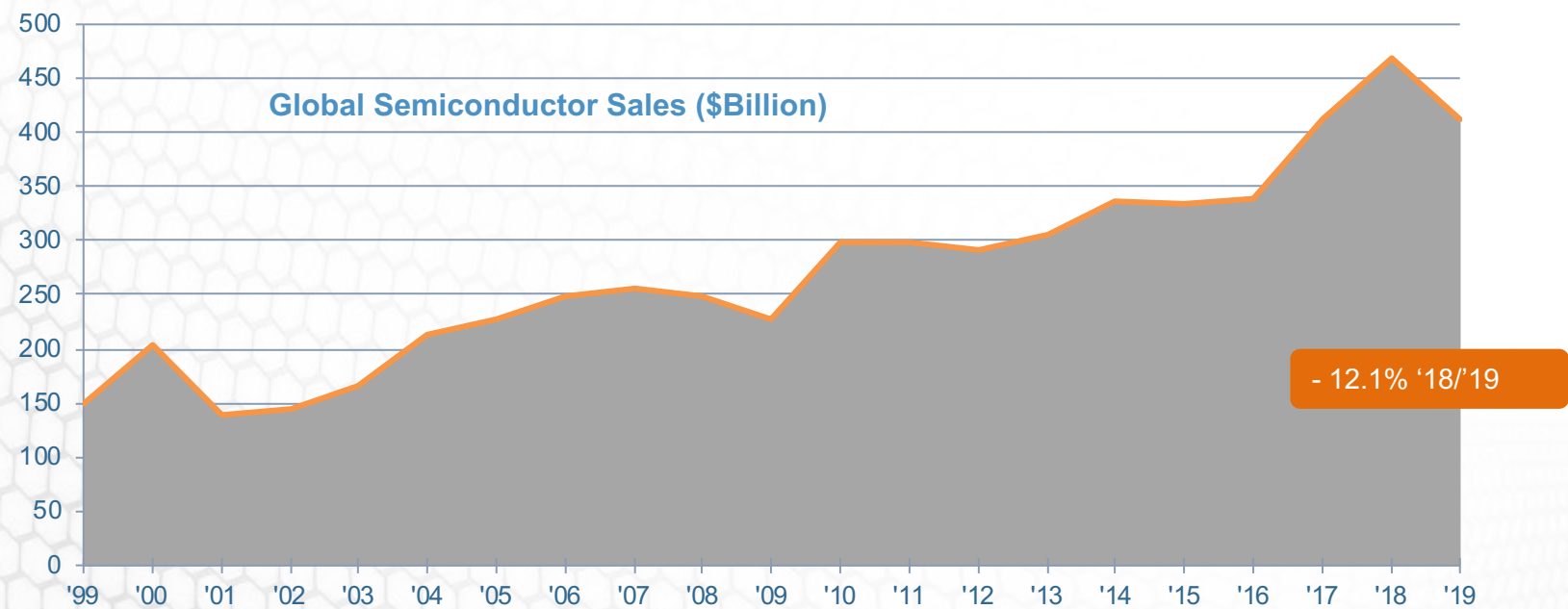
## INDUSTRY OVERVIEW

# SECTION 1: INDUSTRY OVERVIEW

THE GLOBAL SEMICONDUCTOR INDUSTRY IS A KEY GROWTH SECTOR IN THE GLOBAL ECONOMY

Worldwide semiconductor sales increased from \$149.4 billion in 1999 to \$412.3 billion in 2019, a compound annual growth rate of increase of 5.21 percent per year. According to the World Semiconductor Trade Statistics (WSTS) Fall 2019 Semiconductor Industry Forecast, worldwide semiconductor industry sales are forecast to reach \$433 billion in 2020 and \$460 billion in 2021.\*

\*WSTS, Fall 2019 Semiconductor Industry Forecast



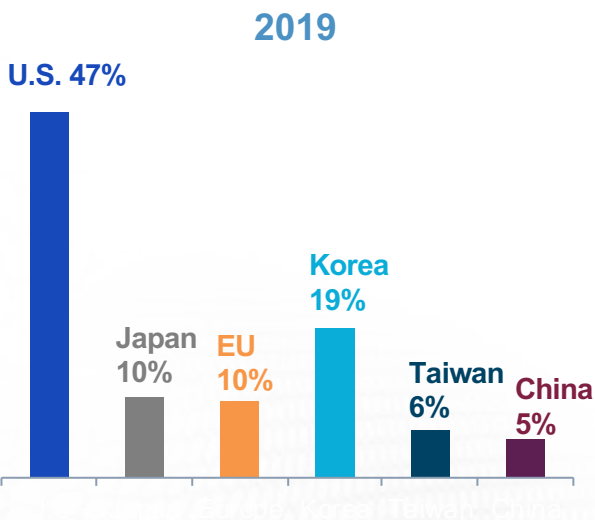
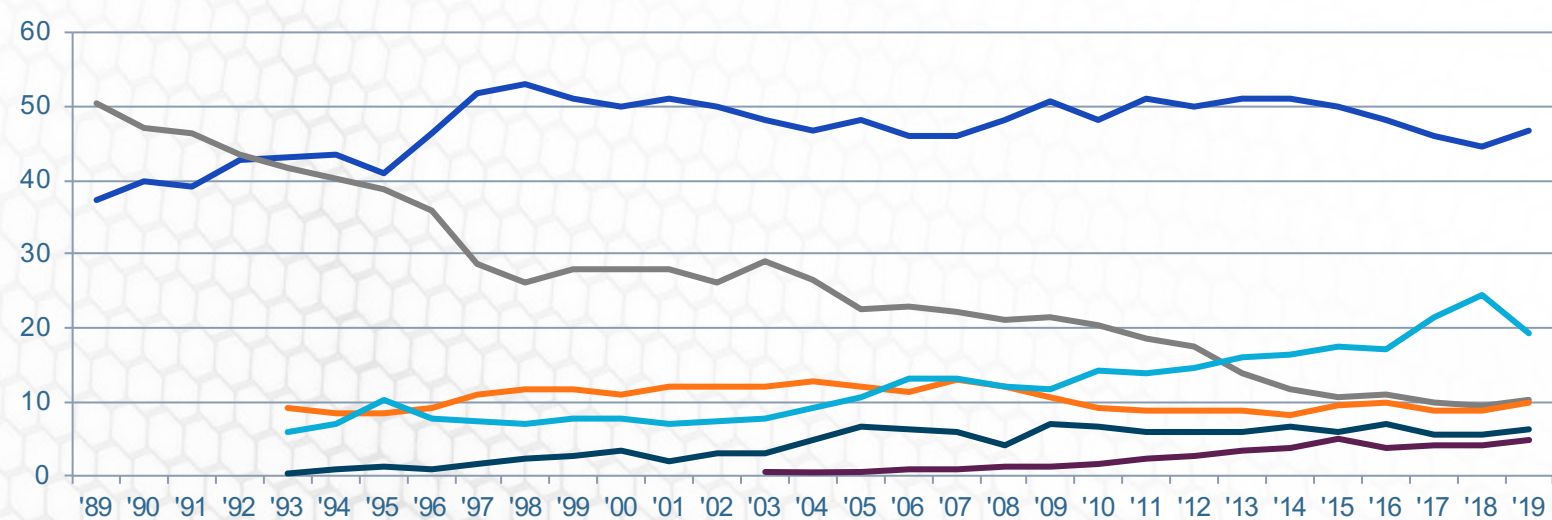
Source: World Semiconductor Trade Statistics (WSTS) and SIA Estimates.

# SECTION 1: INDUSTRY OVERVIEW

## THE U.S. SEMICONDUCTOR INDUSTRY HAS NEARLY HALF THE GLOBAL MARKET SHARE

The U.S. semiconductor industry experienced a significant loss in global market share during the 1980s. In the early 1980s, the U.S.-based producers held more than 50 percent of worldwide semiconductor sales. Due to intense competition from Japan-based firms, the effect of illegal "dumping," and a severe industry recession in 1985 to 1986, the U.S. industry lost a total of nineteen worldwide market share points and had ceded global industry market share leadership to the Japanese semiconductor industry.

The U.S. industry rebounded over the next 10 years, and by 1997, it had regained its leadership position with over 50 percent global market share, a position the industry continues to hold today. U.S. semiconductor firms have maintained their competitive edge in microprocessors and other leading-edge devices, as well as continued to lead in a range of other product areas. In addition, U.S. semiconductor firms maintain a leading position in R&D, design, and process technology. Today, U.S.-based firms have the largest market share with 47 percent. Other countries' industries have between 5 and 19 percent global market share.



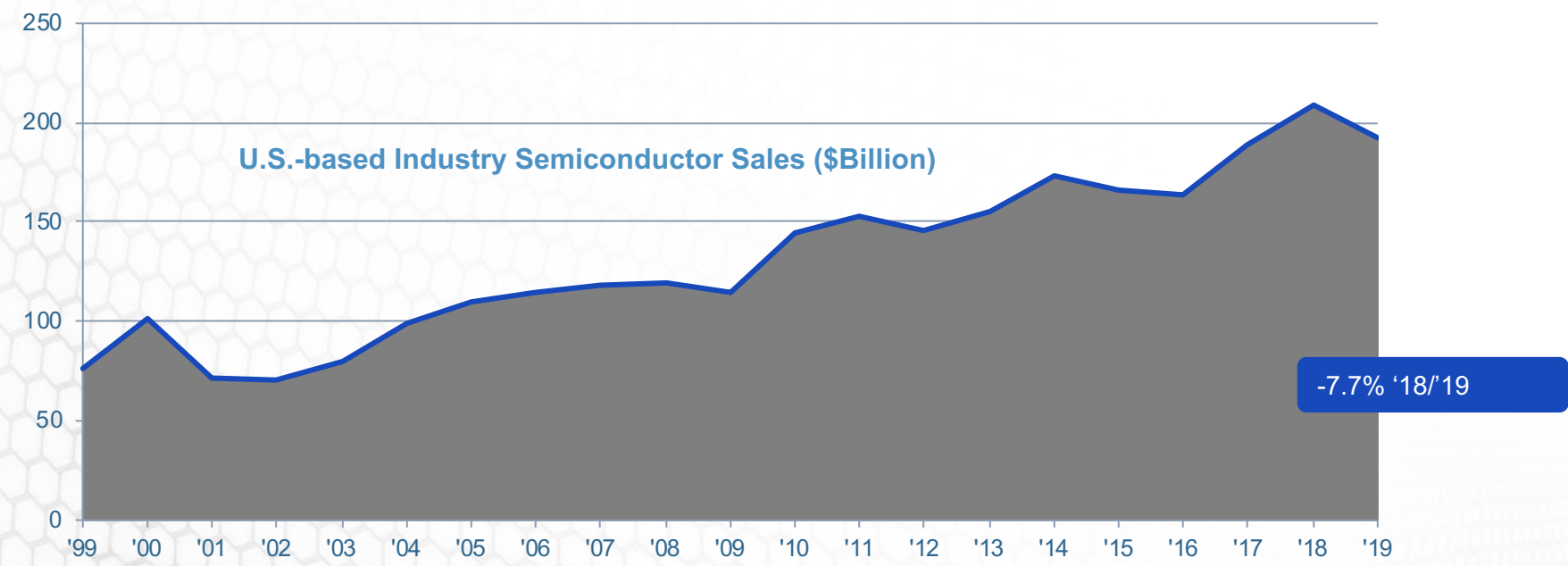
Source: SIA, World Semiconductor Trade Statistics (WSTS), IHS Global, PwC.



# SECTION 1: INDUSTRY OVERVIEW

## U.S.-BASED SEMICONDUCTOR COMPANY SALES HAVE DISPLAYED STEADY ANNUAL GROWTH

Sales by U.S. headquartered semiconductor firms grew from \$76.7 billion in 1999 to \$192.8 billion in 2019 -- a compound annual growth rate of 4.72 percent. Sales growth for U.S. headquartered companies shows the same cyclical fluctuations characterized by the industry as a whole.



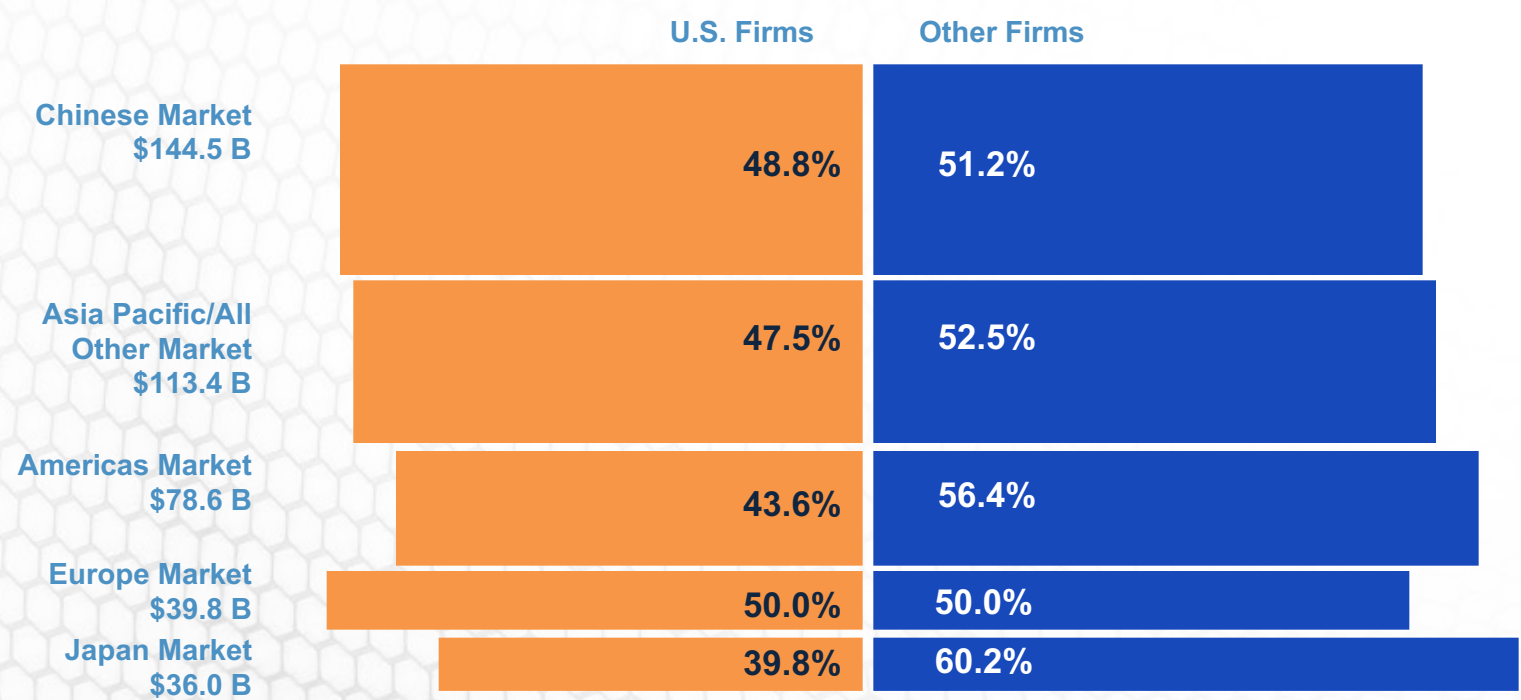
Source: World Semiconductor Trade Statistics (WSTS) and SIA Estimates.



# SECTION 1: INDUSTRY OVERVIEW

## U.S.-BASED SEMICONDUCTOR COMPANIES MAINTAIN MARKET SHARE LEADERSHIP IN MAJOR REGIONAL SEMICONDUCTOR MARKETS

In 2019, semiconductor firms based in the United States held 47 percent of the total semiconductor market, the most of any countries' semiconductor industry. In all major country and regional semiconductor markets, U.S. headquartered companies also held sales market share leadership.

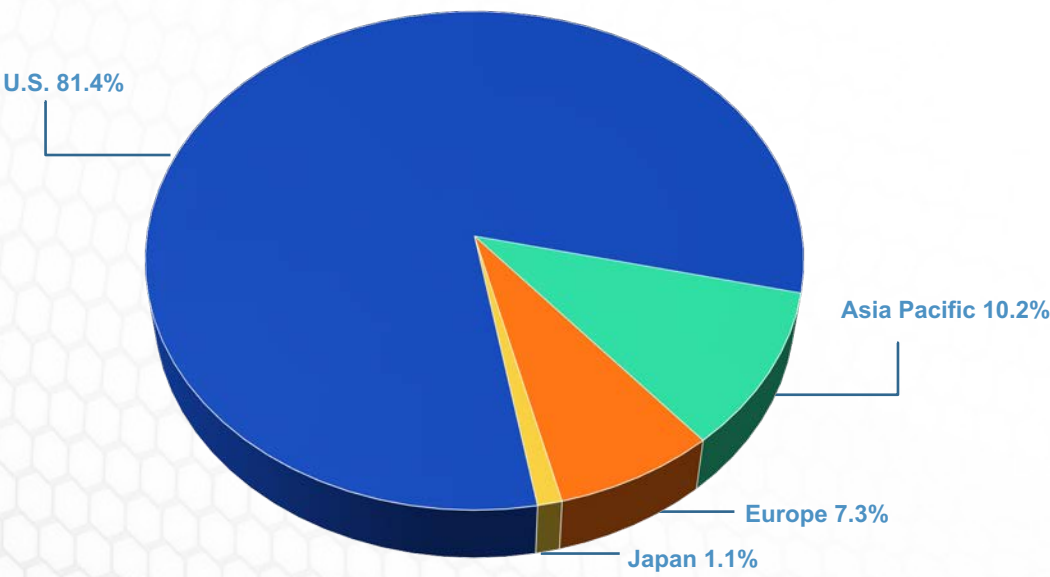


# SECTION 1: INDUSTRY OVERVIEW

## THE VAST MAJORITY OF SEMICONDUCTOR MANUFACTURING DONE IN THE UNITED STATES IS DONE BY U.S. FIRMS

In 2019, roughly 81 percent of all semiconductor wafer fabrication capacity in the United States was accounted for by U.S.-headquartered firms. Semiconductor firms headquartered in the Asia Pacific region accounted for most of the balance of capacity in the United States at around 10 percent.

Percent of Semiconductor Wafer Capacity in the U.S. by Headquarter Location



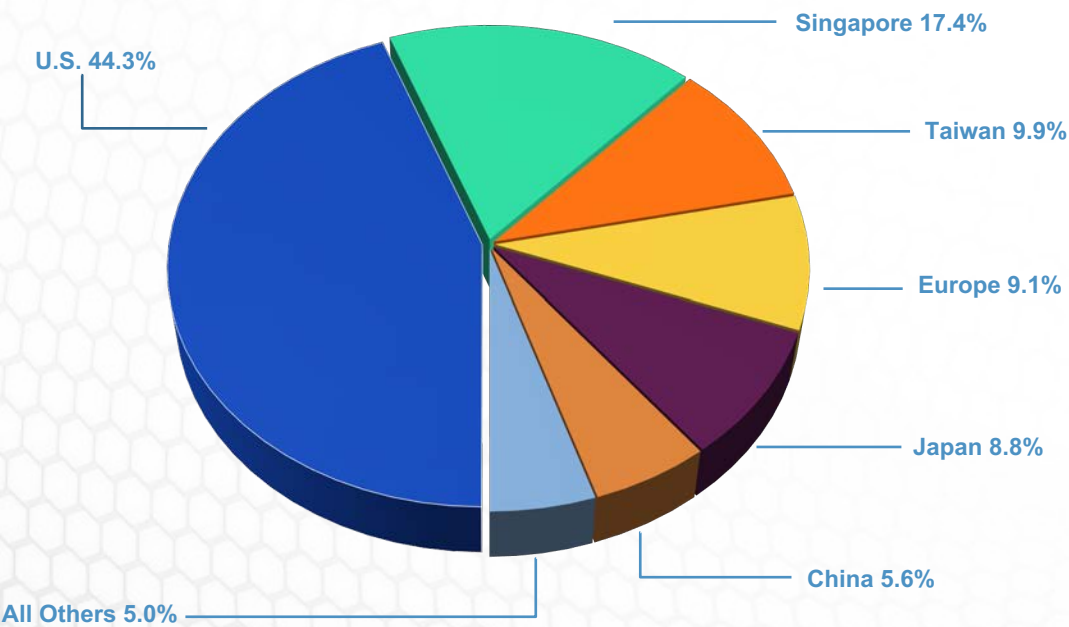
Source: IC Insights Global Fab Database and SIA Estimates.

# SECTION 1: INDUSTRY OVERVIEW

THE U.S. SEMICONDUCTOR INDUSTRY MAINTAINS MORE OF ITS MANUFACTURING BASE IN THE UNITED STATES THAN IN ANY OTHER COUNTRY

In 2019, about 44 percent of U.S.-headquartered firms' front-end semiconductor wafer capacity was located in the United States. Other leading locations for U.S. headquartered front-end semiconductor wafer fab capacity were Singapore, Taiwan, Europe, and Japan.

Percent of U.S.-Headquartered Firm Semiconductor Wafer Capacity by Location



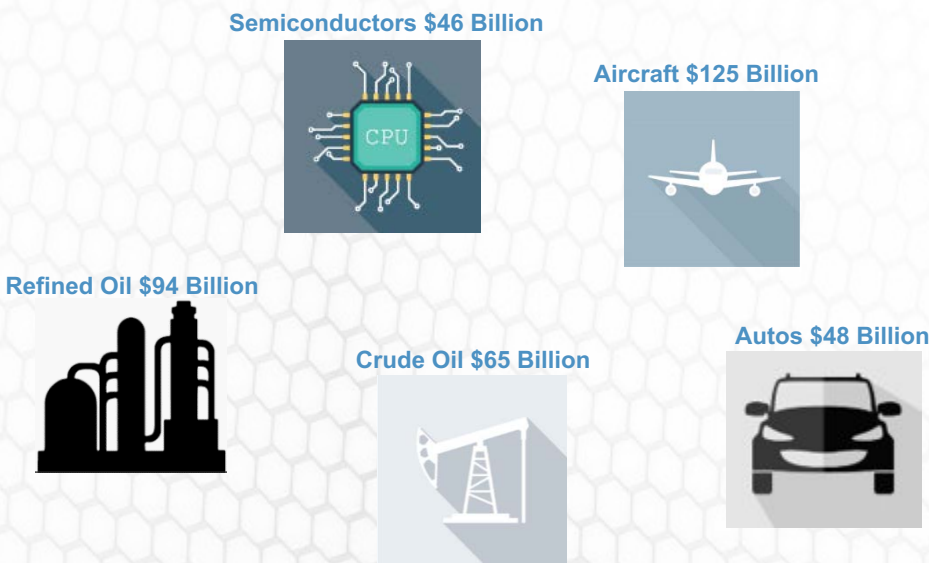
Note: Figures are rounded to the nearest 10th.  
Source: IC Insights Global Fab Database and SIA Estimates.

# SECTION 1: INDUSTRY OVERVIEW

## SEMICONDUCTORS ARE ONE OF AMERICA'S TOP EXPORTS

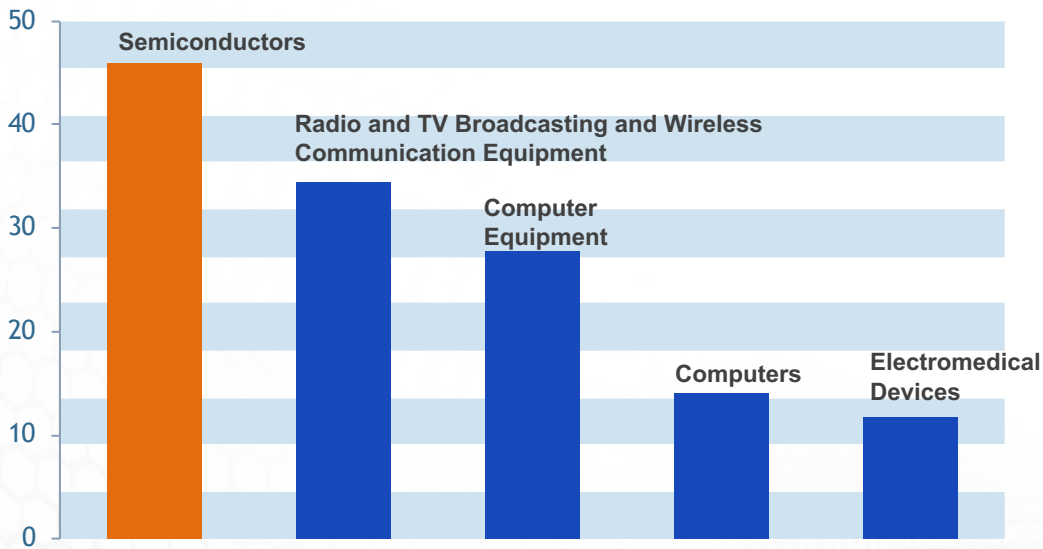
U.S. exports of semiconductors were worth \$46 billion in 2019, fifth highest among U.S. exports behind only airplanes, refined oil, crude oil, and autos. Semiconductors constituted the largest share of U.S. exports of all electronic product exports.

Top 5 U.S. Exports in 2019 (\$ Bn)



Source: U.S. International Trade Commission. Industry defined by NAICS codes: 334413 (Semiconductors); 33641X (Aircraft); 324110 (Refined Oil); 211111 (Crude Oil); 336111 (Autos)

#1 U.S. Electronic Product Export in 2019 (\$ Bn)



Source: U.S. International Trade Commission. Industry defined by NAICS codes: 334413 (Semiconductors); 334220 (Radio and TV Broadcasting and Wireless Communications Equipment); 334118 (Computer Equipment); 334111 (Computers); 334510 (Electromedical Devices).

Note: Some subproducts within NAICS 334413 that are made by different industries and serve different markets (e.g. solar cells) are excluded.





# **Section 2**

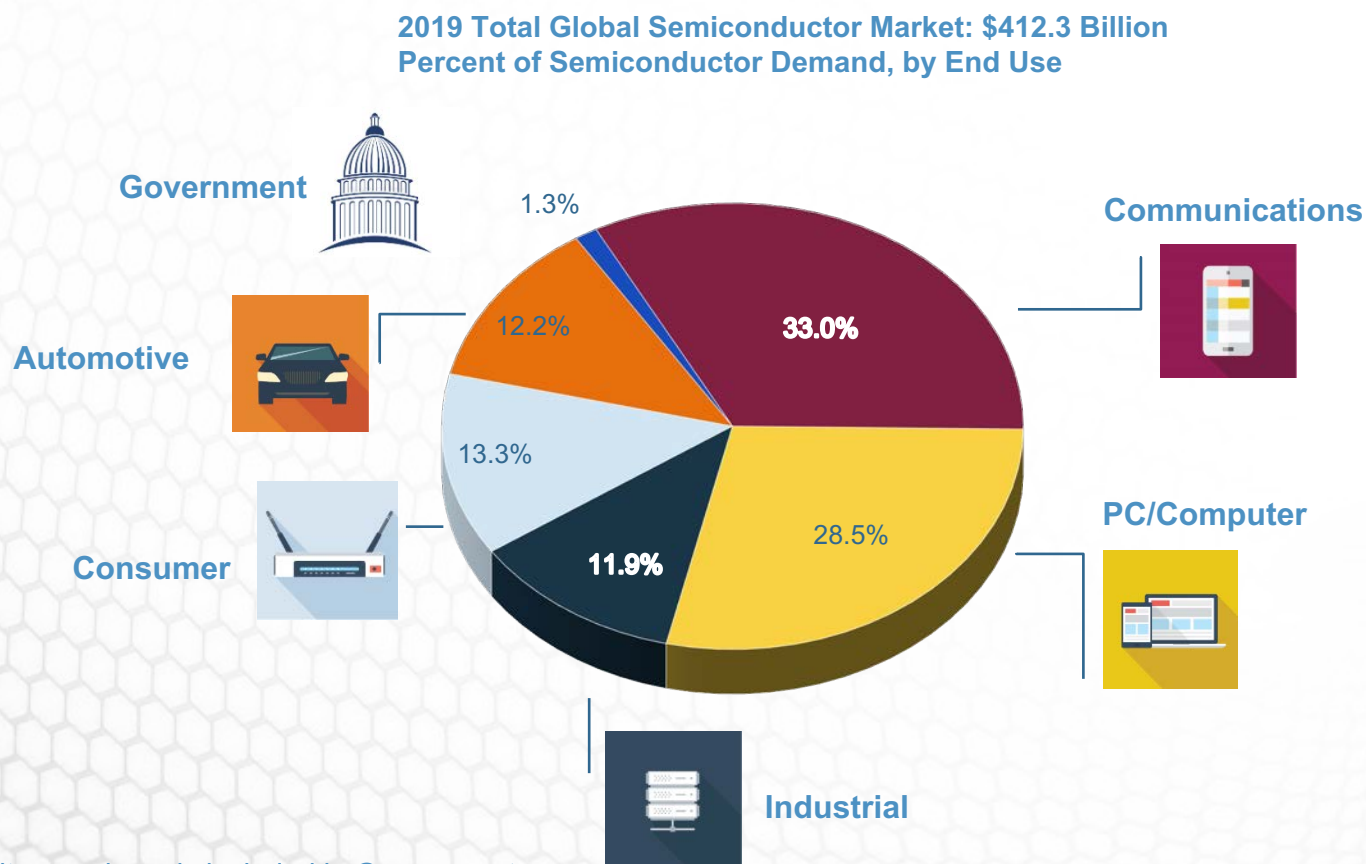
## **GLOBAL MARKET**

Diversified and Consumer-driven

# SECTION 2: GLOBAL MARKET

## GLOBAL SEMICONDUCTOR SALES ARE DRIVEN BY PRODUCTS ULTIMATELY PURCHASED BY CONSUMERS

The vast majority of semiconductor demand is driven by products ultimately purchased by consumers – be they laptops or communication devices such as smartphones. Increasingly, consumer demand is driven in emerging markets including those in Asia, Latin America, Eastern Europe and Africa.

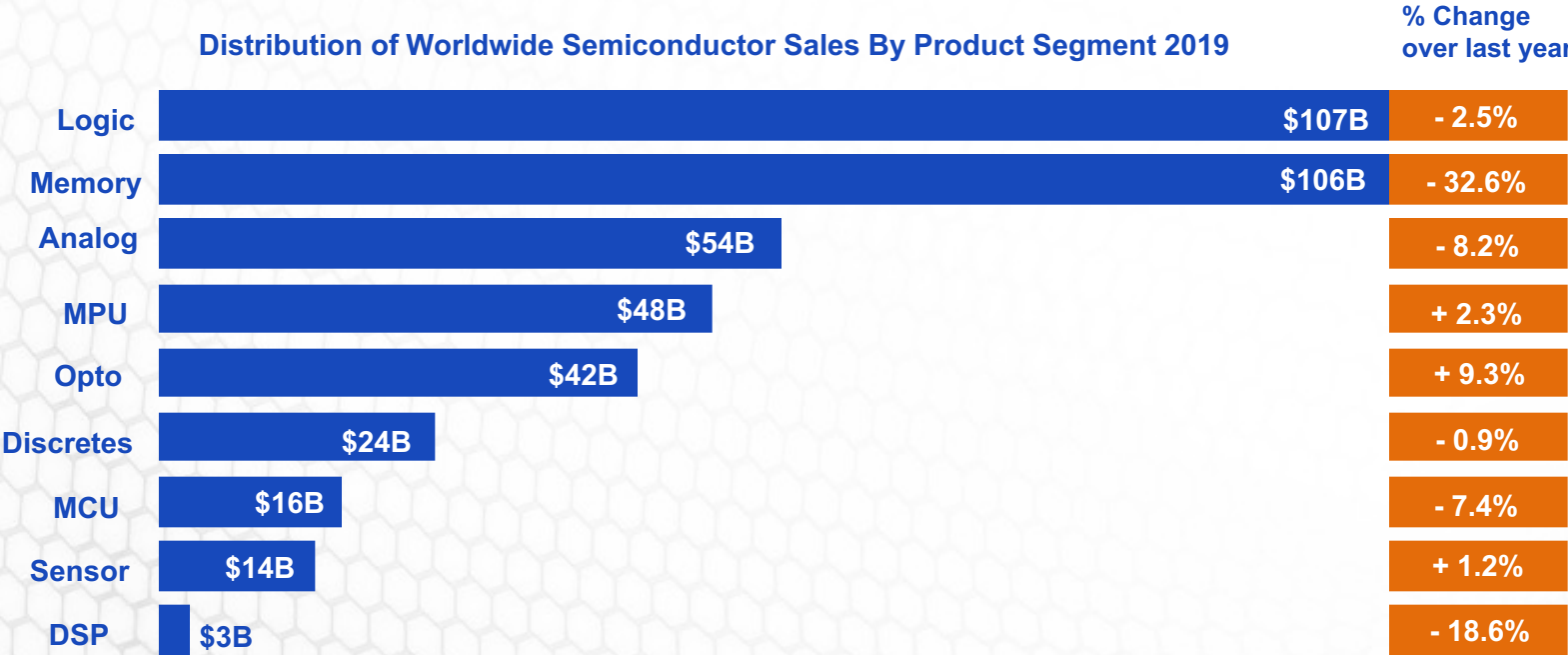


Note: Military end-use is included in Government.  
Sources: World Semiconductor Trade Statistics (WSTS).

# SECTION 2: GLOBAL MARKET

## GLOBAL SEMICONDUCTOR SALES ARE DIVERSIFIED BY TYPE OF PRODUCT SOLD

Semiconductor technology has rapidly evolved as the industry develops more advanced product and process technologies for applications in end-use industries. In recent years, the largest segments of the worldwide semiconductor industry have been logic, memory, analog, and MPU. In 2019, these products accounted for 76 percent of semiconductor industry sales.

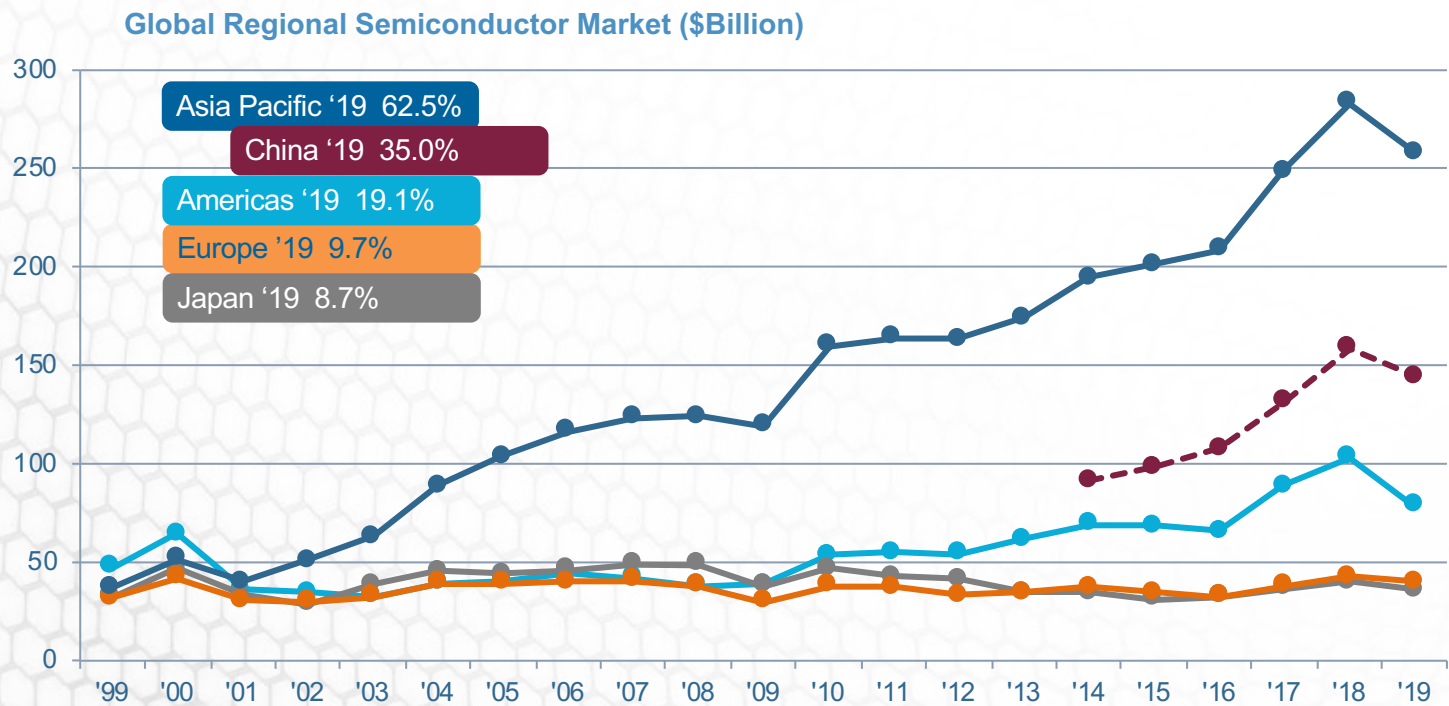


Source: World Semiconductor Trade Statistics (WSTS) and SIA Estimates.

# SECTION 2: GLOBAL MARKET

## ASIA PACIFIC IS THE LARGEST REGIONAL SEMICONDUCTOR MARKET, AND CHINA IS THE LARGEST SINGLE COUNTRY MARKET

In 2001, the Asia Pacific market surpassed all other regional markets in sales, as electronic equipment production shifted to the region. It has multiplied in size since then - from \$39.8 billion to over \$258 billion in 2019. By far, the largest country market within the Asia Pacific region is China, which accounted for 56 percent of the Asia Pacific market and 35 percent of the total global market. This data reflects sales of semiconductors to electronic equipment makers only – final electronic products containing semiconductors are then shipped for consumption around the world.



Note: in this table, the China market data from 2014-2019 represents a subset of the overall Asia Pacific Market

Source: World Semiconductor Trade Statistics (WSTS) and SIA Estimates.





## Section 3

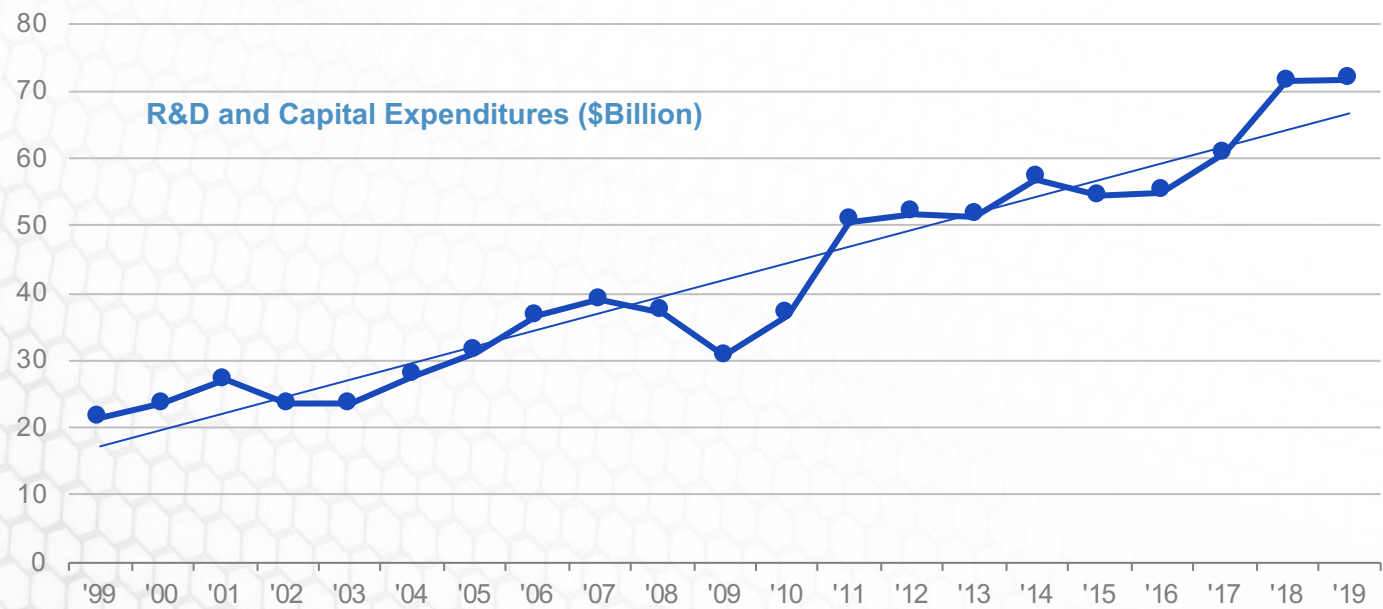
# Capital and R&D Investment

A Driving Force in Maintaining a Competitive U.S.  
Semiconductor Industry

# SECTION 3: CAPITAL AND R&D INVESTMENT

## TOTAL ANNUAL LEVELS OF INVESTMENT IN CAPITAL AND R&D ARE HIGH FOR THE INDUSTRY

Total R&D and capital expenditures by U.S. semiconductor firms including fabless companies was \$71.7 billion in 2019. From 1999 to 2019, the compound annual growth rate was approximately 6.2 percent. Investment levels in share of sales terms have generally not been subject to fluctuations associated with market cyclicality.

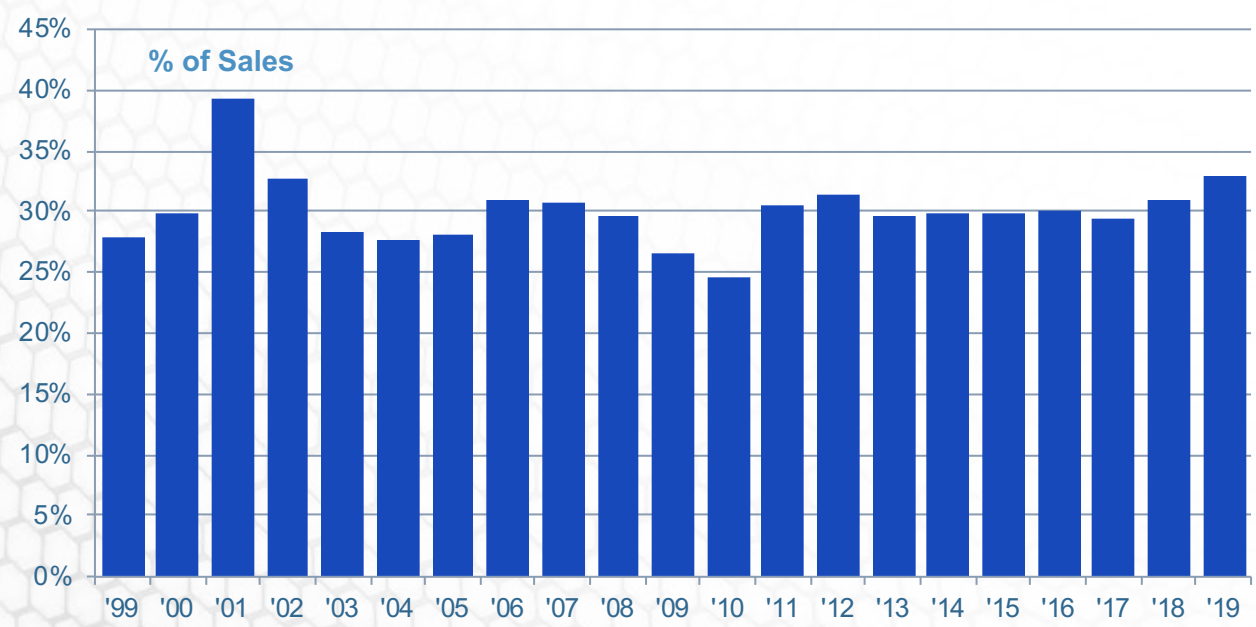


Source: U.S. Semiconductor Companies' 10K and 10Q Filings to the USSEC and SIA Estimates.

# SECTION 3: CAPITAL AND R&D INVESTMENT

## CAPITAL AND R&D INVESTMENT ARE CRITICAL TO MAINTAINING A COMPETITIVE U.S. SEMICONDUCTOR INDUSTRY

To remain competitive in the semiconductor industry, firms must continually invest a significant share of revenues in both R&D and new plant and equipment. The pace of technological changes in the industry requires that companies develop more complex designs and process technology and introduce production machinery capable of manufacturing components with smaller feature sizes. The ability to design and produce state-of-the-art semiconductor components can only be maintained through a continual commitment to keeping pace with industry-wide investment rates of roughly 30 percent of sales. The need to stay at the leading edge of technology has resulted in some extreme fluctuations in years such as 2001, when sales declined precipitously but expenditures on R&D and capital equipment did not decline at the same rate.



Source: U.S. Semiconductor Companies' 10K and 10Q Filings to the USSEC and SIA Estimates.

# SECTION 3: CAPITAL AND R&D INVESTMENT

INVESTMENT IN CAPITAL EXPENDITURES AND R&D PER EMPLOYEE IS VERY HIGH FOR THE U.S. INDUSTRY, REACHING OVER \$178,000 IN 2019

From 1999 to 2019, total investment per employee (measured by combined R&D and new gross plant and equipment) has increased at a rate of about 4.3 percent per year. These expenditures exceeded \$100,000 in 2001 but declined to roughly \$85,000 in 2003 after the 2001 downturn. Investment per employee increased to over \$100,000 in 2006. The 2008-2009 recession resulted in the decline of investment per employee in 2009 and 2010 but returned in 2012 and grew to over \$178,000 in 2019.



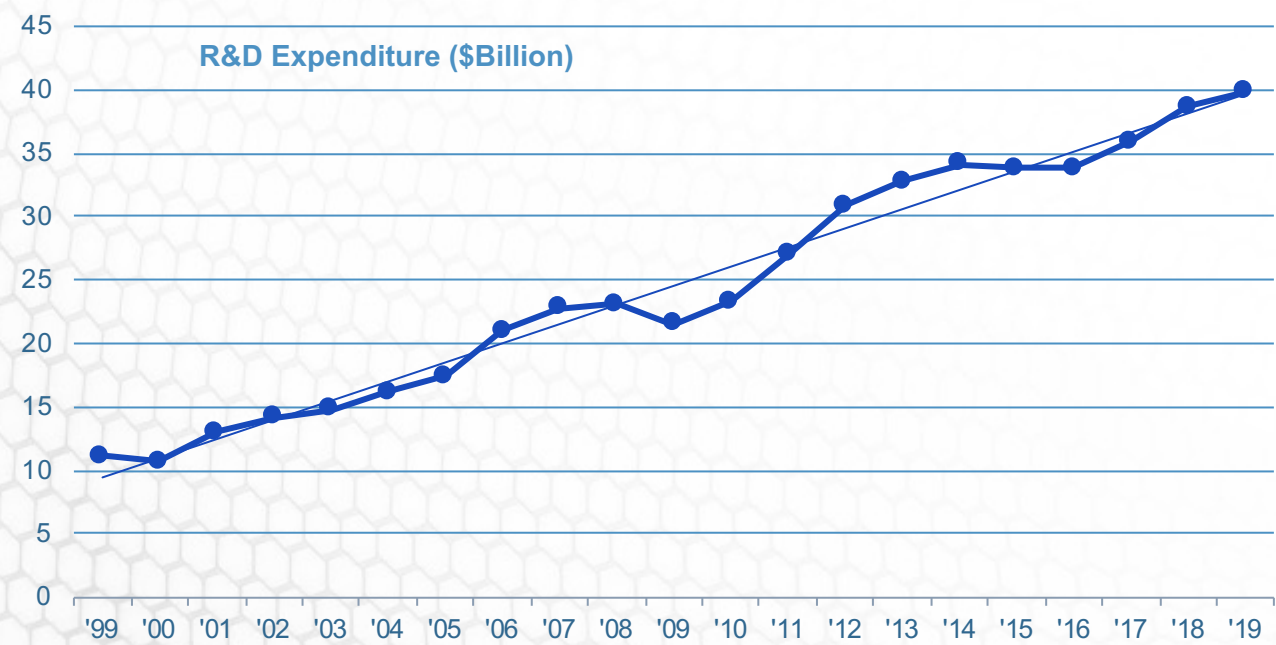
Note: Employees reflect total U.S. industry global employment.  
Source: U.S. Semiconductor Companies' 10K and 10Q Filings to the USSEC and SIA Estimates.



# SECTION 3: CAPITAL AND R&D INVESTMENT

## U.S. SEMICONDUCTOR INDUSTRY R&D EXPENDITURES ARE CONSISTENTLY HIGH, REFLECTING THE INHERENT IMPORTANCE OF R&D TO SEMICONDUCTOR PRODUCTION

U.S. semiconductor industry R&D expenditures grew at a compound annual growth rate of approximately 6.6 percent from 1999 to 2019. R&D expenditures by U.S. semiconductor firms tend to be consistently high, regardless of cycles in annual sales, which reflects the importance of investing in R&D to semiconductor production. In 2019, total U.S. semiconductor industry investment in R&D totaled \$39.8 billion.

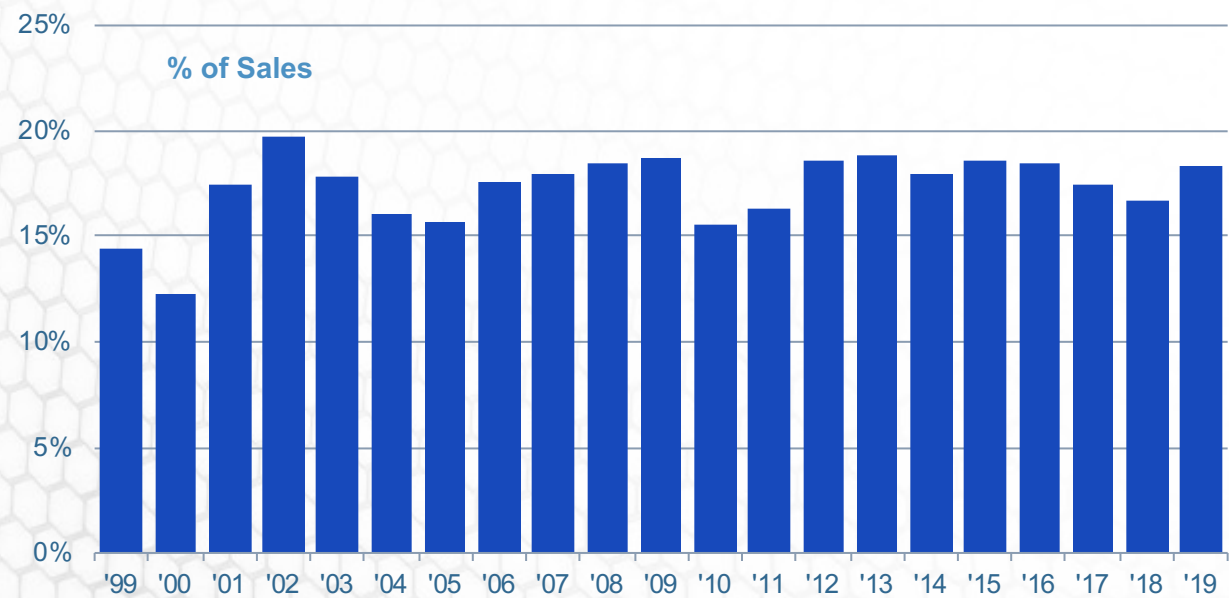


Source: U.S. Semiconductor Companies' 10K and 10Q Filings to the USSEC and SIA Estimates.

# SECTION 3: CAPITAL AND R&D INVESTMENT

ANNUAL R&D EXPENDITURES AS A PERCENT OF SALES HAVE EXCEEDED 10 PERCENT OVER THE PAST 20 YEARS, AMONG THE HIGHEST RATES FOR ANY U.S. INDUSTRY

Annual R&D expenditures as a percent of sales have exceeded 10 percent over the past 20 years. This rate is unprecedented among major manufacturing sectors of the United States economy. R&D expenditures are essential to the competitive position of semiconductor firms. The rapid pace of technological change requires constant advancements in process technology and device capabilities. The increase in R&D in 2001 and 2002 was caused by companies' commitment to the future of technology despite an industry downturn. The 2003-2004 decrease was not due to cuts in R&D budgets but rather to a stronger than expected industry recovery which increased revenues faster than expected. The increased share in 2019 was based on overall revenues decreasing while overall R&D expenditures increased.

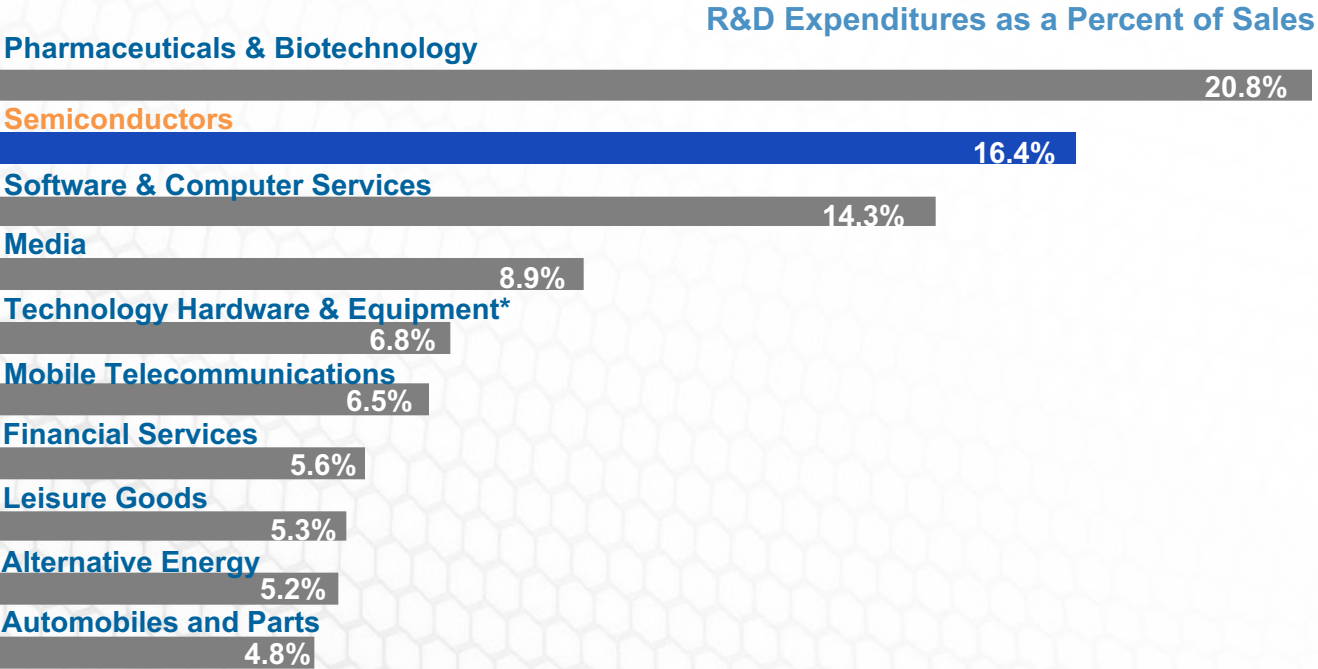


Source: U.S. Semiconductor Companies' 10K and 10Q Filings to the USSEC and SIA Estimates.

# SECTION 3: CAPITAL AND R&D INVESTMENT

## THE U.S. SEMICONDUCTOR INDUSTRY IS A LEADER IN R&D SPENDING AS A PERCENT OF SALES AMONG MAJOR U.S. INDUSTRIES

The rate of U.S. semiconductor industry R&D spending is among the highest in key major high technology industrial sectors. Based on the 2019 EU Industrial R&D Investment Scoreboard, the U.S. semiconductor industry was second only to the U.S. pharmaceuticals & biotechnology industry in terms of the rate of R&D spending as a percent of sales.



Note: \*Excluding semiconductors.

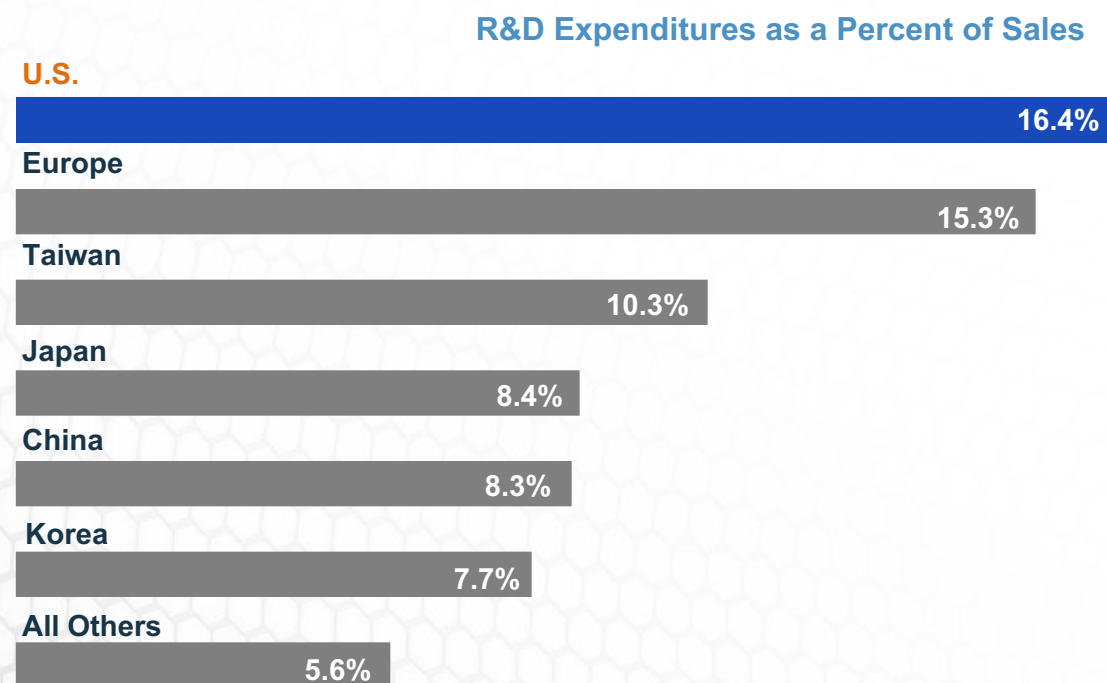
Note: Slight differences in semiconductor industry share from page 18 table due to differences in methodology and source data.

Source: The 2019 EU Industrial R&D Investment Scoreboard.

# SECTION 3: CAPITAL AND R&D INVESTMENT

THE U.S. SEMICONDUCTOR INDUSTRY SPENDS MORE ON R&D AS A PERCENT OF SALES THAN ANY OTHER COUNTRY'S SEMICONDUCTOR INDUSTRY

U.S. semiconductor industry R&D spending as a percent of sales is unsurpassed by any other country's semiconductor industry.



Note: Slight differences in semiconductor industry share from page 18 table due to differences in methodology and source data.

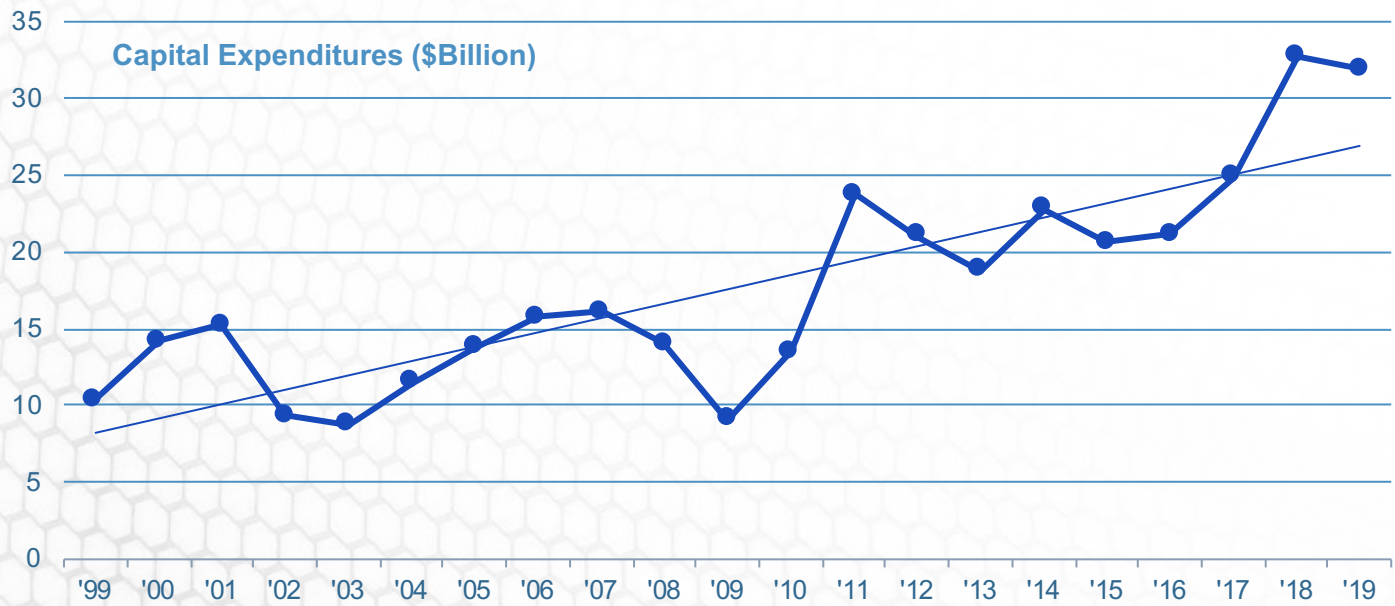
Source: The 2019 EU Industrial R&D Investment Scoreboard.



# SECTION 3: CAPITAL AND R&D INVESTMENT

THE U.S. SEMICONDUCTOR INDUSTRY IS HIGHLY CAPITAL INTENSIVE, AND ANNUAL INDUSTRY SPENDING ON CAPITAL EQUIPMENT TENDS TO BE HIGH AS A SHARE OF SALES

Semiconductor industry gross capital expenditures was \$31.9 billion in 2019. Capital expenditures declined from 2001-2003 due to the completion of major new facilities during 1999-2001 and increased use of foundries. 2004 saw a rebound and in 2005 the industry was in a balanced position in terms of capital expenditures as a percentage of sales. In 2011, after a sharp decline in 2009 due to the global economic recession, capital expenditures rebounded to reach \$23.8 billion. In 2018, capital expenditures reached an all-time high of \$32.7 billion.

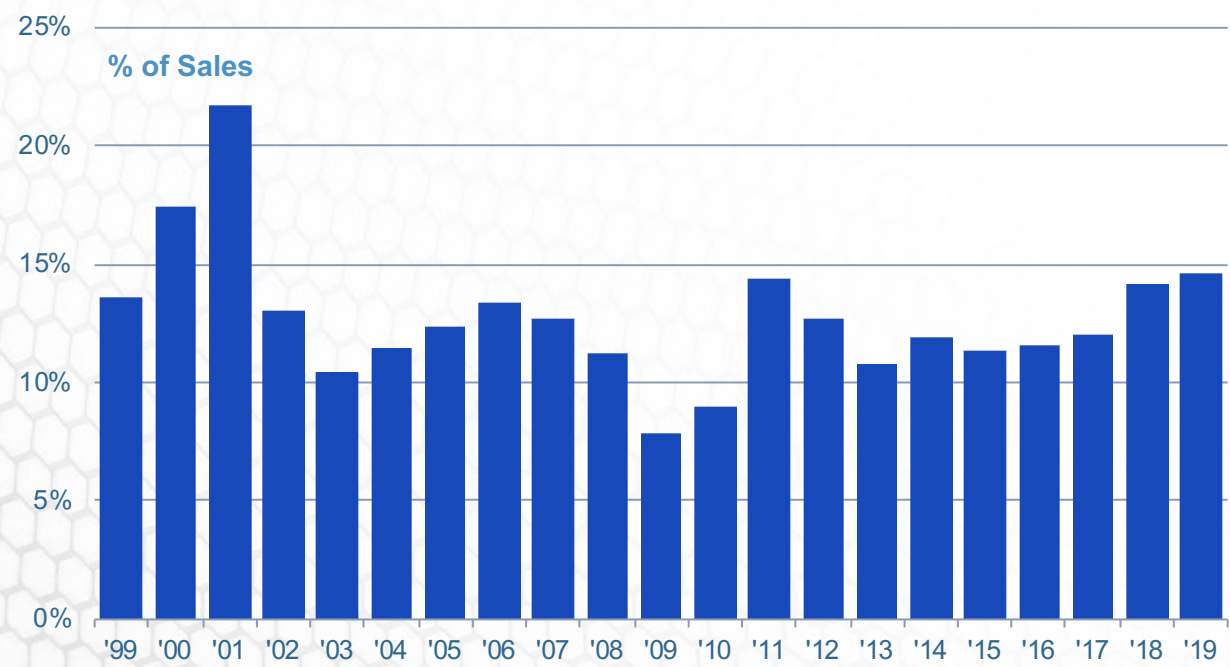


Source: U.S. Semiconductor Companies' 10K and 10Q Filings to the USSEC and SIA Estimates.

# SECTION 3: CAPITAL AND R&D INVESTMENT

ANNUAL CAPITAL EXPENDITURES AS A PERCENT OF SALES HAVE AVERAGED BETWEEN 10 AND 15 PERCENT OVER THE PAST 20 YEARS, AMONG THE HIGHEST RATES FOR ANY U.S. INDUSTRY

Annual capital expenditure as a percent of sales have exceeded 10 percent in all but 2 of the past 20 years. This rate is extremely high among major manufacturing sectors of the United States economy. For semiconductor manufacturers, capital spending is essential to their competitive position. The rapid pace of industry innovation requires huge outlays in capital spending to continue to produce more advanced devices.

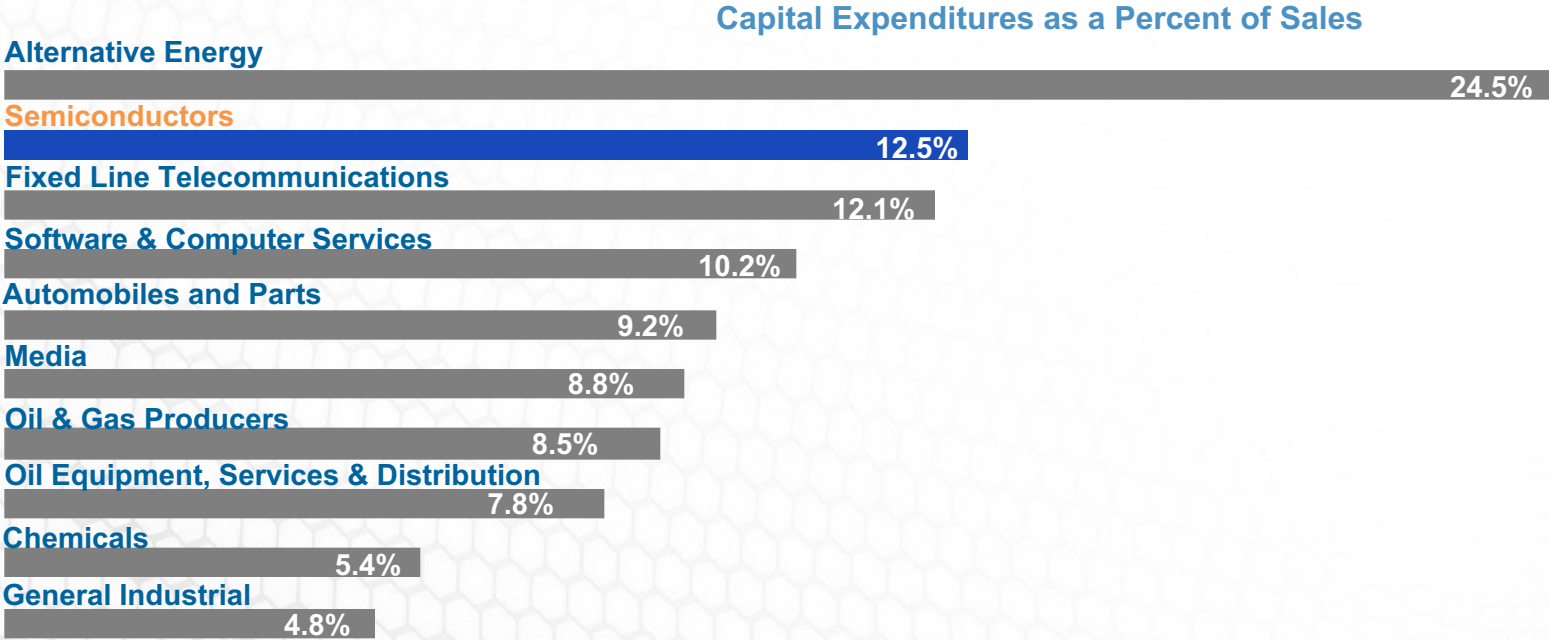


Source: U.S. Semiconductor Companies' 10K and 10Q Filings to the USSEC and SIA Estimates.

# SECTION 3: CAPITAL AND R&D INVESTMENT

## THE U.S. SEMICONDUCTOR INDUSTRY IS A LEADER IN CAPITAL SPENDING AS A PERCENT OF SALES AMONG MAJOR U.S. INDUSTRIES

The rate of U.S. semiconductor industry capital spending is among the highest in key major high technology industrial sectors. Based on the 2019 EU Industrial R&D Investment Scoreboard, the U.S. semiconductor industry was second only to the U.S. alternative energy industry in terms of the rate of capital spending as a percent of sales.



Note: \*Excluding semiconductors.

Note: Slight differences in semiconductor industry share from page 22 table due to differences in methodology and source data.

Source: The 2019 EU Industrial R&D Investment Scoreboard.



## Section 4

# U.S. JOBS



## Section 4: U.S. JOBS

THE U.S. SEMICONDUCTOR INDUSTRY ACCOUNTS FOR ROUGHLY A QUARTER OF A MILLION  
DIRECT U.S. JOBS AND OVER A MILLION ADDITIONAL INDIRECT U.S. JOBS

**241,134**

direct jobs in the U.S. semiconductor industry

**ONE**



U.S. semiconductor job supports

**4.89**



jobs in other parts of the U.S. economy...

...that's more than **1 MILLION ADDITIONAL** American Jobs.





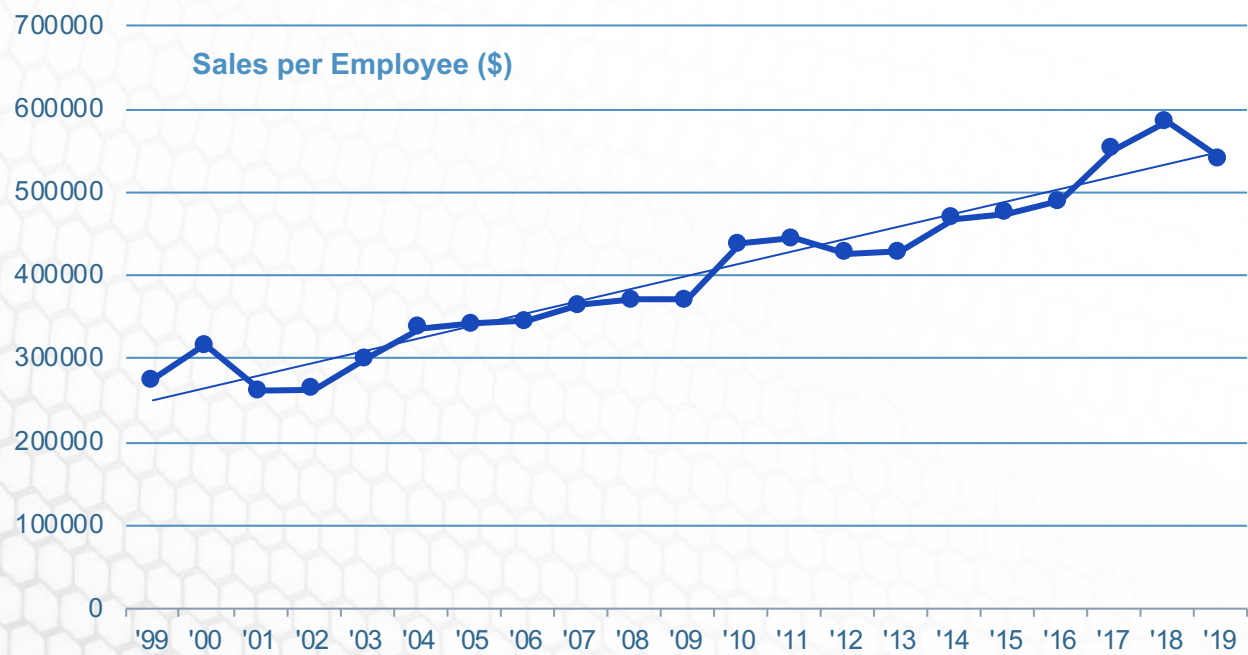
# Section 5

## U.S. PRODUCTIVITY

# Section 5: U.S. PRODUCTIVITY

## U.S.-BASED SEMICONDUCTOR FIRMS HAVE EXPERIENCED RAPID IMPROVEMENTS IN PRODUCTIVITY OVER THE PAST 20 YEARS

U.S. semiconductor industry labor productivity has more than doubled since 1999. These productivity gains have been made possible by maintaining high capital investment levels and R&D spending rates. In 2019, the U.S. semiconductor industry recorded an average sales revenue per employee ratio of over \$539,000.



Note: Employees reflect total U.S. industry global employment.  
Source: U.S. Semiconductor Companies' 10K and 10Q Filings to the USSEC and SIA Estimates.

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