



SEMICONDUCTOR  
INDUSTRY  
ASSOCIATION

2020 2021 2022 2023 2024

FACTBOOK

# SEMICONDUCTOR INDUSTRY ASSOCIATION

## FACTBOOK

### Introduction

The data included in the 2022 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, national security, 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 were invented in America, and U.S. companies still lead the global market, accounting for nearly half the world's chip sales.

Still, the U.S.-based industry faces significant challenges. The share of modern semiconductor manufacturing capacity located in the U.S. has eroded from 37% in 1990 to 12% today, mostly because other countries' governments have invested ambitiously in chip manufacturing incentives and the U.S. government has not. Meanwhile, federal investments in chip research have held flat as a share of GDP, while other countries have significantly ramped up research investments. And while America is still the global leader in semiconductor design—the complex mapping of a chip's tiny and intricate circuitry—its lead is slipping and not assured.

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

#### **1. Invest in U.S. Semiconductor Leadership:**

- Fund the domestic semiconductor manufacturing, research, and design provisions in the CHIPS for America Act.
- Enact an investment tax credit encompassing both manufacturing and

design to spur the construction of new onshore advanced semiconductor research, design, and manufacturing facilities and to promote domestic chip innovation.

#### **2. Strengthen America's Technology Workforce:**

- Implement a national strategy – backed by appropriate investments and in consultation with education leaders and the private sector – to improve our education system and increase the number of Americans graduating in STEM fields.
- Reform America's high-skilled immigration system to enable access to, and retention of, the best and brightest in the world.

#### **3. Promote Free Trade and Protect IP:**

- Approve and modernize free trade agreements that remove market barriers, protect IP, and enable fair competition.
- Expand the Information Technology Agreement, one of the World Trade Organization's most successful free trade agreements.

#### **4. Cooperate Closely with Like-Minded Economies:**

- Recognizing the global nature of the semiconductor industry, expand collaboration with like-minded allies on shaping a regulatory and legal environment more conducive to growth, innovation, and supply chain resilience in such areas as regulatory coherence, standards, and export controls.

By implementing these policies, Congress and the Administration can take key steps to protect American leadership in semiconductor technology and win the global competition for the technologies of the future.

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# Section 1

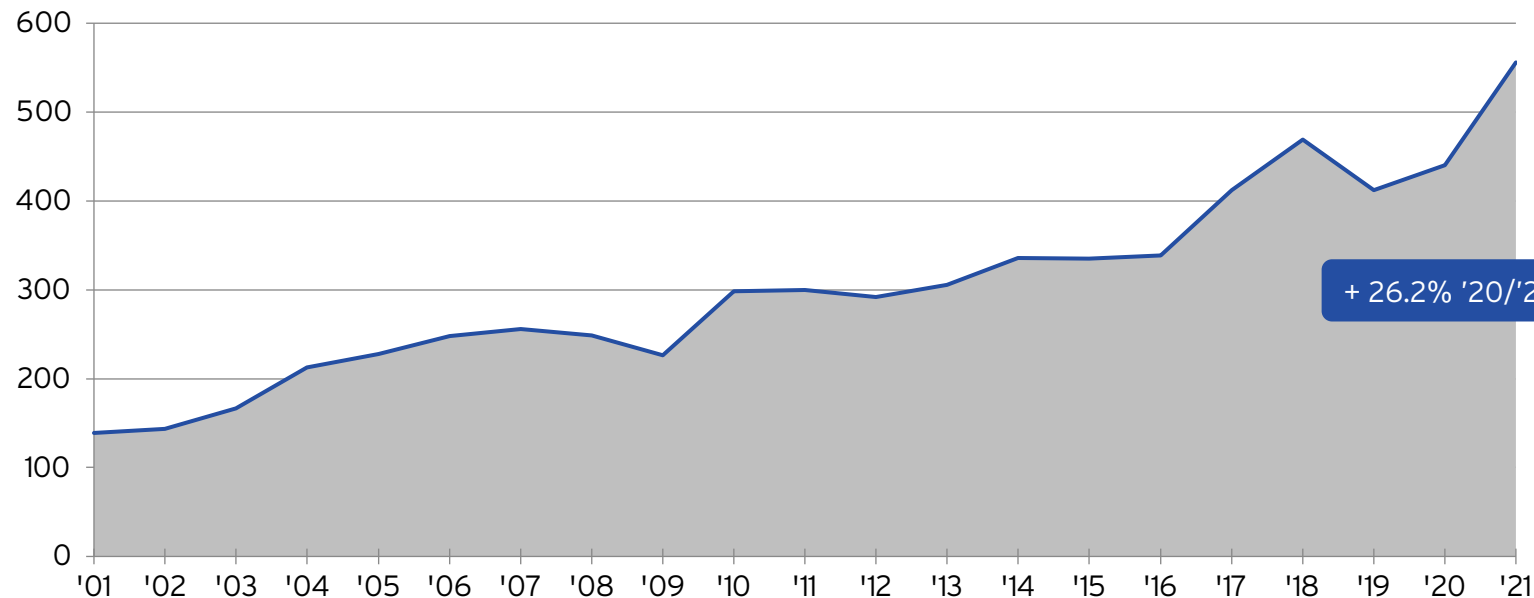
## INDUSTRY OVERVIEW

# SECTION 1: INDUSTRY OVERVIEW

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

Worldwide semiconductor sales increased from \$139.0 billion in 2001 to \$555.9 billion in 2021, a compound annual growth rate of 7.18 percent per year. According to the World Semiconductor Trade Statistics (WSTS) Fall 2021 Semiconductor Industry Forecast, worldwide semiconductor industry sales are forecasted to reach \$601 billion in 2022 and 633 billion in 2023.\*

\*WSTS, Fall 2021 Semiconductor Industry Forecast



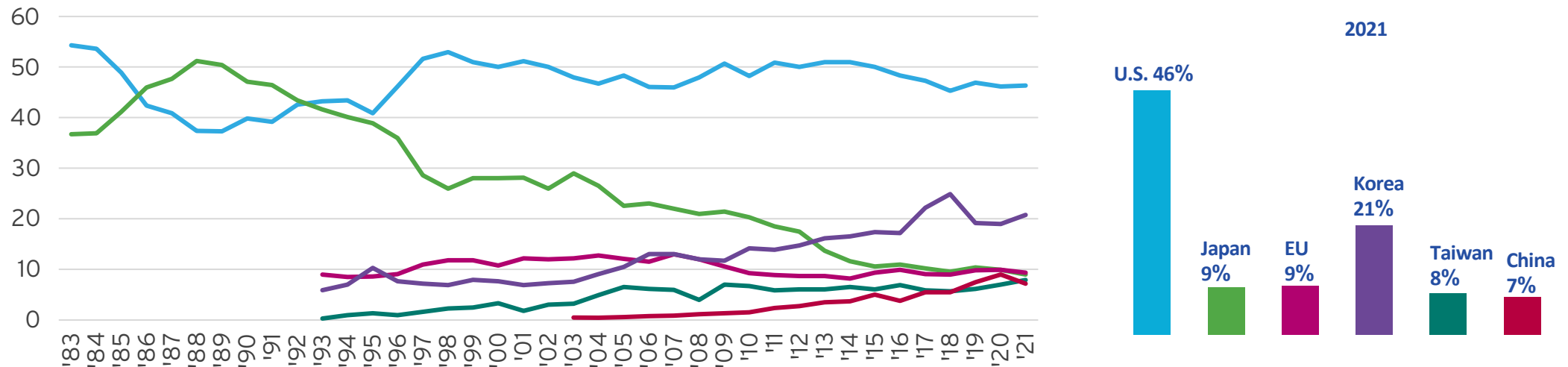
Source: World Semiconductor Trade Statistics (WSTS) and SIA Estimates.

# 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, 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", as well as a severe industry recession in 1985 to 1986, the U.S. industry lost a total of nineteen worldwide market share points, and it 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 having 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 46 percent. Other countries' industries have between 7 and 20 percent global market share.

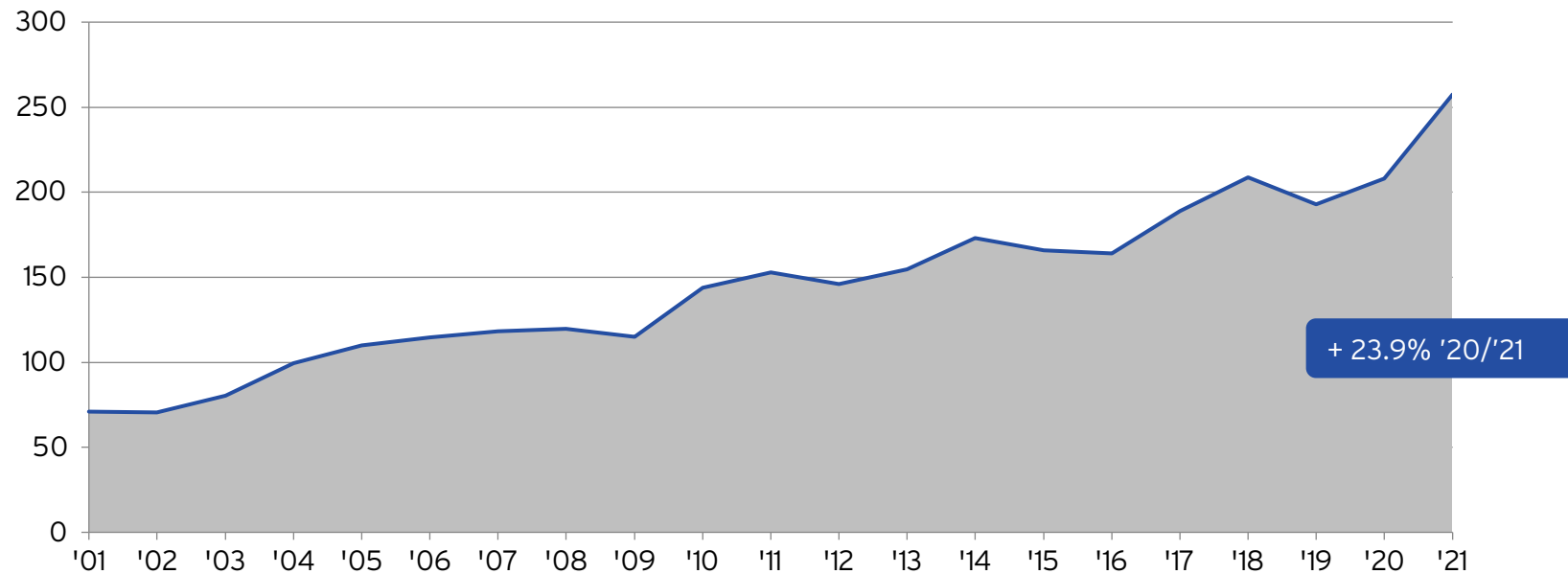


Source: World Semiconductor Trade Statistics (WSTS), Omdia, and SIA Estimates.

# SECTION 1: INDUSTRY OVERVIEW

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

Sales by U.S. headquartered semiconductor firms grew from \$71.1 billion in 2001 to \$257.5 billion in 2021 -- a compound annual growth rate of 6.65 percent. Sales growth for U.S. headquartered companies shows the same cyclical fluctuations characterized by the industry as a whole.

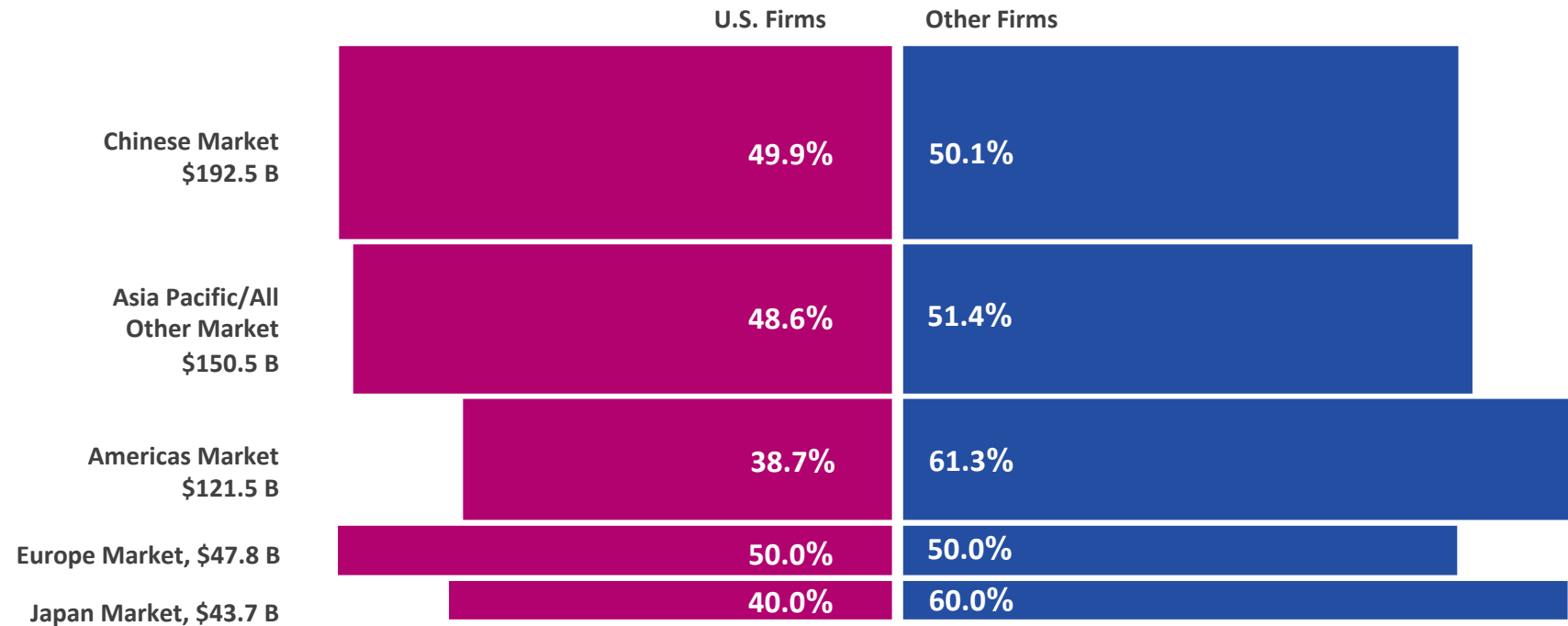


Source: World Semiconductor Trade Statistics (WSTS) and SIA Estimates.

# SECTION 1: INDUSTRY OVERVIEW

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

In 2021, semiconductor firms based in the U.S. held 46.3 percent of the total semiconductor market share, the most of any country's semiconductor industry. In all major country and regional semiconductor markets, U.S. headquartered companies also held sales market share leadership.



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

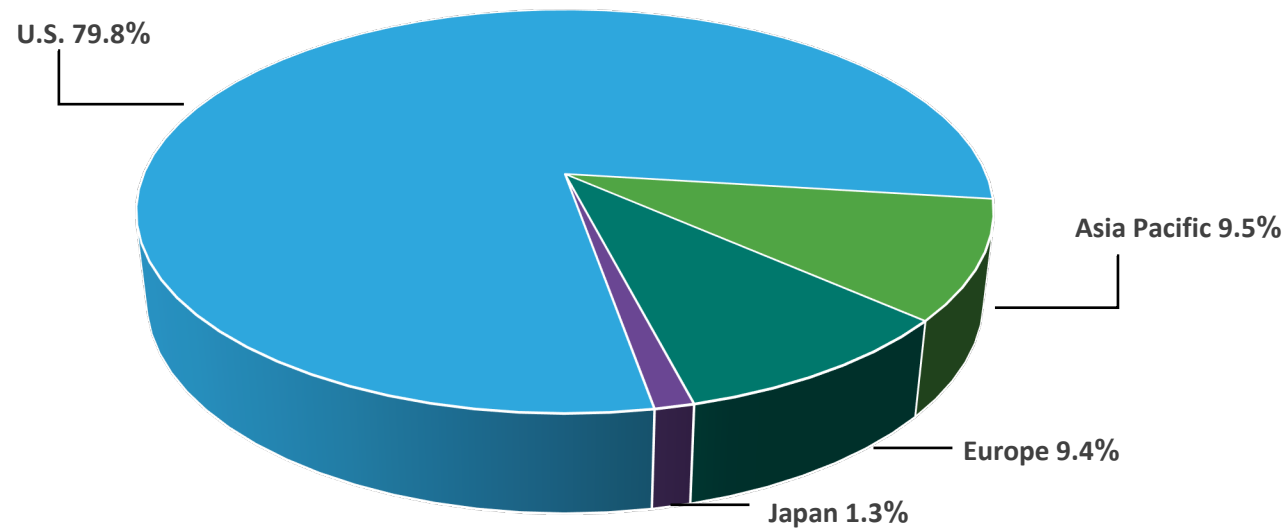


# SECTION 1: INDUSTRY OVERVIEW

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

In 2021, roughly 80 percent of all semiconductor wafer fabrication capacity in the U.S. 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 U.S. at 10 percent.

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

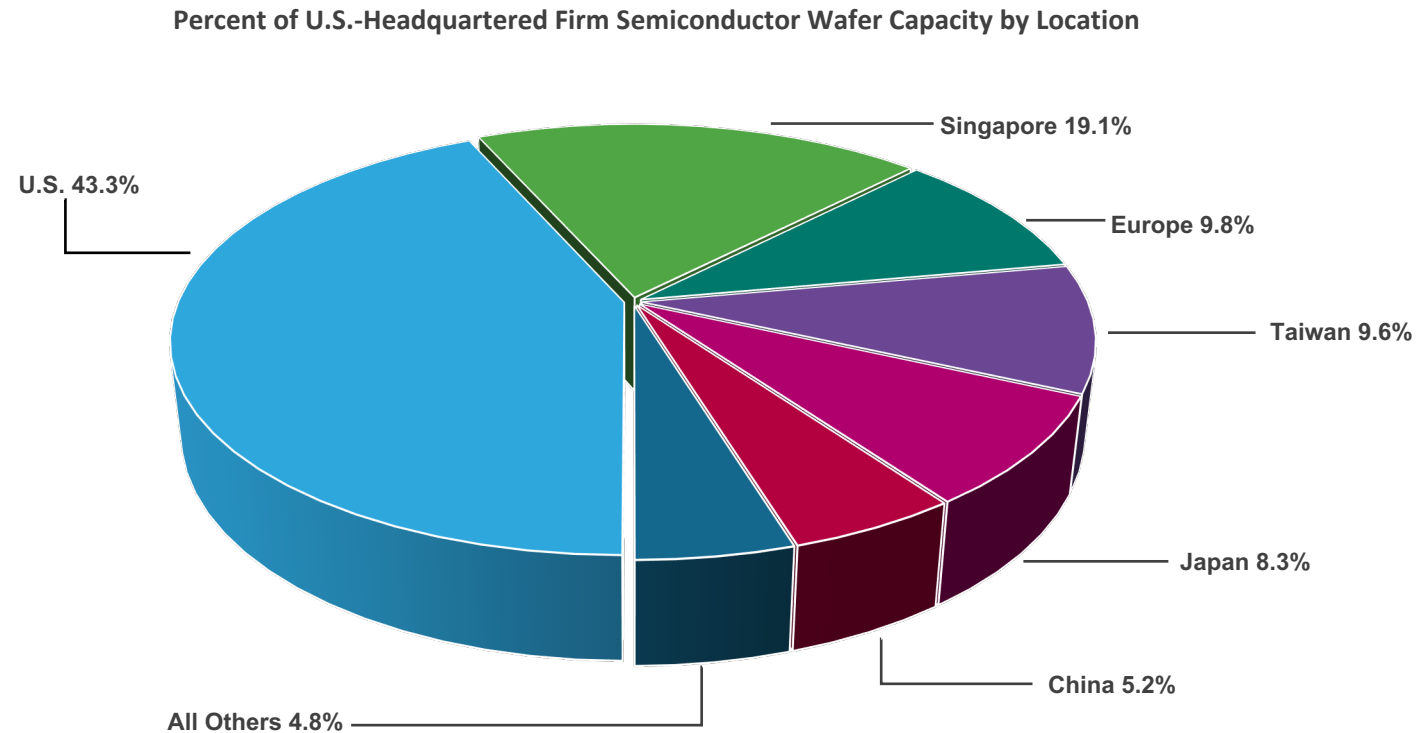


Source: IC Insights Global Fab Database and SIA Estimates.

# SECTION 1: INDUSTRY OVERVIEW

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

In 2021, about 43 percent of U.S.-headquartered firms' front-end semiconductor wafer capacity was located in the U.S. Other leading locations for U.S. headquartered front-end semiconductor wafer fab capacity were Singapore, Europe, Taiwan, and Japan.

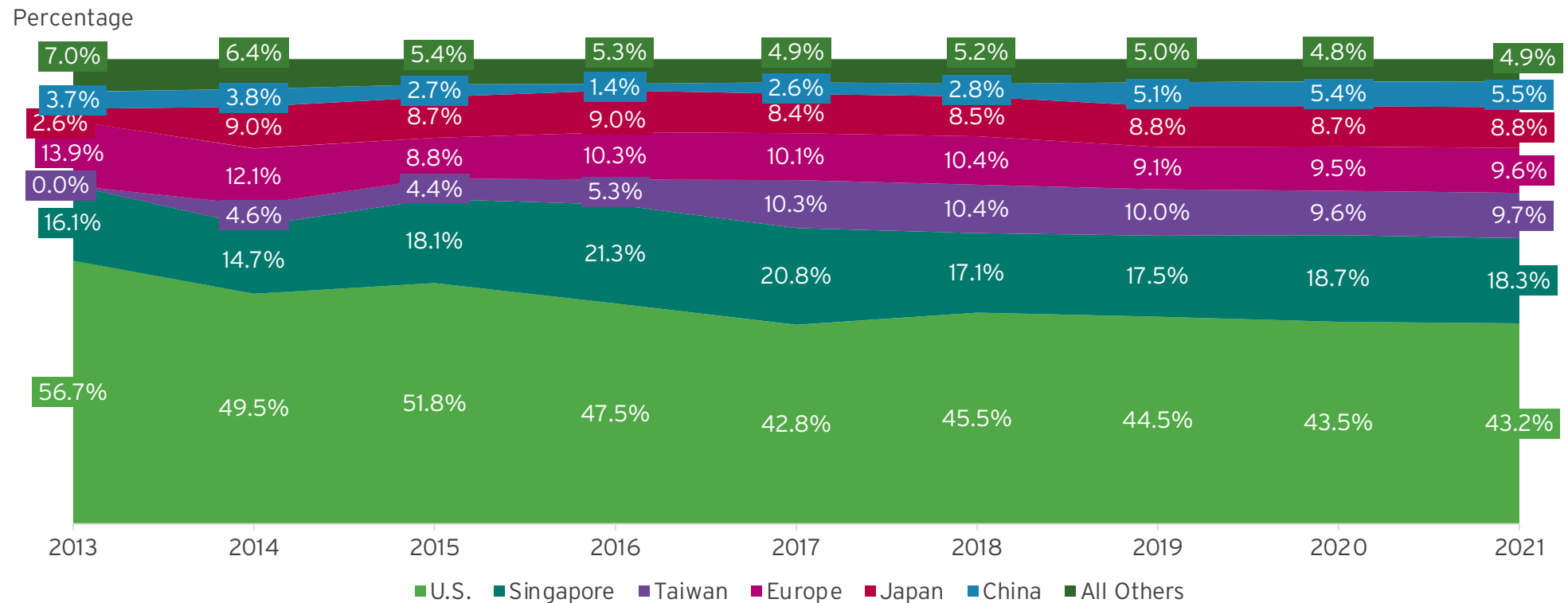


Source: IC Insights Global Fab Database and SIA Estimates.

# SECTION 1: INDUSTRY OVERVIEW

## U.S. SEMICONDUCTOR MANUFACTURING CAPACITY IN THE U.S. REPRESENTS A SHRINKING SHARE

Due to the ambitious chip manufacturing incentives offered by other countries' governments and ongoing consolidation in the industry, the share of U.S. semiconductor manufacturing capacity in the U.S. fell by more than 10 percent over the past 8 years.



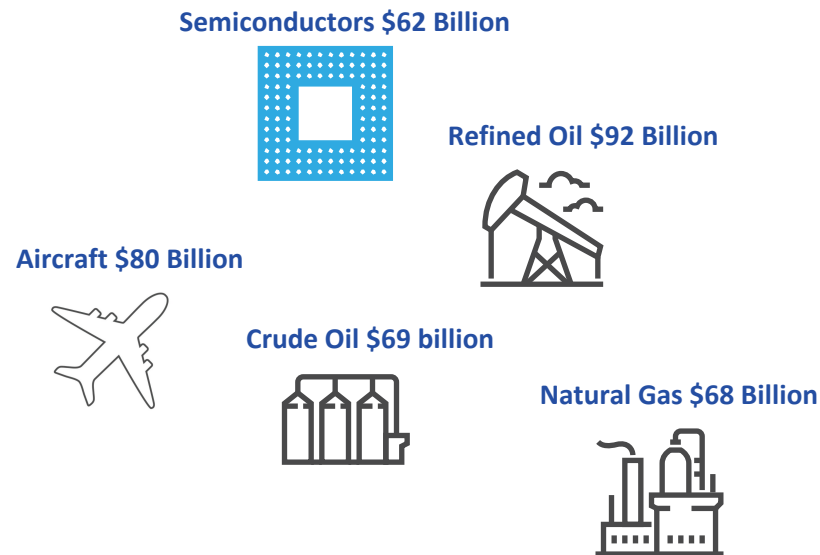
Source: IC Insights Global Fab Database and SIA Estimates.

# SECTION 1: INDUSTRY OVERVIEW

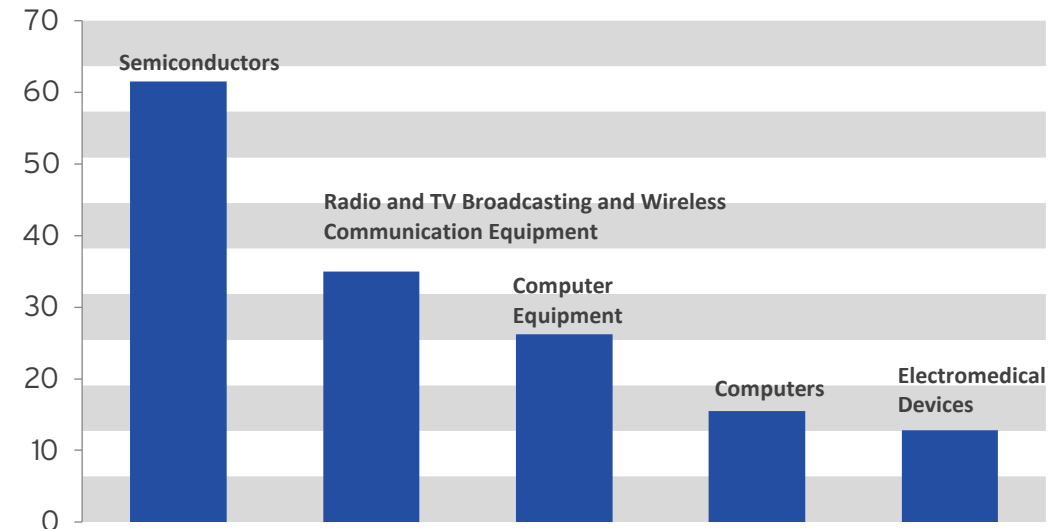
## SEMICONDUCTORS ARE ONE OF AMERICA'S TOP EXPORTS

U.S. exports of semiconductors were worth \$62 billion in 2021, fifth-highest among U.S. exports, behind only refined oil, airplanes, crude oil, and natural gas. Semiconductors constituted the largest share of U.S. exports of all electronic product exports.

Top 5 U.S. Exports in 2021 (\$ Bn)



#1 U.S. Electronic Product Export in 2021 (\$ Bn)



Source: U.S. International Trade Commission. Industry defined by NAICS codes: 334413 (Semiconductors); 33641X (Aircraft); 324110 (Refined Oil); 211130 (Natural Gas); 211120 (Crude Oil)

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).



## Section 2

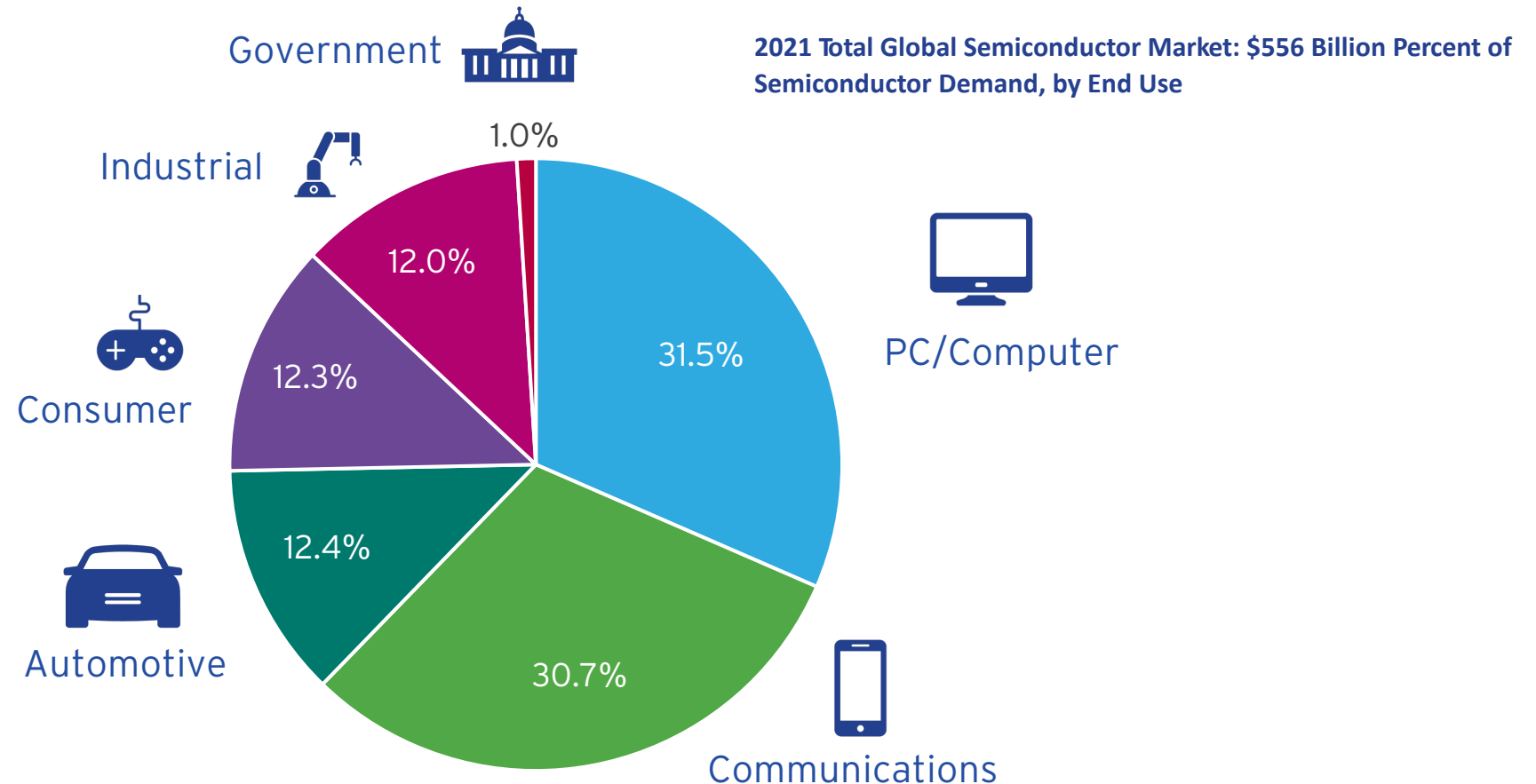
# GLOBAL MARKET

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, such as laptops or smartphones. Increasingly, consumer demand is driven in emerging markets including those in Asia, Latin America, Eastern Europe, and Africa.

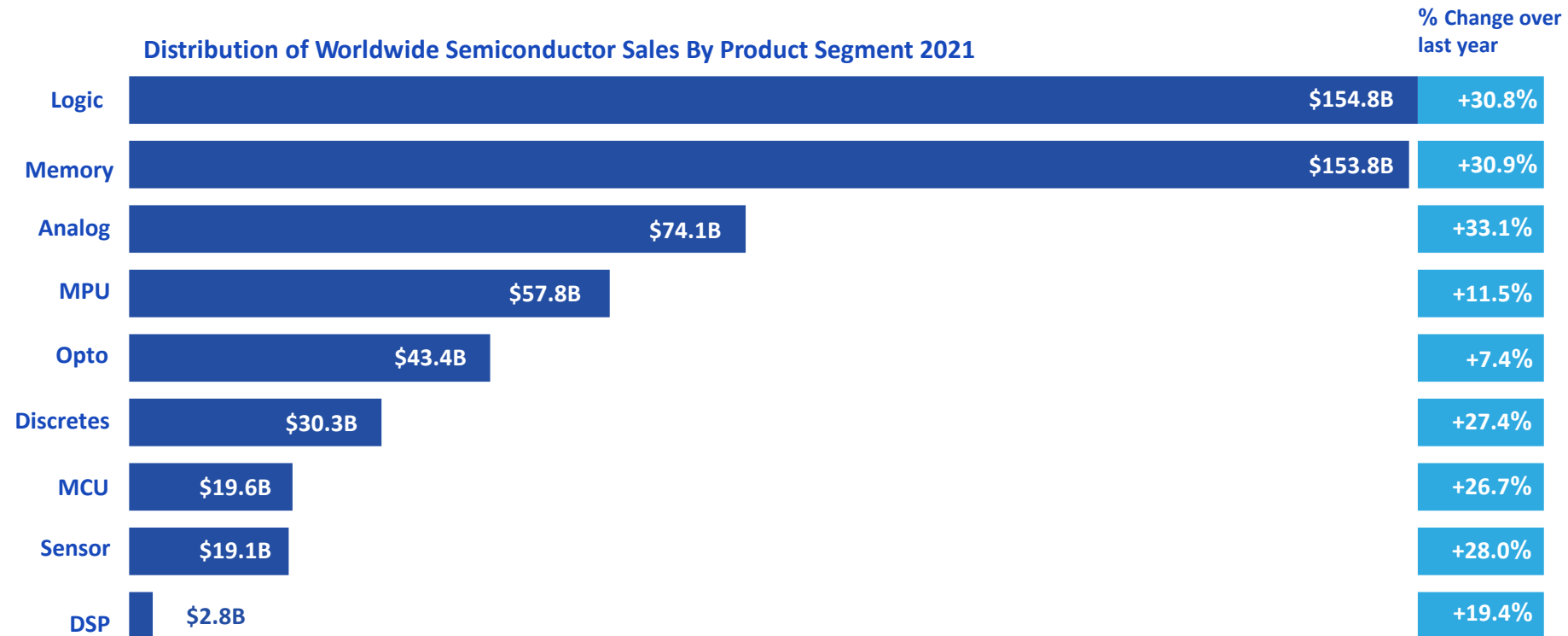


Note: Military end-use is included in Government.  
Sources: World Semiconductor Trade Statistics (WSTS).

# 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 products and process technologies for applications in end-use industries. In recent years, the largest segments of the worldwide semiconductor industry have been memory, logic, analog, and MPU. In 2021, these products accounted for 79 percent of semiconductor industry sales.

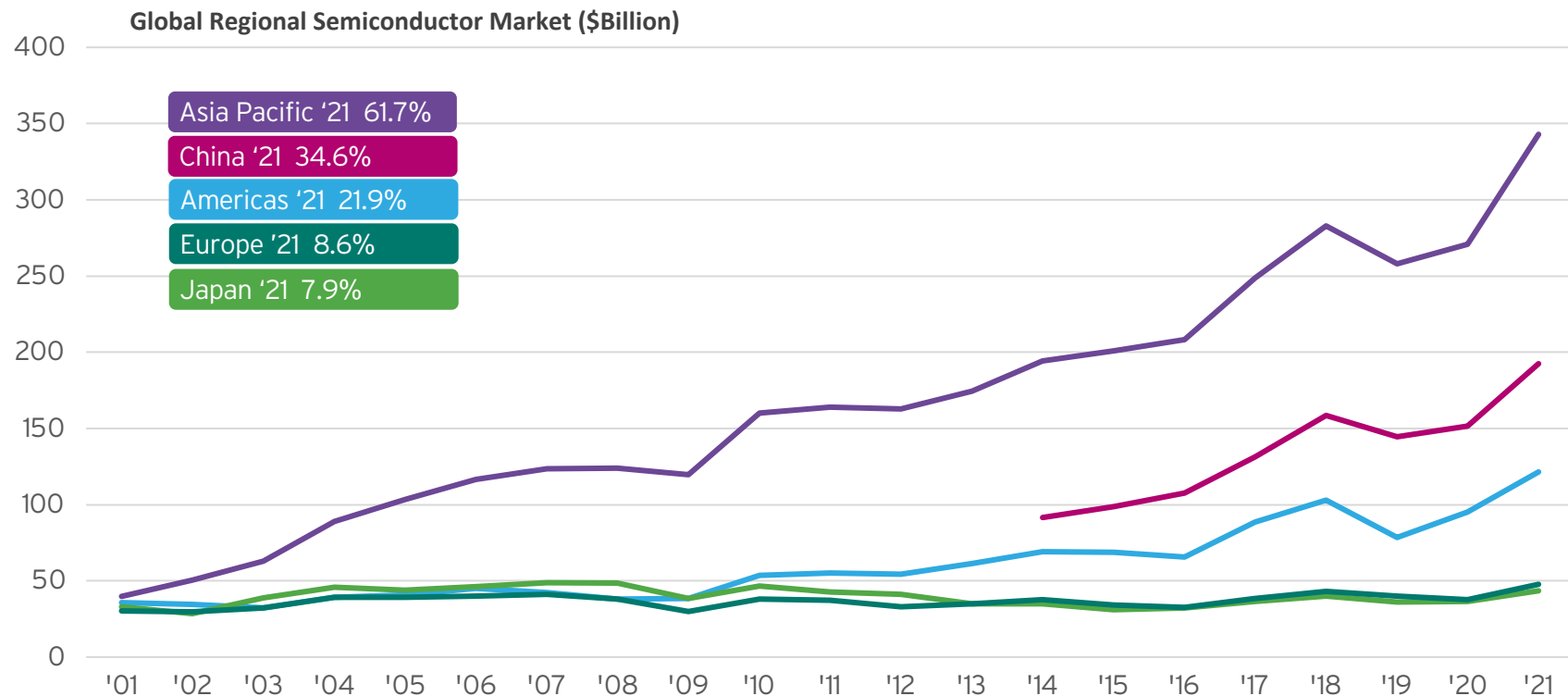


Source: World Semiconductor Trade Statistics (WSTS) and SIA Estimates.

# 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 \$343 billion in 2021. By far, the largest country market in 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.







## **Section 3**

# **Capital and R&D Investment**

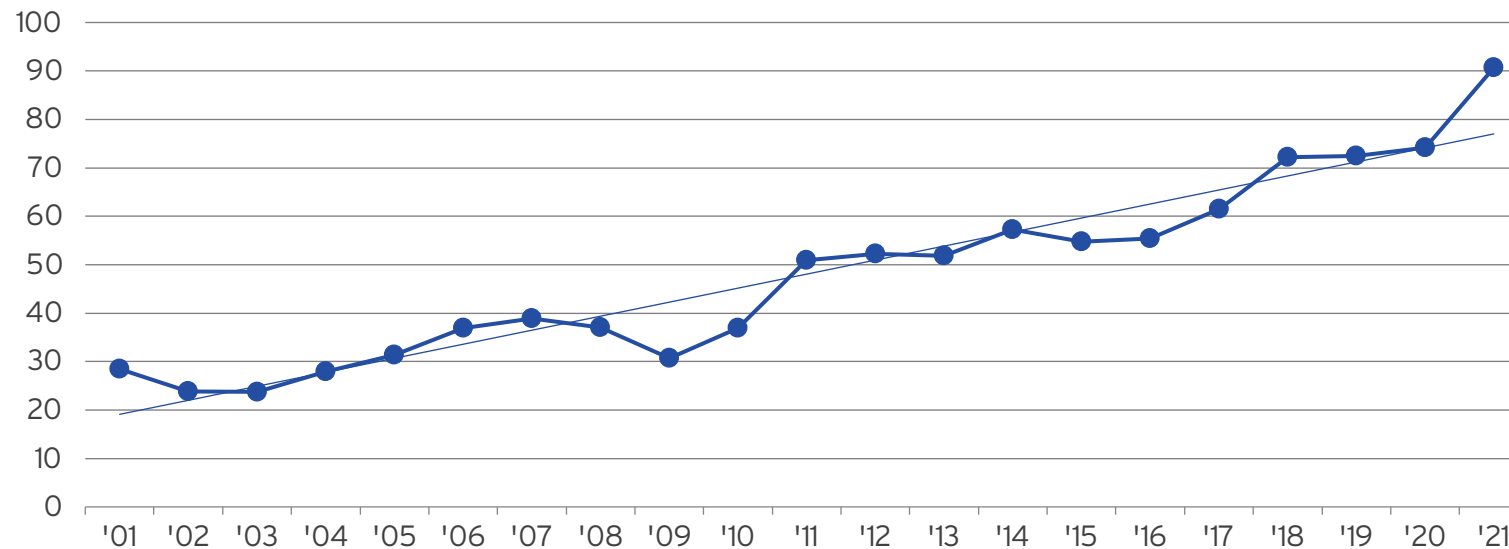
A Driving Force in Maintaining a Competitive  
U.S. Semiconductor Industry

# 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 \$90.6 billion in 2021. From 2001 to 2021, the compound annual growth rate was approximately 5.9 percent. Investment levels in terms of share of sales have generally not been subject to fluctuations associated with market cyclicalities.

R&D and Capital Expenditures (\$Billion)



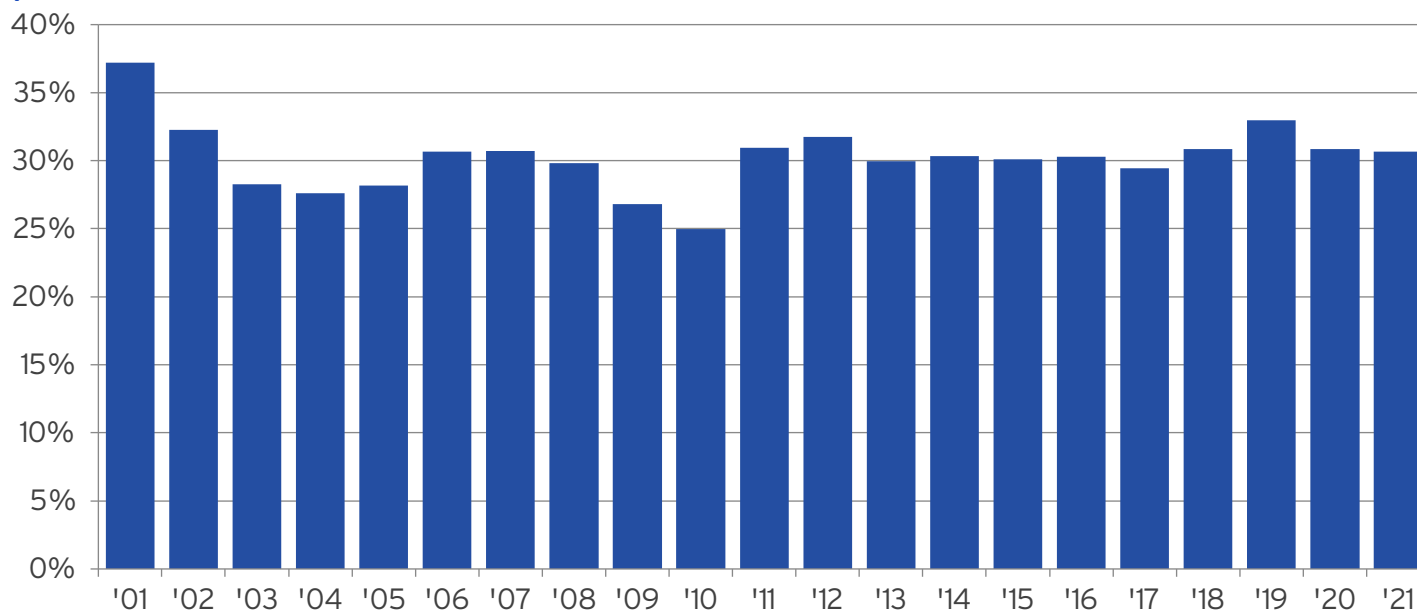
Source: U.S. Semiconductor Companies' 10K and 10Q Filings to the U.S. SEC and SIA Estimates.

# 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 revenue in both R&D and new plants and equipment. The pace of technological change in the industry requires that companies develop more complex designs and process technologies, as well as 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 and 2002, when sales declined precipitously while expenditures on R&D and capital equipment did not decline at the same rate.

Capital and R&D Investment as Percent of Sales

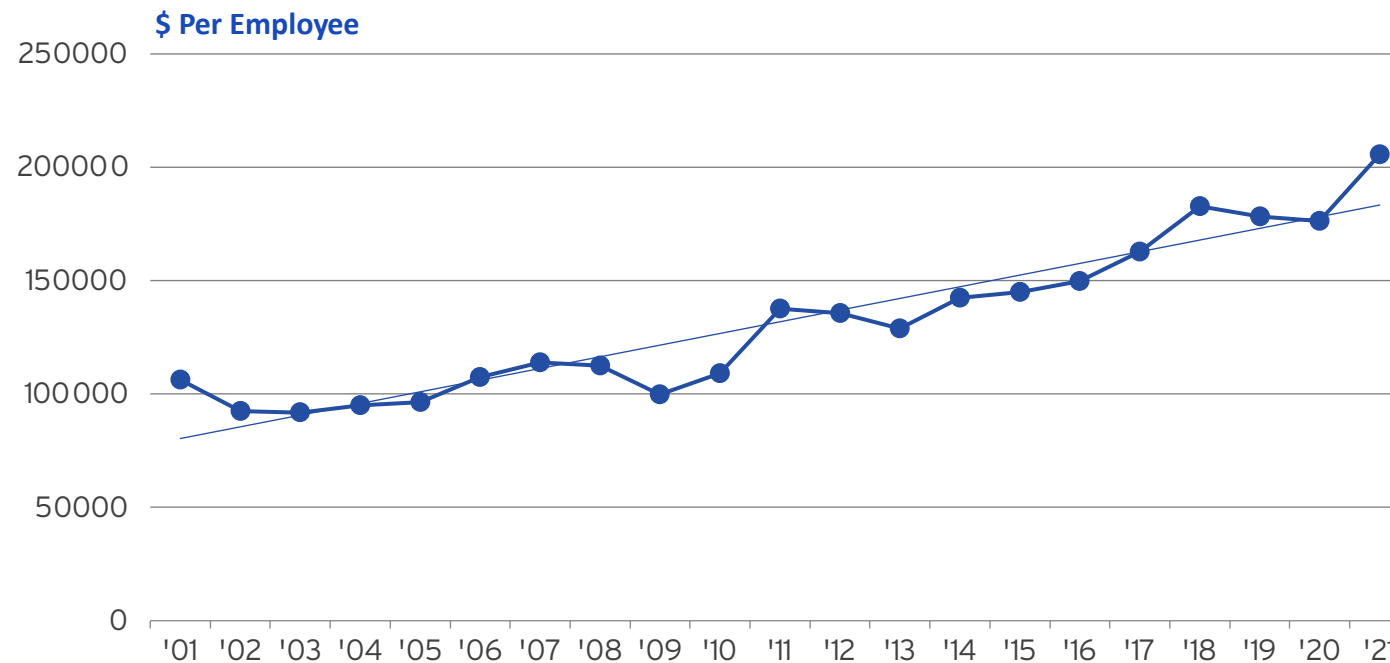


Source: U.S. Semiconductor Companies' 10K and 10Q Filings to the U.S. SEC and SIA Estimates.

# 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 \$206,000 IN 2021**

From 2001 to 2021, total investment per employee (measured by combined R&D and new gross plant and equipment) has increased at a rate of about 3.4 percent per year. These expenditures exceeded \$100,000 in 2001 but declined to roughly \$91,000 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 a record high of \$206,000 in 2021.

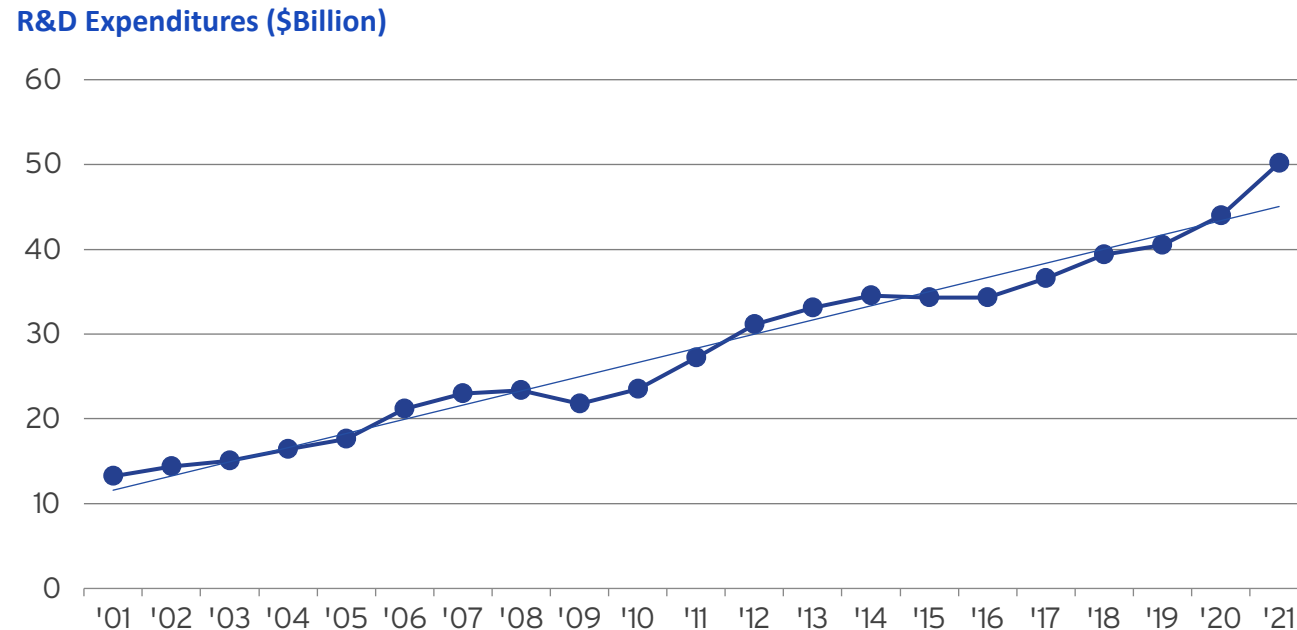


Source: U.S. Semiconductor Companies' 10K and 10Q Filings to the U.S. SEC and SIA Estimates.

# 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 6.9 percent from 2001 to 2021. 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 2021, total U.S. semiconductor industry investment in R&D totaled \$50.2 billion.

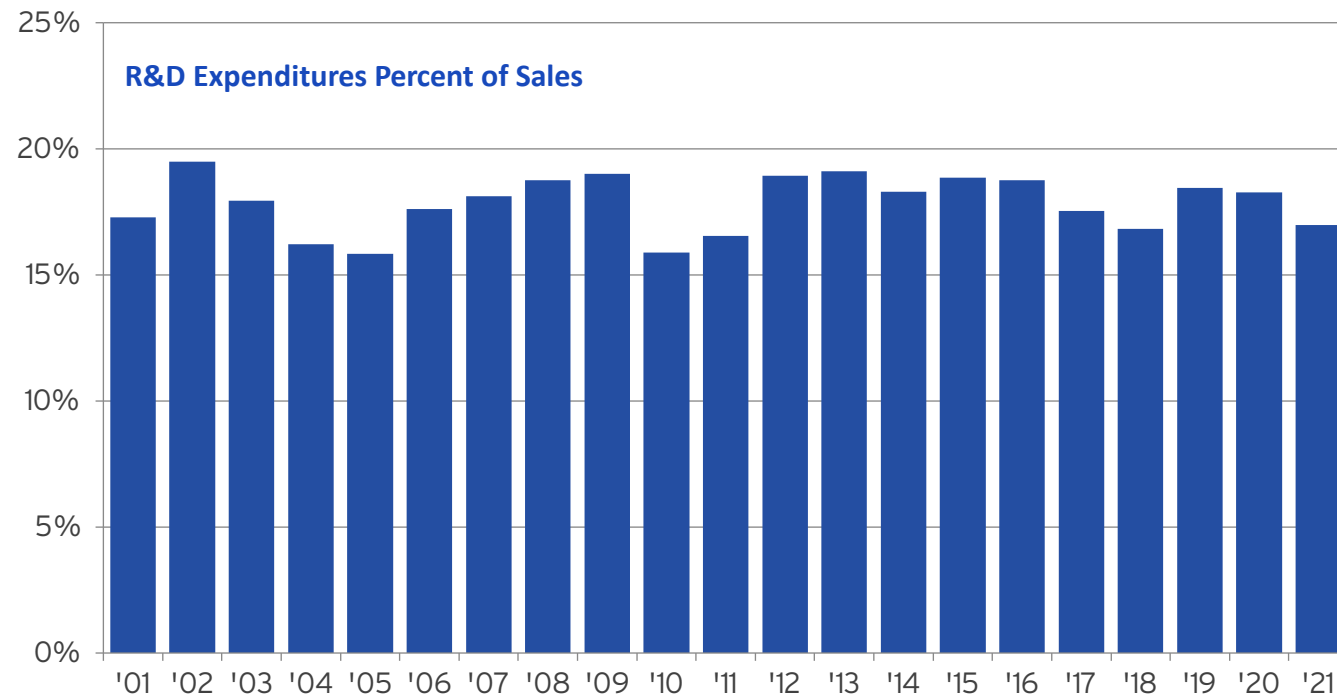


Source: U.S. Semiconductor Companies' 10K and 10Q Filings to the U.S. SEC and SIA Estimates.

# SECTION 3: Capital and R&D Investment

## ANNUAL R&D EXPENDITURES AS A PERCENT OF SALES HAVE EXCEEDED 15 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 the industry's commitment to the future of technology despite an economic downturn. The 2003-2004 decrease, as well as the 2020-2021 decrease, was not due to cuts in R&D budgets but rather to stronger than expected industry growth, which increased revenues faster than expected.

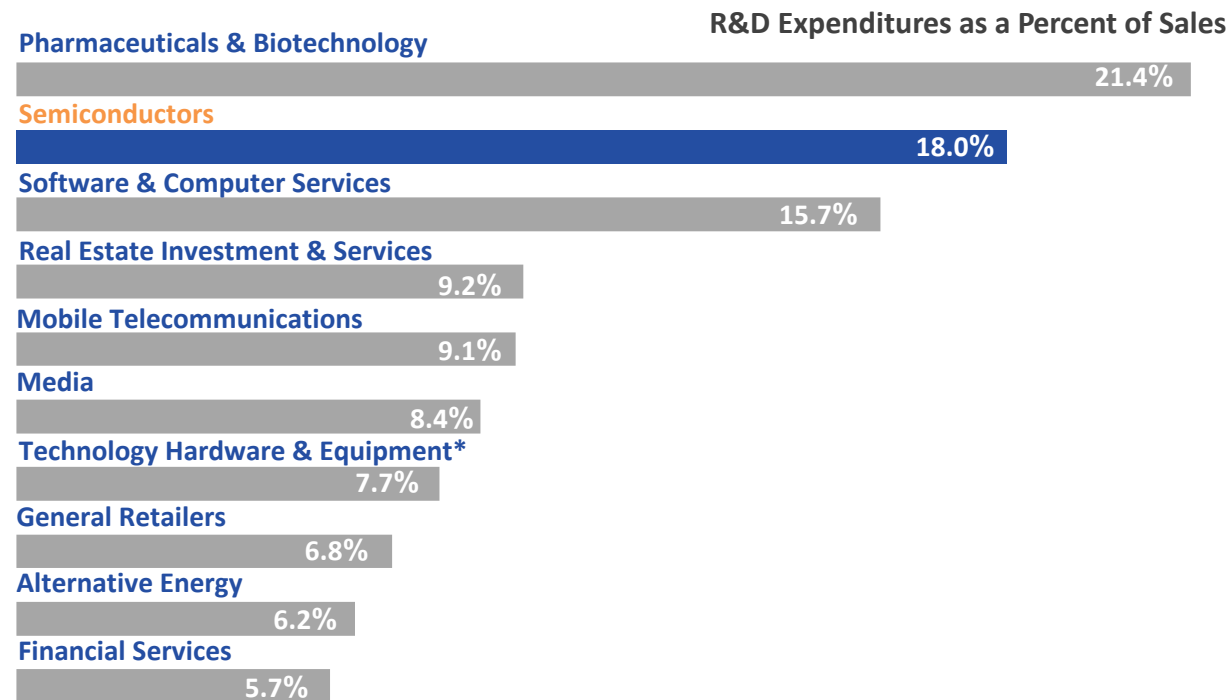


Source: U.S. Semiconductor Companies' 10K and 10Q Filings to the U.S. SEC and SIA Estimates.

# 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 2021 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.

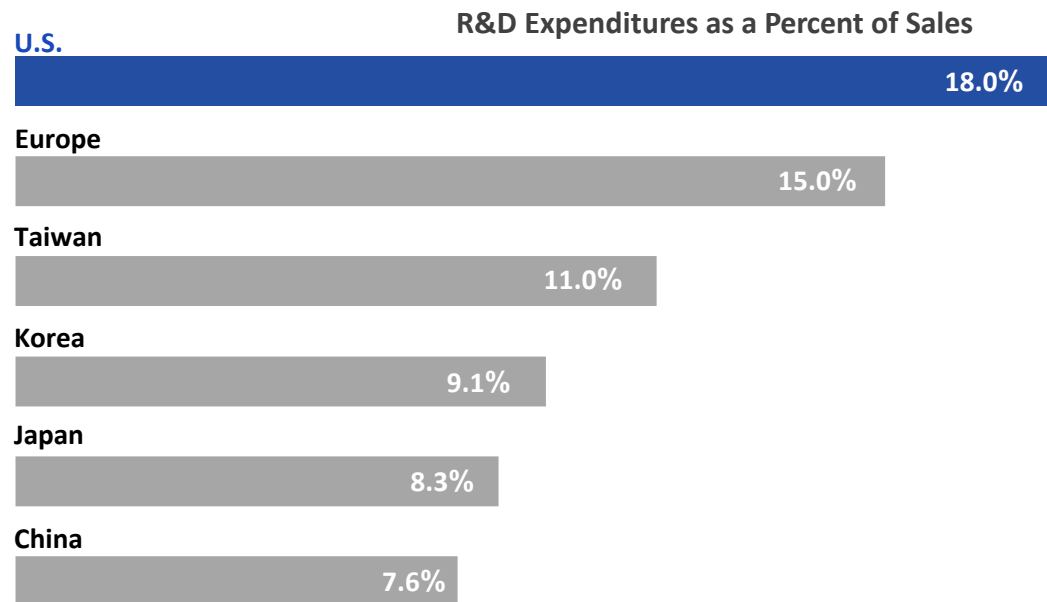
Note: Slight differences in semiconductor industry share from page 18 table due to differences in methodology and source data.

Source: The 2021 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's 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 2021 EU Industrial R&D Investment Scoreboard.

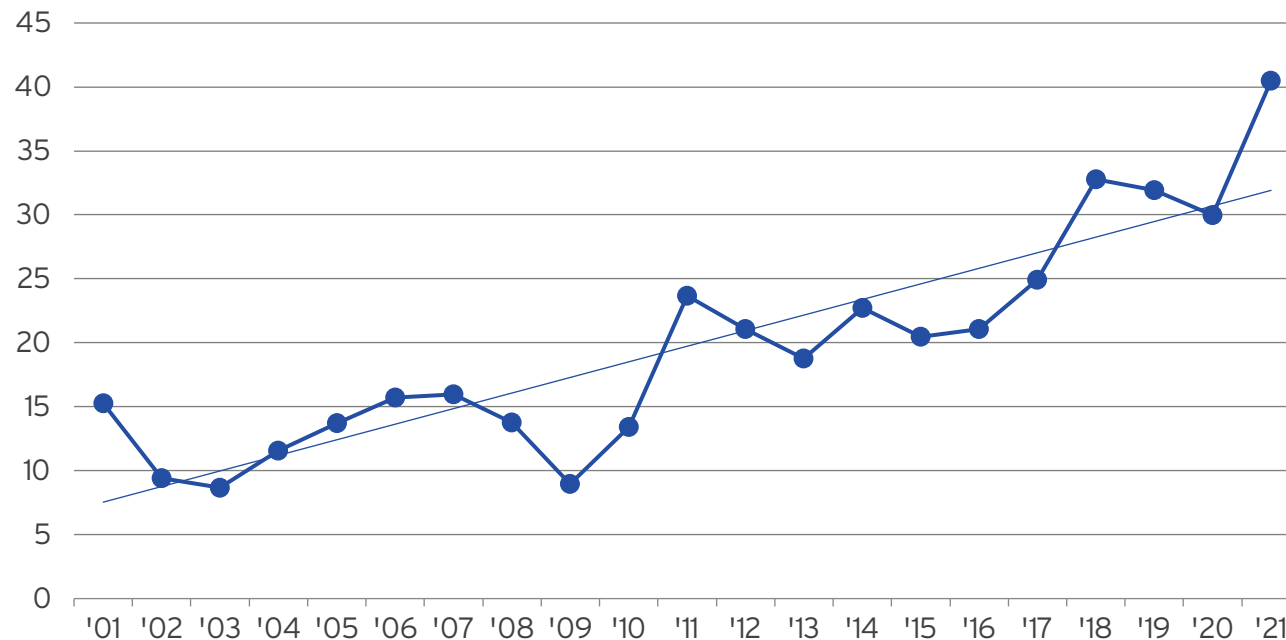


# SECTION 3: Capital and R&D Investment

## 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

The U.S. semiconductor industry gross capital expenditures were \$40.5 billion in 2021. 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 \$23.7 billion. In 2021, capital expenditures exceeded \$40 billion, as chip manufacturers ramped up capacity to meet the surge in demand for semiconductors.

Capital Expenditures (\$Billion)

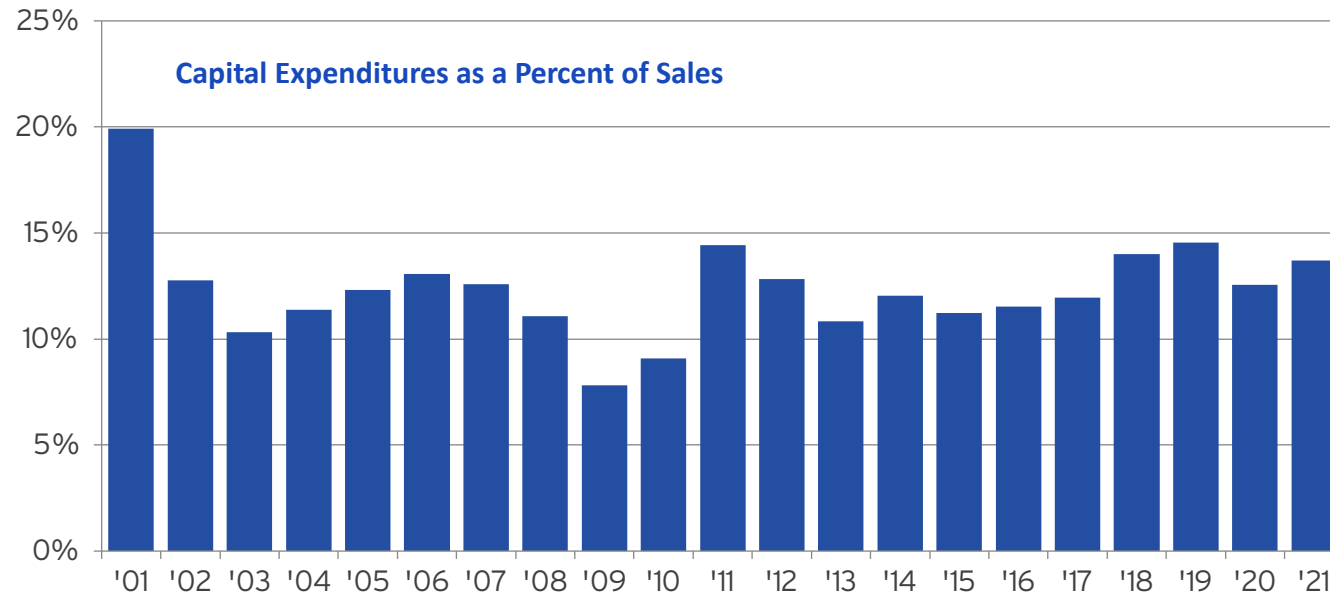


Source: U.S. Semiconductor Companies' 10K and 10Q Filings to the U.S. SEC and SIA Estimates.

## 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 expenditures 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 U.S economy. For semiconductor manufacturers, capital spending is essential to their competitive position. The rapid pace of industry innovation requires large outlays in capital spending to continue to produce more advanced devices.



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



# Section 4

## U.S. JOBS

## SECTION 4: U.S. JOBS

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

**277,000**

direct jobs in the U.S. semiconductor industry

**ONE**



U.S. semiconductor job supports

**5.7**



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

...that's more than **1.6 MILLION ADDITIONAL** American Jobs.



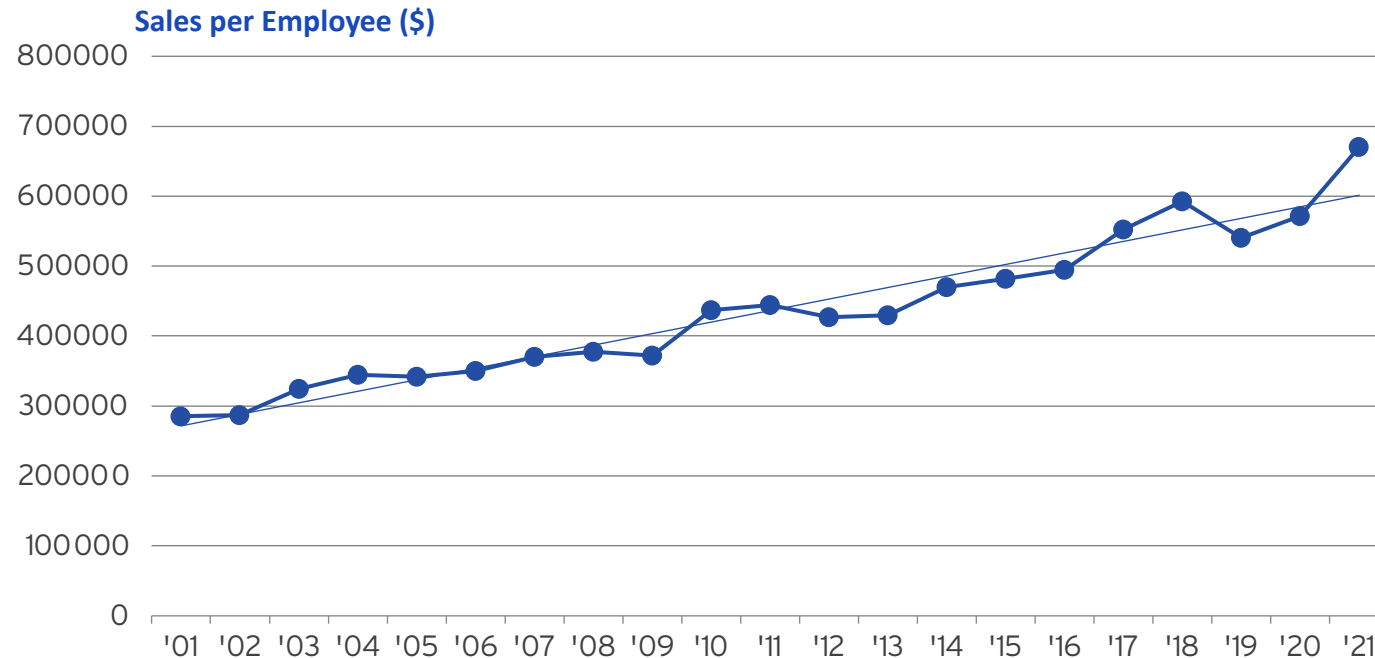
## **Section 5**

# **U.S. PRODUCTIVITY**

# SECTION 5: 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 2001. These productivity gains have been made possible by maintaining high capital investment levels and R&D spending rates. In 2021, the U.S. semiconductor industry recorded an average sales revenue per employee ratio of over \$670,000.



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