OXFORD ECONOMICS

THE POSITIVE IMPACT OF THE SEMICONDUCTOR INDUSTRY ON THE AMERICAN WORKFORCE AND HOW FEDERAL INDUSTY INCENTIVES WILL INCREASE DOMESTIC JOBS

May 2021

SIA SEMICONDUCTOR INDUSTRY ASSOCIATION

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2 Economic contribution of the US semiconductor industry in 2020

3 Economic impact of federal chip incentives program

4 Enduring legacy impact to the domestic semiconductor

5 Semiconductor workforce

* Background

Jobs and workforce equity value of the CHIPS Act

- **The CHIPS for America Act** is designed to support the US semiconductor manufacturing sector, as well as R&D and supply-chain security, through investment and incentives.

- Because legislation to fund the CHIPS Act has not been finalized as of publication, this report models the domestic jobs and economic impact of a hypothetical **$50 billion federal program to incentivize domestic semiconductor manufacturing** that was modeled in the recent SIA/BCG joint report, Turning the Tide for Semiconductor Manufacturing in the U.S.

- The passage of the CHIPS Act would put the US on track to regain global competitiveness status, fortify supply-chain risk and vulnerabilities, and create **significant new jobs and employment opportunities across the skills spectrum** for a recovering US economy.

Specific objectives

SIA sought to quantify the job creation and workforce value that would likely occur from passage of the CHIPS Act. Project objective was to **generate key data-driven findings**—with specific emphasis on jobs creation and the CHIPS act. To achieve this overarching objective we:

1. **Set the semiconductor baseline**. Calculated the US jobs impact of the semiconductor industry in 2020—including multipliers and model the additional new jobs (direct, indirect and induced)

2. **Evaluate new, additional value generated through CHIPS ACT**. Calculated the US jobs impact associated with CHIPS act from 2021-2026;

3. **Demonstrate the socioeconomic implications**. Examined the workforce uplift implications of new job creation across key themes: business size, race/ethnicity and other demographics, employed occupation and the associated wages, and employment opportunities across the education/skills spectrum.

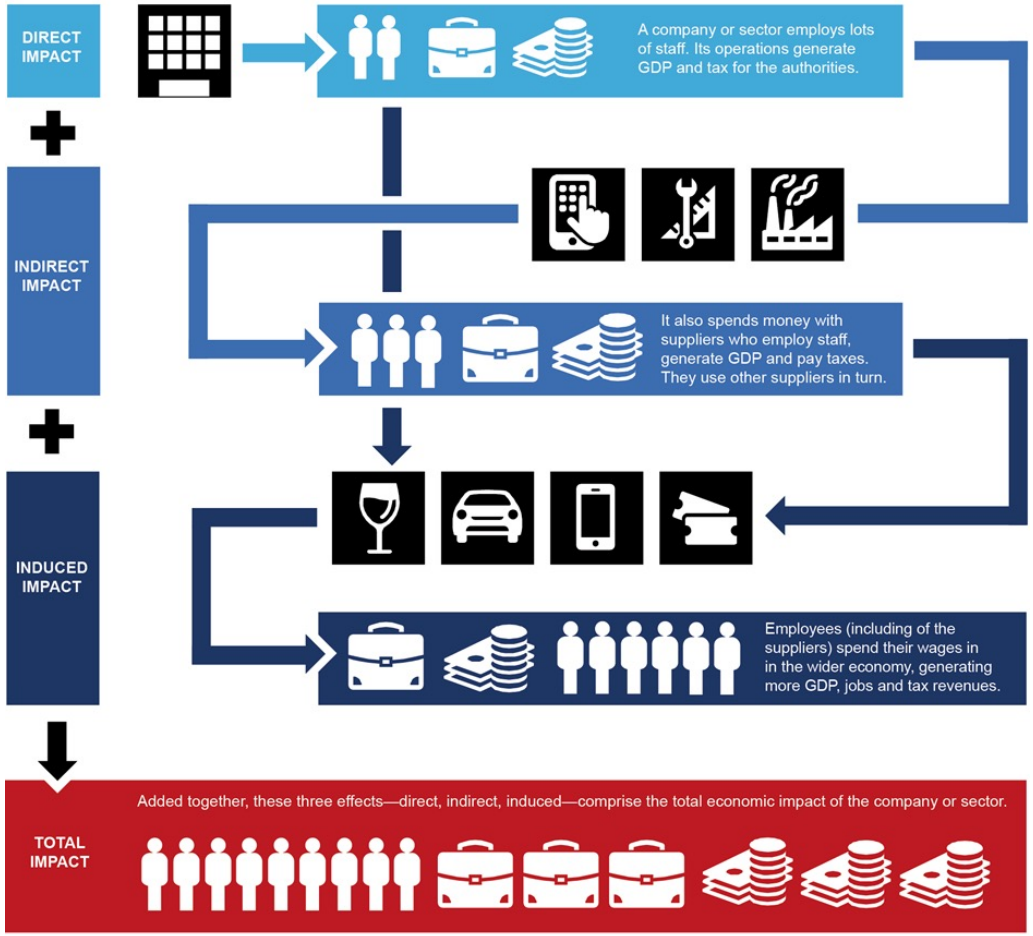
The overreaching goal is to provide a highly defensible, quantitative framework and methodology.

Calculate economic impact and multipliers for the semiconductor industry

- **Use direct jobs and GVA to calculate indirect and induced job creation**. We will use IMPLAN impact modeling system (derived from BEA input-output tables) to calculate 2020 baseline.

- **Develop estimate for CHIPS Act incentives and subsequent new fab facilities.** We worked with SIA to develop the key direct inputs to calculate the impact (direct, indirect and induced) effects that would likely occur if CHIPS Act is passed.

A conceptual framework of impact models



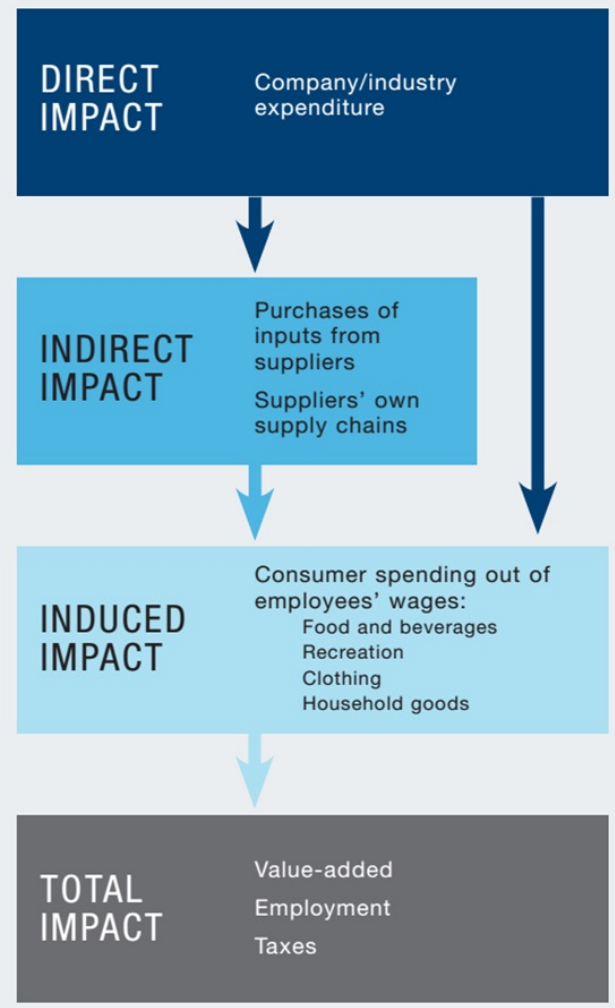
Economic impact modeling structure

The channels of impacts assessed across: GVA, Employment, and Income.

- Gross Value Added (GVA): The gross value added contribution to GDP
- Employment: Measured as a headcount of workers
- Income: Wages/salaries paid to workers

*Results broken down further by industry sectors benefitting from economic activity

Channels of impact



Valuing the semiconductor impacts in 2020

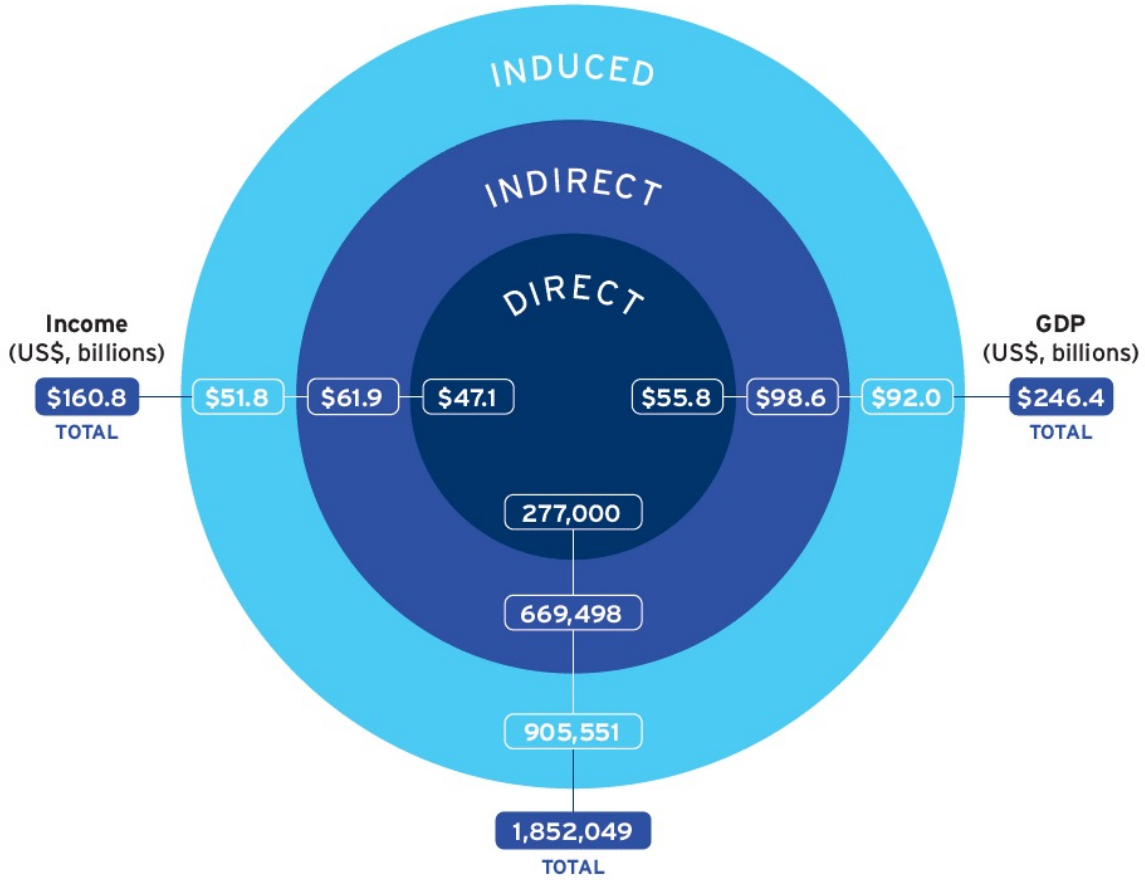
In total, the semiconductor industry supported nearly 1.85 million U.S. jobs and contributed $246.4 billion to GDP in 2020. The U.S. semiconductor industry directly employs more than 277,000 domestic workers in R&D, design, and manufacturing activities, among others.

Industry direct impact:

- 277,000 direct jobs,
- $47.1 billion in labor income and
- $55.8 billion in economic output

This supports an additional:

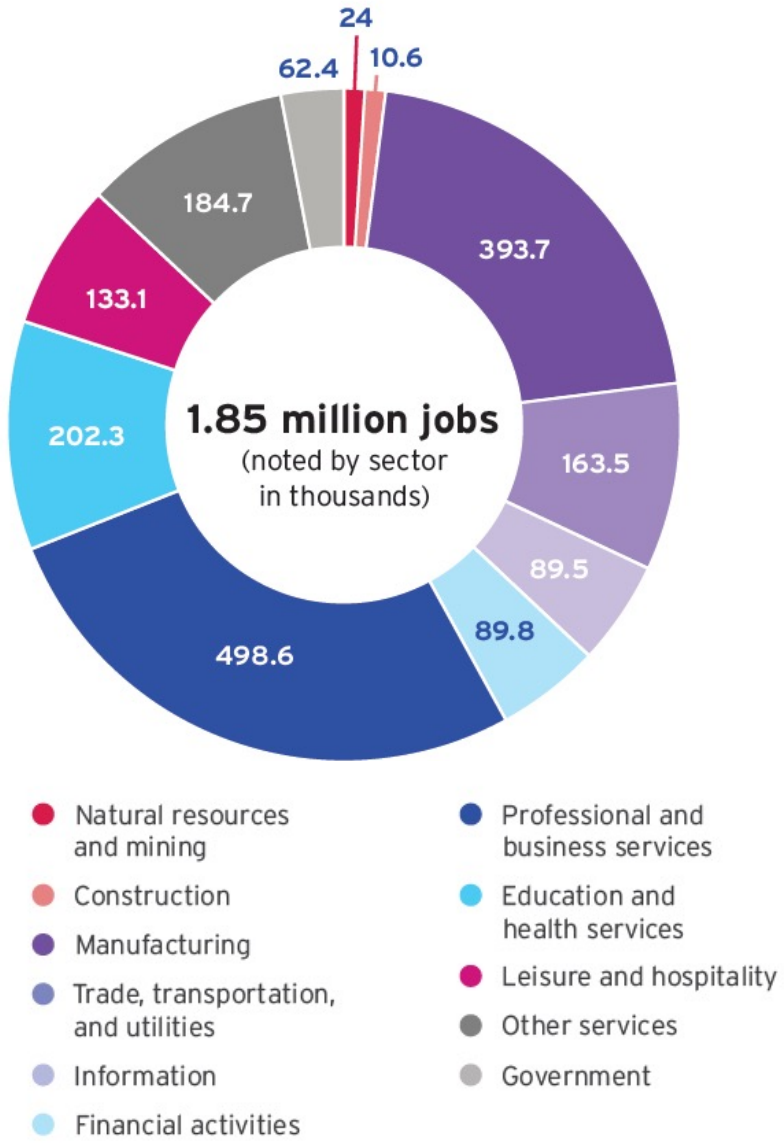
- 1.6 million jobs
- $113.7 billion in labor income
- $190.6 billion in economic activity



Semiconductor jobs impacts in 2020

The industry's employment impact is concentrated in the manufacturing industry, which accounts for 21 percent of the total employment impact.

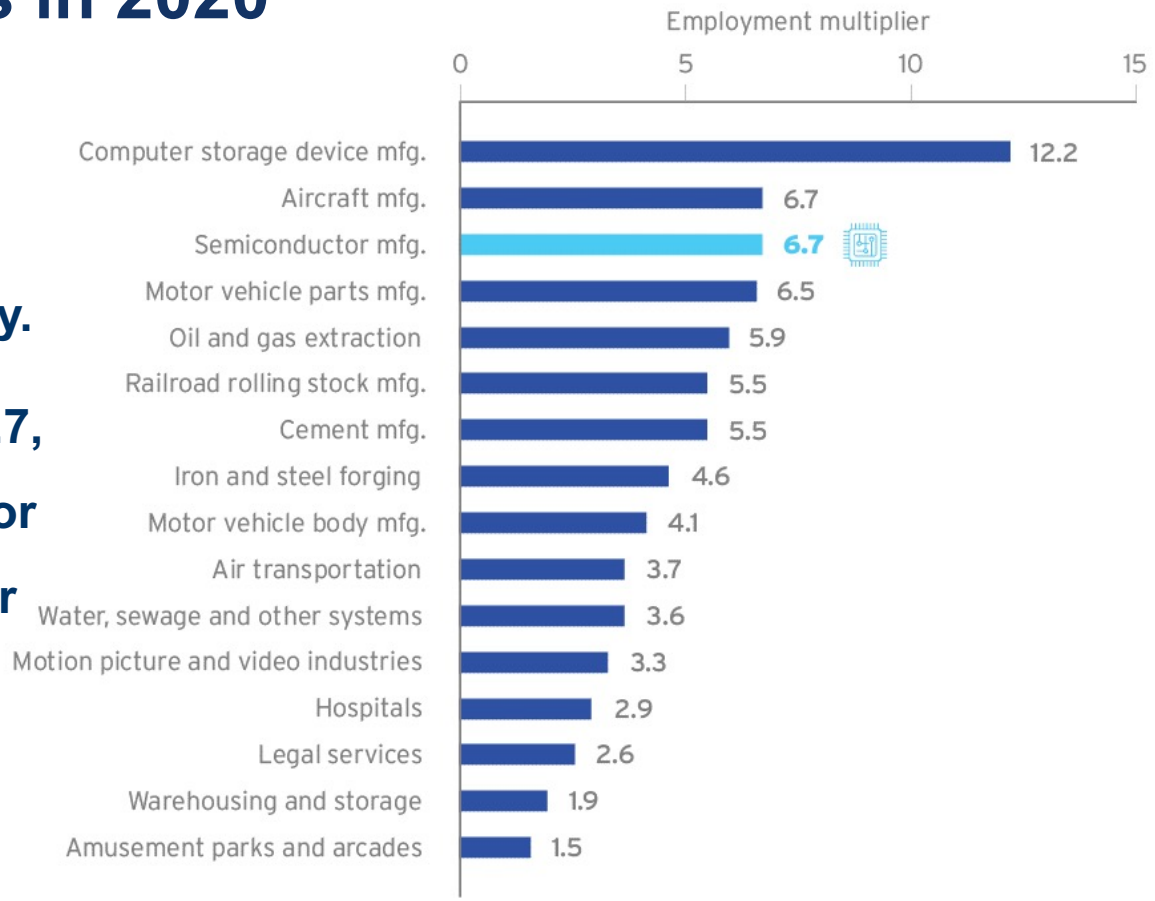
Still, other sectors are supported by the industry's activities including professional and business services (27 percent); education (11 percent); and other services (10 percent).



Valuing the semiconductor impacts in 2020

Jobs multipliers provide a useful metric to compare different. These multipliers represent the total jobs generated as a result of 1 job in the specified industry.

We found that the semiconductor jobs multiplier is 6.7, meaning that for every direct job in the semiconductor industry, an additional 5.7 jobs are supported in other domestic industries.

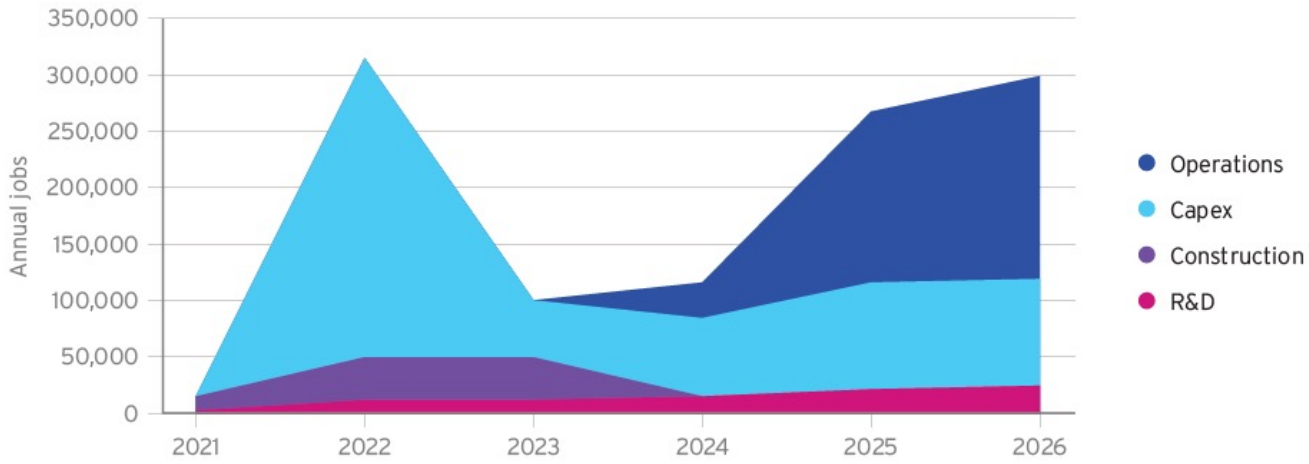


Source: IMPLAN

Valuing the CHIPS Act impacts from 2021-2026

The CHIPS Act impacts are estimated over a 6-year period and captures the following activities:

- **R&D activity:** The R&D activity will capture plant design and layout activity as well as operational support when the new facilities are up and running.
- **Construction of new facilities:** The construction values occur at the initial stages of the time horizon and are considered one-time impacts.
- **Installation of manufacturing equipment and offi furniture (Capex):** The Capex value impacts we capture will occur as construction is winding down a the facilities are preparing for operations.
- **Plant operations:** The operational value impacts we capture will occur when the fabs are up and running, and will assume a ramp up period to full capacity by 2026.



Valuing the CHIPS Act impacts from 2021-2026

	Direct	Indirect	Induced	Total
	Income and GVA in billions of US$			
Employment	235,480	347,551	530,796	1,113,827
Income	$34.0	$29.9	$30.4	$94.4
GVA	$49.0	$44.8	$53.9	$147.7

Source: Oxford Economics, IMPLAN

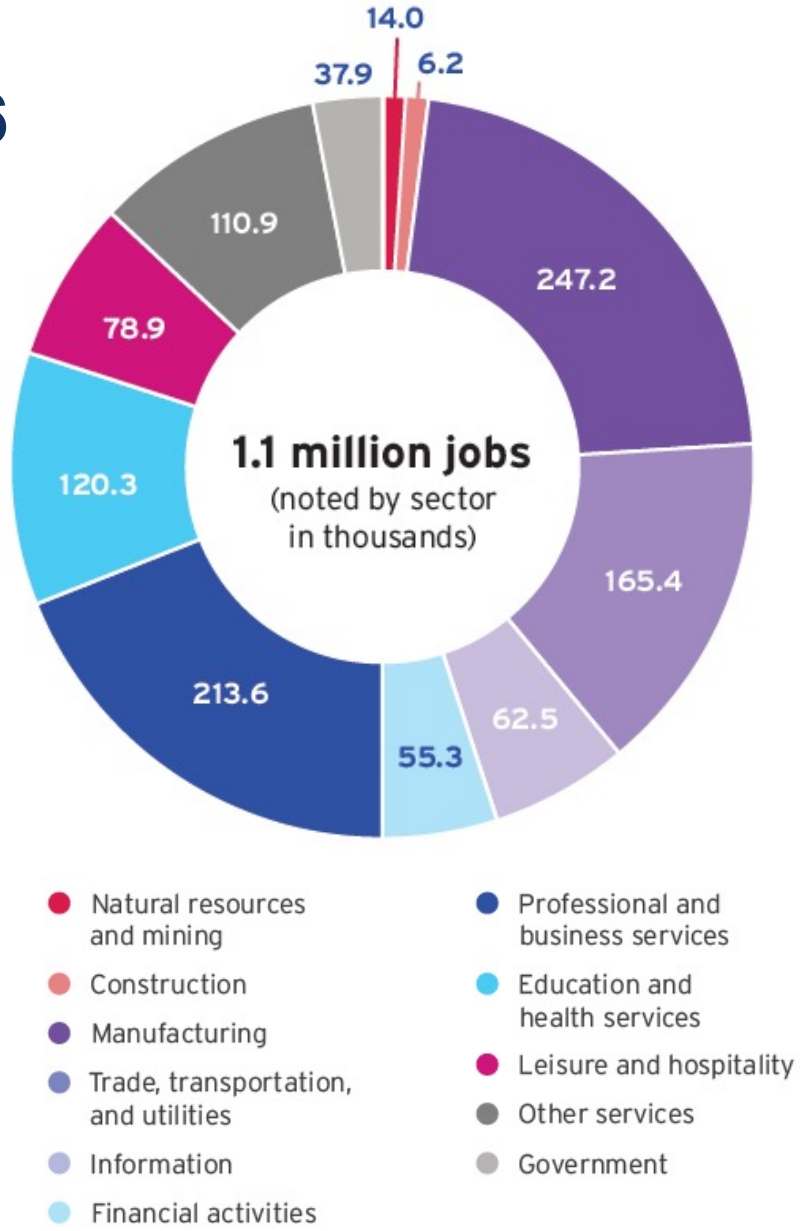
We estimate a $50 billion federal investment to fund the semiconductor manufacturing incentives would add $147.7 billion to the U.S. GDP and create 1.1 million new temporary jobs throughout the U.S. economy from 2021-2026.

These economic benefits combine all the channels of impact—direct, indirect (supply chain) and induced (wage spending).

Jobs impact by sector from 2021 to 2026

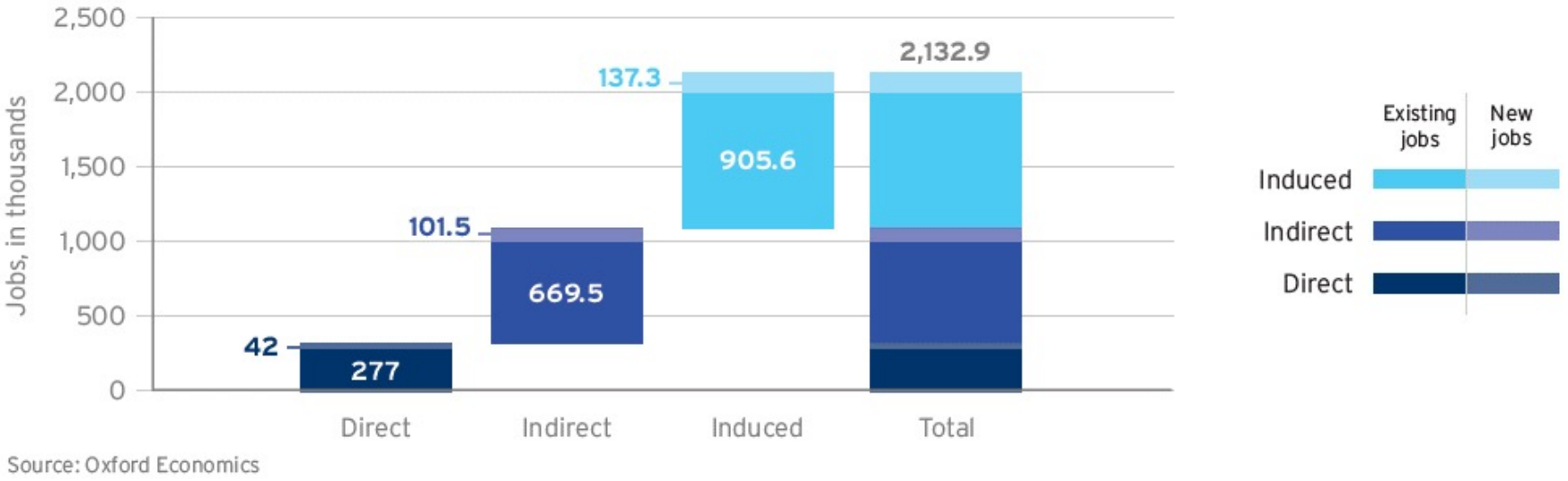
The industry's employment impact is concentrated in the manufacturing industry, which accounts for 22 percent of the total employment impact.

Still, other sectors are supported by the industry's activities including professional and business services (19 percent); and trade, transportation, and utilities (15 percent).



4 Legacy impacts of the US semiconductor industry

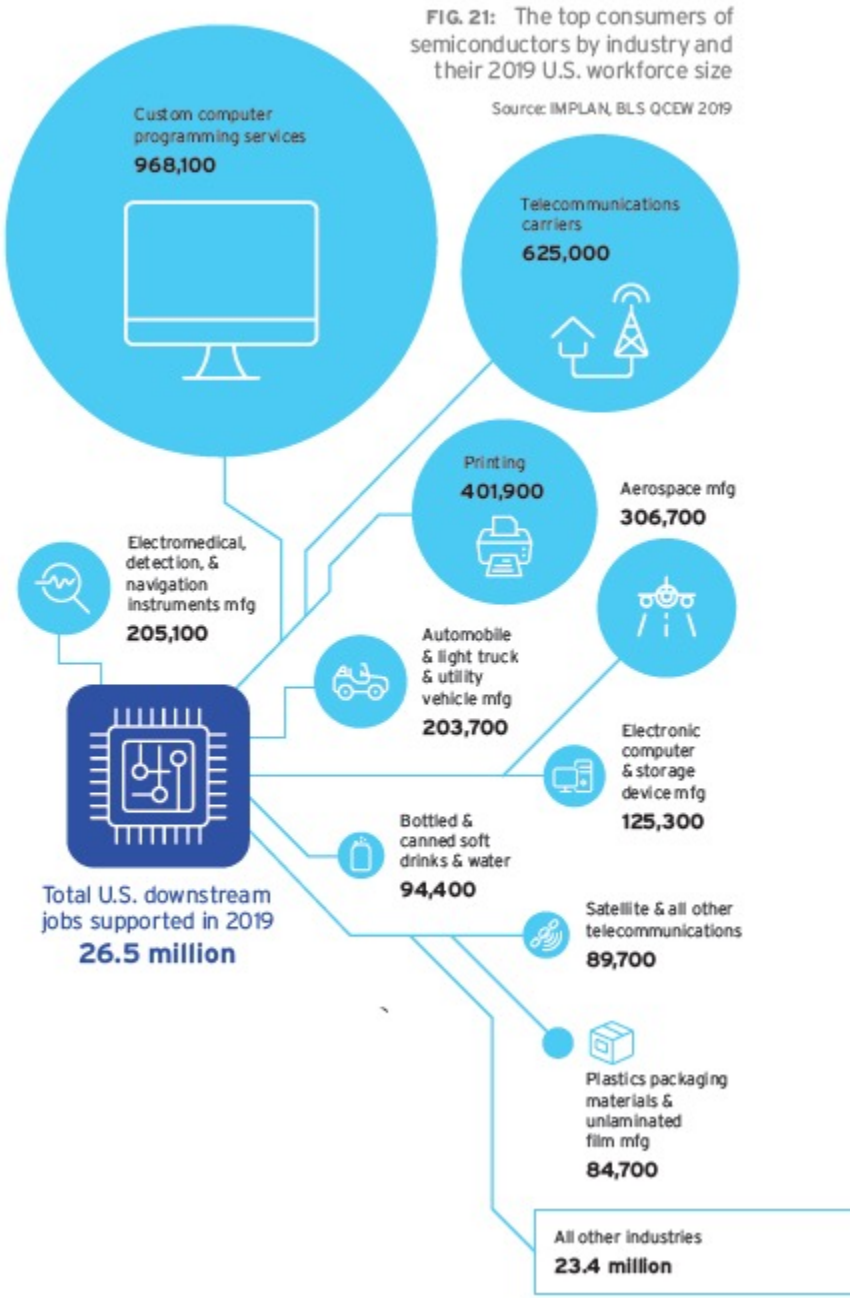
- **Building up domestic semiconductor industrial infrastructure will have an enduring positive impact on the U.S. economy and jobs. Specifically, a $50 billion US investment would help create an estimated 10 additional fabs in the U.S. that would otherwise not be built.**
- **Additionally, we would expect the U.S. semiconductor workforce to reach 319,000 by 2027, an increase of 42,000 from the 2020 total of 277,000.**
- **Assuming a similar magnitude of jobs multipliers identified in our 2020 findings, (6.7 jobs multiplier), we anticipate the U.S. semiconductor industry would support roughly 2.13 million jobs in the U.S. economy by 2027.**



Source: Oxford Economics

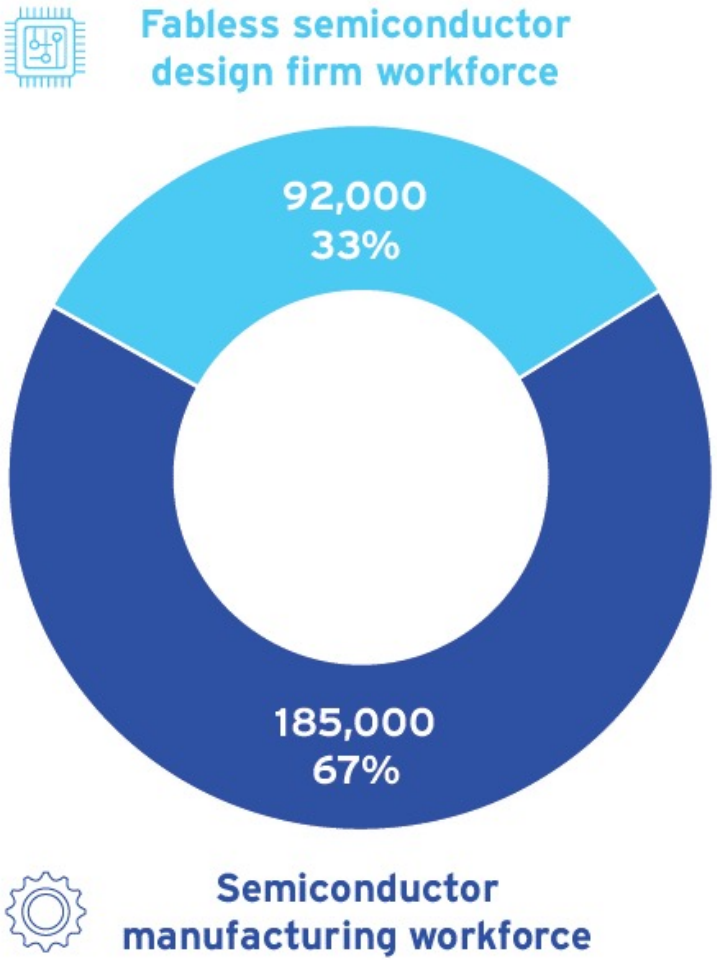
4 The many uses of semiconductors

- Over 300 different industries purchased semiconductors as inputs to produce goods throughout the economy in 2019.
- If you were to total all the workers in the 300 plus sectors that purchased semiconductors in 2019 (i.e. sectors whose products and productivity are enabled by semiconductors), then this would total 26.5 million US jobs.



Workforce composition

- The workforce includes workers in research and fabrication facilities where semiconductors are designed and manufactured.
- Semiconductor integrated device manufacturers and pure-play foundries directly employed nearly 185,000 U.S. workers.
- In addition, we estimate the employment of fabless chip design firms to be an additional 92,000 workers in the U.S.



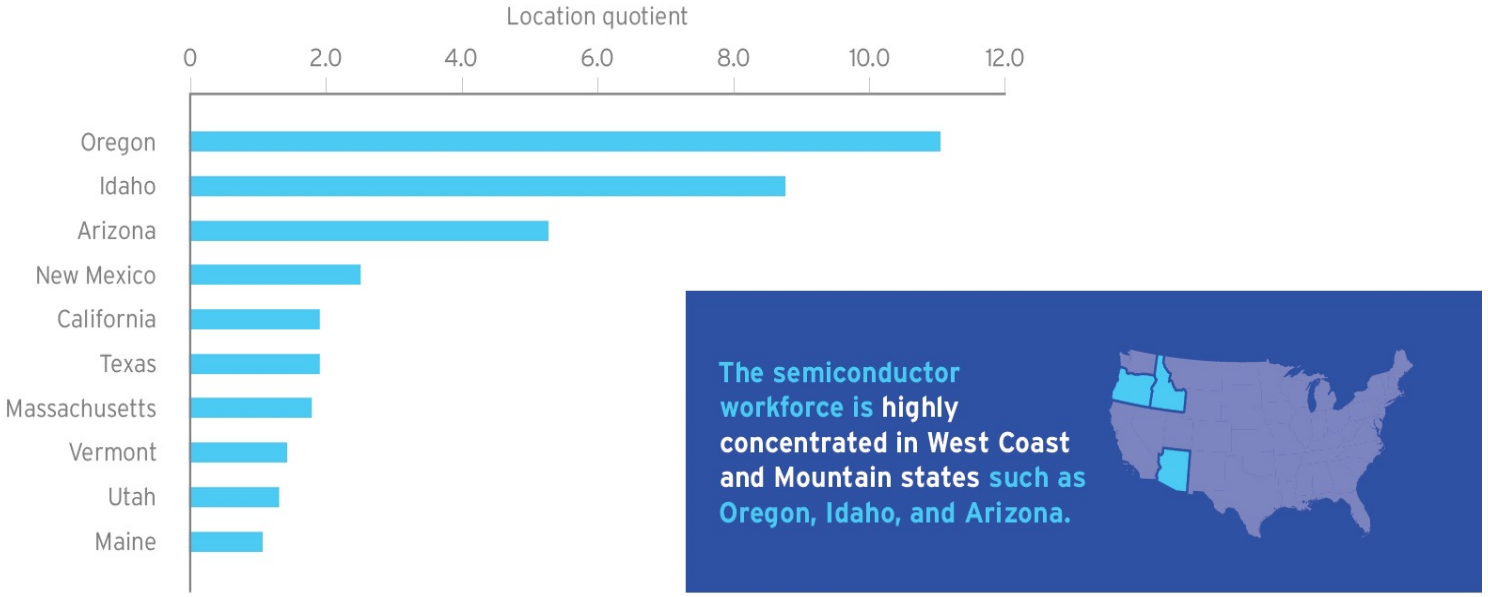
Geographic distribution of the semiconductor workforce

Largest 15 states ranked

Rank	State	Semiconductor employment	Share of U.S. semiconductor employment	Rank	State	Semiconductor employment	Share of U.S. semiconductor employment
1	California	63,300	23%	9	North Carolina	7,900	3%
2	Texas	43,800	16%	10	Washington	5,000	2%
3	Oregon	40,300	15%	11	Virginia	4,100	1%
4	Arizona	28,900	10%	12	Ohio	4,000	1%
5	Florida	12,900	5%	13	New Mexico	4,000	1%
6	Idaho	12,300	4%	14	Utah	3,700	1%
7	Massachusetts	12,200	4%	15	Pennsylvania	3,300	1%
8	New York	10,200	4%				

Source: Oxford Economics

Geographic concentration of the semiconductor workforce

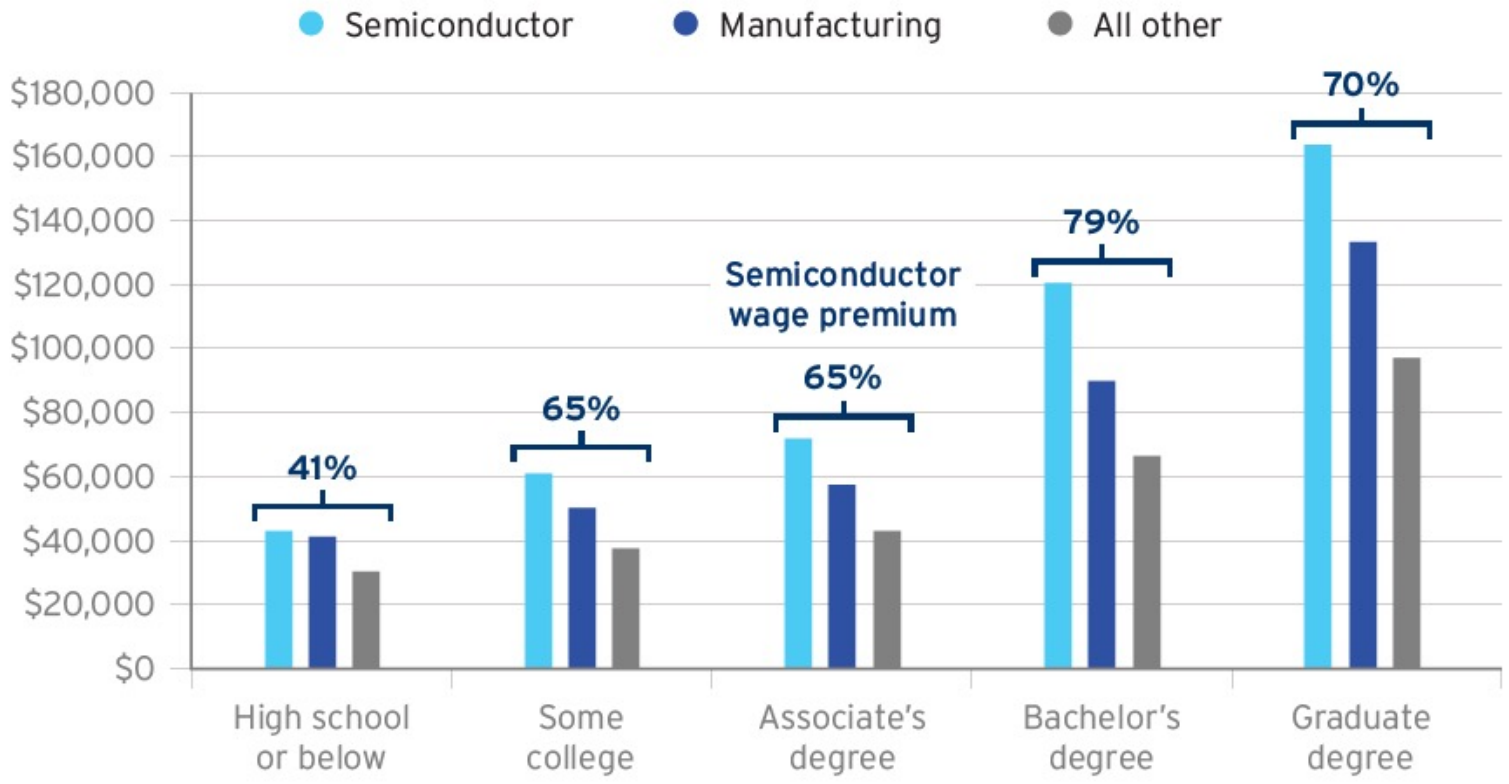


A location quotient (LQ) helps to illustrate how concentrated an industry is in one state by comparison to other geographies. A location quotient equal to one indicates that the state's industry concentration is equal to the national concentration of the same industry. Industries with above-average location quotients (greater than 1.0) indicate that a region has a higher concentration in the production of that good or service, relative to the rest of the nation. A value of 1.5 indicates that industry output within the region is 1.5 times more concentrated than the U.S. average. A location quotient below 1.0 indicates that industry output within the region is less concentrated compared to the U.S. average

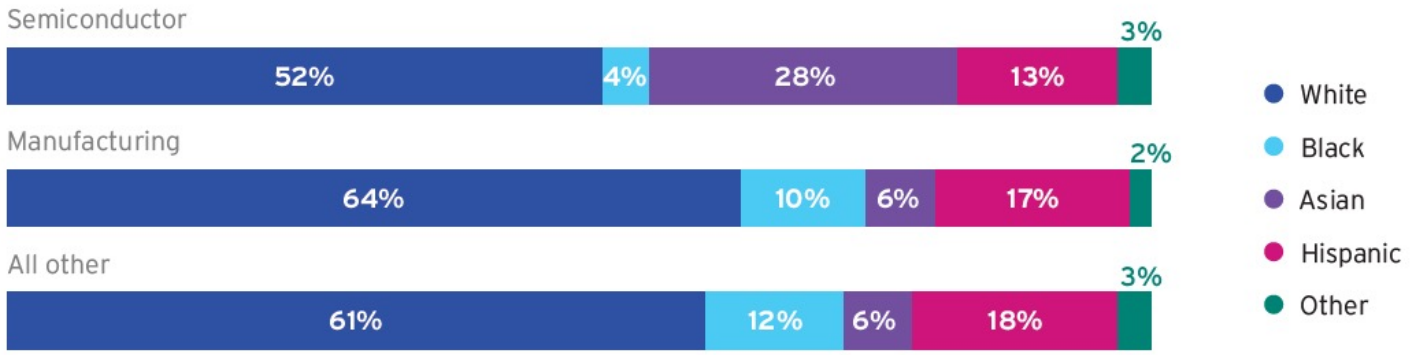
Occupation profile of the US semiconductor industry

Occupation group	Share of total	Average wage
Management	8.6%	$375,124
Business and Financial Operations	6.3%	$204,223
Computer and Mathematical	6.9%	$265,582
Architecture and Engineering	**23.9%**	**$226,145**
Life, Physical, and Social Science	0.6%	$207,991
Legal	0.2%	$213,996
Arts, Design, Entertainment, Sports, and Media	0.5%	$195,762
Healthcare Practitioners and Technical	<0.1%	$63,432
Protective Service	0.1%	$61,116
Building and Grounds Cleaning and Maintenance	0.2%	$40,164
Sales and Related	2.4%	$116,664
Office and Administrative Support	6.3%	$57,864
Construction and Extraction	0.1%	$75,108
Installation, Maintenance, and Repair	3.3%	$70,320
Production	**38.6%**	**$94,824**
Transportation and Material Moving	2.0%	$43,836
Total	**100%**	**$170,000**

Wage premium of the semiconductor industry across the educational attainment spectrum



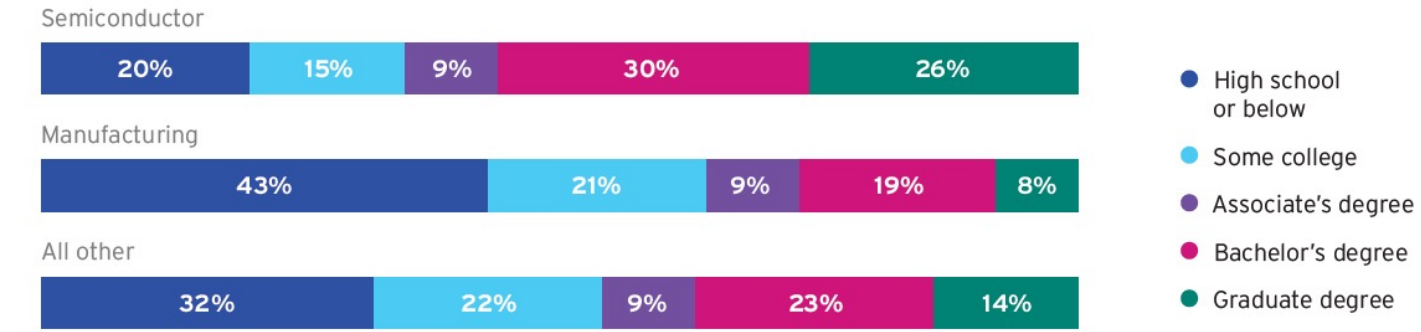
Race/ethnicity profile comparison



Source: ACS 2019, Oxford Economics tabulations

[4] All other excludes workers in the manufacturing sector.

Educational attainment profile comparison



Source: ACS 2019, Oxford Economics tabulations

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