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# **Measuring and Projecting U.S. Investment in Semiconductor Manufacturing Capacity**

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# Measuring and Projecting U.S. Investment in Semiconductor Manufacturing Capacity\*

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## Abstract

We consider official and alternative data sources for measuring and projecting the role of U.S. manufacturing in the global semiconductor manufacturing industry. We find that the government sources we consider face significant limitations for tracking semiconductor fab investment in real time: they use industry and product categories that are too broad, and come with substantial publication lags. We then analyze project-level alternative data from Semiconductor Equipment and Materials International (SEMI), which provides quarterly tracking of individual fab projects with greater timeliness and specificity. Comparing SEMI data with official statistics through 2023, we find broad consistency in investment levels, validating SEMI as a credible supplement to official statistics. This work provides both a practical guide for tracking real-time trends in semiconductor manufacturing and a case study in synthesizing government and alternative data sources.

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\*This work was strengthened by feedback from Ryan Decker, David Wasshausen, and staff members of CBO and JCT. The views expressed here are those of the authors and do not necessarily reflect the views of the Federal Reserve Board, the Federal Reserve System, or CBO.

## 1. INTRODUCTION

Fueled by anticipated use of frontier AI, the recent wave of data center investment has increased demand for semiconductor chips, which account for over half the cost of AI-ready data centers (Brown et al., 2026). The large contribution of data center investment to recent economic growth, anticipated productivity gains from AI use, and the perceived vulnerability of the electronics supply chain to geopolitical events have heightened longstanding concerns about the decline in the U.S. share of chip fabrication plant (“fab”) capacity that dates to the late 1990s (Figure 1a). Indeed, the share of the U.S. chip market supplied by the U.S. industry has dwindled, implying that the lion’s share of the chip demand from domestic data centers is supplied by imports, damping the contribution of AI to U.S. economic growth (Figure 1b).

In recent years, U.S. policymakers have responded to these developments with a variety of efforts. The CHIPS Act of 2022 aimed to increase the U.S. role in semiconductor manufacturing with grants and tax credits for fab construction (Platzer et al., 2020; Goldberg et al., 2024; Kwon, 2026). This government support for investment has been put in place alongside efforts to impede foreign manufacturing of advanced semiconductors, such as export controls on semiconductor manufacturing equipment (Sutter, 2025). Other countries have simultaneously engaged in similar efforts to promote domestic capacity (Sutter et al., 2023). Not all announcements regarding potential new U.S. chip fabs have moved forward: Kwon (2026) notes that before the Department of Commerce began announcing final awards in the second half of 2024, some companies had postponed the expected start or completion of their projects. They cited uncertainties around federal funding, difficulty recruiting the specialized workers needed to build and equip fabs, and challenges related to mitigation planning for required environmental reviews. Given these implementation challenges, efforts by foreign economies, and the fluid nature of the economic and policy changes, timely measures of both announced (planned) and actual fab investment are needed to track how the U.S. share of the electronics supply chain is evolving; this work reviews government and private-sector data one can use for that purpose.

We consider four data sources. We start with the investment estimates published by the Bureau of Economic Analysis (BEA): the National Income and Product Accounts (NIPAs)—very timely, quarterly-frequency, but less granular—and the Fixed Asset Accounts (FAAs)—less timely, annual frequency, and more granular. Next, we consider the Census Bureau’s Annual Integrated Economic Survey (AIES), which is based on survey responses from firms, unlike NIPA and FAA data which are constructed from aggregate flows. Next we examine the government’s most timely sources—the Manufacturers’ Shipments, Inventories, and Orders Survey (M3) and the Value of Construction Put in Place Survey (VIP). We show that all of these government sources fall short for tracking

fab investment in real time: They use industry and product categories that are too broad or come out with too long a lag. We then consider alternative data sources, focusing on project-level data from Semiconductor Equipment and Materials International (SEMI), which provides an extensive database of fabs from around the world, comes out quarterly with about a ten-week lag, and is based on SEMI’s integration of public information.

We find that government data is broadly consistent with SEMI, an alternative data source with the exact scope of interest. Because most uses of alternative data will ultimately be in combination with official sources, a solid understanding of differences between alternative and government data (and among government data sources) in scope and definition is essential to leveraging any alternative data. A contribution of our work is to provide a case study for a synthesis in this spirit.

More detail about the government data discussed in this work is available from sources such as U.S. Census Bureau (2023a), U.S. Census Bureau (2023b), U.S. Census Bureau (2024), and U.S. Bureau of Economic Analysis (2024). We attempt here to distill the key details needed to compare definitions across datasets of spending categories such as investment (see Appendix Table A.1) and of North American Industry Classification (NAICS) industries that may easily be confused with one another (see Appendix Table A.2).

## 2. WHAT GOVERNMENT STATISTICS CAN TELL US

### 2.1. *The National Income and Product Accounts and Fixed Asset Accounts from BEA*

The BEA publishes the NIPAs quarterly, with the first “advance” estimates provided about 30 days following the close of the quarter. BEA analysts integrate a variety of low-latency data sources, aligning these to ensure consistency with respect to accounting concepts, timing, and coverage. Naturally, the tight publication schedule precludes the use of source data not available at the time and restricts the feasible level of detail. Less timely sources, including Census Bureau economic surveys, are incorporated annually in a benchmarking process. The NIPAs include two investment series that reflect semiconductor fab investment. Private investment in nonresidential structures—“construction,” for short—is provided for the manufacturing sector as a whole (Figure 2a), and equipment investment is provided for industrial equipment (Figure 2b). For our purposes, while the sharp increase in manufacturing construction in 2023 and in investment in industry equipment very recently is consistent with a step up in fab construction and investment, the signal is a noisy one: Other industries and product classes within the available categories obscure the signal.

The BEA Fixed Asset Accounts (FAAs) incorporate additional data sources to provide more investment detail by industry and type. Related to the question of interest, the fixed assets by industry tables include construction and equipment investment for the Computer and Electronic Product

Manufacturing sector (NAICS 334) (the teal and plum lines in Figure 3). Fab investment is only a portion of reported investment in equipment and structures for NAICS 334, which also includes plants that manufacture computers, communications equipment, and electronic instruments. The fixed assets by type tables break the “industrial equipment” category from the NIPAs into six subcategories, including “special industry machinery, n.e.c.” (the black line), which includes fab equipment. But again, the category is too coarse for our purposes, as it includes machinery used to manufacture cigarettes, food, paper, and so forth.

## *2.2. The Establishment Surveys from the Census Bureau*

The Census Bureau’s Economic Census—in years ending with 2 and 7—and AIES—in other years—provide more industry detail on investment than the NIPAs and FAAs (for the remainder of this work we just cite these data as coming from the AIES).<sup>1</sup> Capital spending is reported for new and used buildings and structures and for machinery and equipment for the narrow industry containing the plants we care about: Semiconductor and Related Device Manufacturing (NAICS 334413). The FAA series track these Census estimates closely at the NAICS three-digit level, reflecting the use of the Census data in estimating the FAAs (Figure 4). The consistent gap between the two estimates may be a result of differences in their definitions of investment (see Appendix Table A.1). The large discrepancy in 2023 between the Census and BEA statistics likely reflects the fact that at the time of writing, the 2026 annual update to the FAAs, which will incorporate the 2023 AIES (and other data sources), was not complete.

The coverage and timing of the Census data are not ideal for our purpose. The narrower industry categories in the Census surveys are more informative for our analysis, but are still not as narrow as we would like: In addition to the chip fabs that are the focus of our discussion, this industry contains plants that produce raw silicon wafers, test and assemble the processed wafers, and produce solar cells (see Appendix Table A.2). While chip fabs are identifiable in the establishment-level microdata made available to researchers with projects approved by the Census Bureau, project output is reviewed to ensure information is not disclosed about individual firms, and this system effectively precludes regular, timely public analysis of Census data on chip fabs.

Response rates are another concern. While response is legally required, participation can nonetheless be well below 100 percent. For example, the number of reporting units returning a questionnaire for the 2022 Economic Census was 73 percent.<sup>2</sup> Moreover, if new entrants are more commonly missed than incumbents, there is a particular risk of bias in exactly the periods when the industry

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<sup>1</sup>The AIES integrates several discontinued sector-based annual surveys, most importantly for this note the Annual Survey of Manufactures and the Annual Capital Expenditure Survey.

<sup>2</sup>See [2022 Economic Census Methodology](https://www.census.gov/programs-surveys/economic-census/year/2022/technical-documentation/methodology.html), available at <https://www.census.gov/programs-surveys/economic-census/year/2022/technical-documentation/methodology.html>.

is changing quickly.

Finally, as we write, the AIES runs only through 2023. Since most of the investment boom has come since then, the official record simply has not caught up.

### *2.3. Timely Monthly Surveys from the Census Bureau*

There are two candidates for more timely signals from government data, one for equipment and one for construction.

On the equipment side, the M3 provides rapid monthly estimates of shipments, orders, and inventory for the Industrial Machinery Manufacturing Industry (NAICS 3332), which includes semiconductor manufacturing machinery (the teal line in Figure 5a). However, two characteristics undermine the M3’s usefulness for our purposes. First, the scope of the series is too broad: it contains Semiconductor Machinery Manufacturing (NAICS 333242) combined with many other industries. Second, and more importantly, shipments measure domestic production, not investment. The United States is both a meaningfully large exporter of semiconductor manufacturing equipment—Applied Materials, Lam Research, and KLA are three of the world’s five largest suppliers—and a meaningfully large importer, notably of ASML’s lithography tools. So domestic shipments and domestic use can be quite different. Following the approach used in the NIPAs, we construct absorption—shipments plus exports less imports—as an investment indicator for the broad industrial machinery category using the monthly Harmonized System trade data from the International Trade Commission. The black line in Figure 5a indicates that investment in industrial equipment has moved up sharply in recent years.

On the construction side, the Census Bureau’s VIP survey reports monthly construction spending with about a two-month lag, and it is the main source behind NIPA investment in manufacturing structures. The published category closest to our scope is manufacturing construction for “computer, electronic, and electrical” manufacturing (NAICS 334 and 335 combined). Once again the category is too broad. It includes the computer, communications equipment, and instrument plants in NAICS 334, plus all of electrical equipment manufacturing in NAICS 335, where a boom in battery plant construction happened to coincide with the fab buildout. The recent contour of this series is dramatic: It increased tenfold from 2021 to 2023 (Figure 5b). This surge is consistent with the narrative of industry announcements for fabs: TSMC, Micron, and Intel have each announced planned expansions of \$100 billion or more.<sup>3</sup> However, the sum of the annual-frequency estimates of construction in the AIES for these two sectors does not surge from 2021 to 2023 to nearly the same

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<sup>3</sup>See the table of announcements maintained by the Semiconductor Industry Association at <https://www.semiconductors.org/chip-supply-chain-investments/>.

degree, illustrating the need for data on actual construction and equipment spending by project to sort out such discrepancies.

So the monthly indicators are useful as a rough check on the timing of the boom, but neither one isolates fab investment.

### 3. ALTERNATIVE DATA SOURCES

Alternative data is available on chip fab investment from industry consultancies. We focus here on the *World Fab Forecast* published by SEMI.<sup>4</sup> This database is an attempt at a census of chip fabs that tracks both construction spending and equipment investment for new plant projects and upgrades to existing fabs.<sup>5</sup> Importantly, the global scope of the database allows for observation of the share of the industry located in the United States, which cannot be calculated using official government data alone. For each plant, SEMI reports capacity, technology generation (wafer size and process node), product type (e.g., memory, logic, or analog), location, and ownership. The data are quarterly, come out with about a ten-week lag, and include a forecast six to eight quarters ahead.<sup>6</sup>

So how does this industry data compare with the official record where the two overlap? Figure 6 puts annual SEMI totals for the United States next to the AIES capital expenditure numbers, both at the three-digit level (NAICS 334) and for semiconductor and related device manufacturing specifically (NAICS 334413). Three things stand out. Through 2020, the SEMI totals track the AIES figures for NAICS 334413 closely, which is reassuring given that the two are built independently. In 2021 and 2022, SEMI runs well above the AIES industry measure. That fits the idea that SEMI picks up the early phase of the boom, especially on the construction side, more fully or more quickly than the Census does. And in 2023, the last year they overlap, the two agree on total investment but split sharply on its composition: SEMI puts much more of the total into construction and less into equipment than the AIES does. It is possible that this difference comes from where each source draws the line between structures and equipment (see Appendix Table A.1), from the modeling process used by SEMI, or from differences in the timing of when spending is recorded.<sup>7</sup> The upshot

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<sup>4</sup>This database is used in estimation of the industrial production index published by the Federal Reserve Board. Other consultancies with similar products include IC Insights, Omdia, and TechInsights.

<sup>5</sup>SEMI describes their methodology as follows: “Updates are made continuously each quarter by directly engaging with company executives, conducting site visits, and monitoring financial statements, press releases, and other critical market signals.”

<sup>6</sup>We restrict our attention to the plants of interest for this note; namely, the “front-end” fabs that create circuitry on silicon wafers for commercial use. The SEMI database also includes “back end” (test and assembly) plants, research labs, and a variety of other related facilities.

<sup>7</sup>Equipment and structures face different price trends, different depreciation rates, and different tax treatment, including under the Section 48D credit.

is that the SEMI totals are a credible, timely supplement to the official record, but the split between structures and equipment deserves more caution.

#### 4. PROJECTING FAB INVESTMENT FORWARD

Of course, we are also interested in what comes next. This is where the project-level structure of the SEMI data can be particularly helpful. Because the data follow individual fabs through their lifecycle, the published six-to-eight-quarter forecast is built up from a pipeline of specific projects rather than extrapolated from an aggregate. A forecast published in 2026:Q1 is presented in Figure 7. The forecast includes investment that SEMI analysts assess to have a likelihood of at least 50 percent of taking place. The main near-term risk is slippage in timing—commercial construction has long and variable lags between planning and completion (Glancy et al., 2025). And, importantly, the forecast is the projected impact of plants that have already been announced; no assumption is made about future announcements.

To see beyond the committed pipeline, one has to look at earlier stages of the project lifecycle. As noted above, SEMI picks up planned projects in their database that have a high enough likelihood of moving forward. It is possible that other construction project databases, such as data from Dodge Construction Network—which follow projects from announcement through planning to start and feed into the VIP survey—could be a useful supplement for more speculative, early-stage announcements. Indeed, Brandsaas et al. (2025) show, for data centers, how to turn this kind of project-level plan data from Dodge into disciplined aggregate forecasts. However, for semiconductor fabs, Dodge picks up planned projects less consistently than for data centers. For data centers, Dodge tracks all projects throughout their lifecycle from plan to start to completion (or abandonment/deferral along the way) as part of their Real Estate Analyzer (REA) database. In contrast, Dodge provides information on semiconductor fab construction as part of their manufacturing “starts” database; this data product intends to obtain project values at time of construction start.<sup>8</sup> Even given the difference in intent regarding tracking projects over their lifecycles, the “starts” data still includes information on plans or project completion or abandonment, just less consistently than the REA data. These differences in how projects are tracked between the datasets even within the same data provider could imply that plans may have a different signal between the datasets; therefore, comparisons along the lines we have performed for the SEMI data would be warranted to understand the Dodge data’s information content for this purpose.

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<sup>8</sup>For reference, it is also possible to get information on project starts for data centers as part of Dodge “starts” database product.

## 5. CONCLUSION

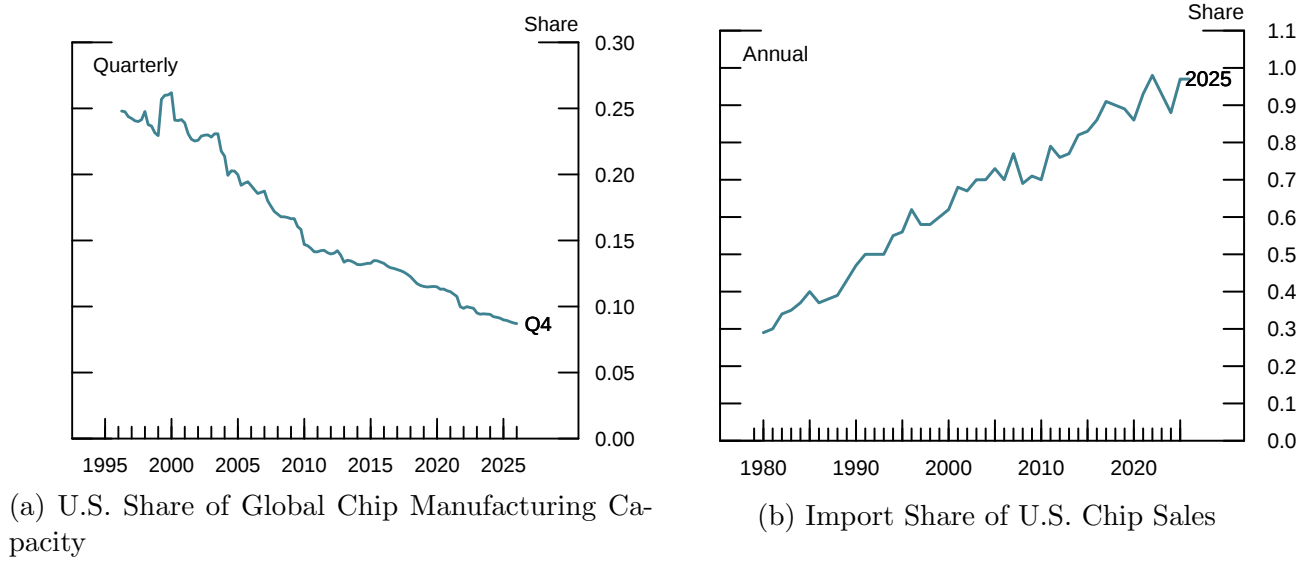
This work provides a synthesis of government and alternative data to analyze semiconductor fab construction in the United States. The NIPAs and FAAs provide economy-wide consistency: the contribution of semiconductor-related investment to GDP, comparisons across sectors, and any analysis that has to sit inside the full national accounts require these data. The Census establishment surveys are the industry benchmark that any other source should be checked against. The alternative data we analyze (from SEMI) are better for questions that are specific to the industry and sensitive to timing: tracking the fab investment cycle close to real time, breaking investment down by technology, product type, and company, and projecting spending a few quarters ahead from the project pipeline. And for the longer horizons that policy evaluation eventually needs, plan-level data from sources like Dodge and public announcements, disciplined by the lifecycle method in Brandsaas et al. (2025), may provide additional insights. Altogether, this work demonstrates how official statistics and alternative industry data are complements, not substitutes, and how using these sources in concert properly requires careful attention to their sources, definitions, and methods.

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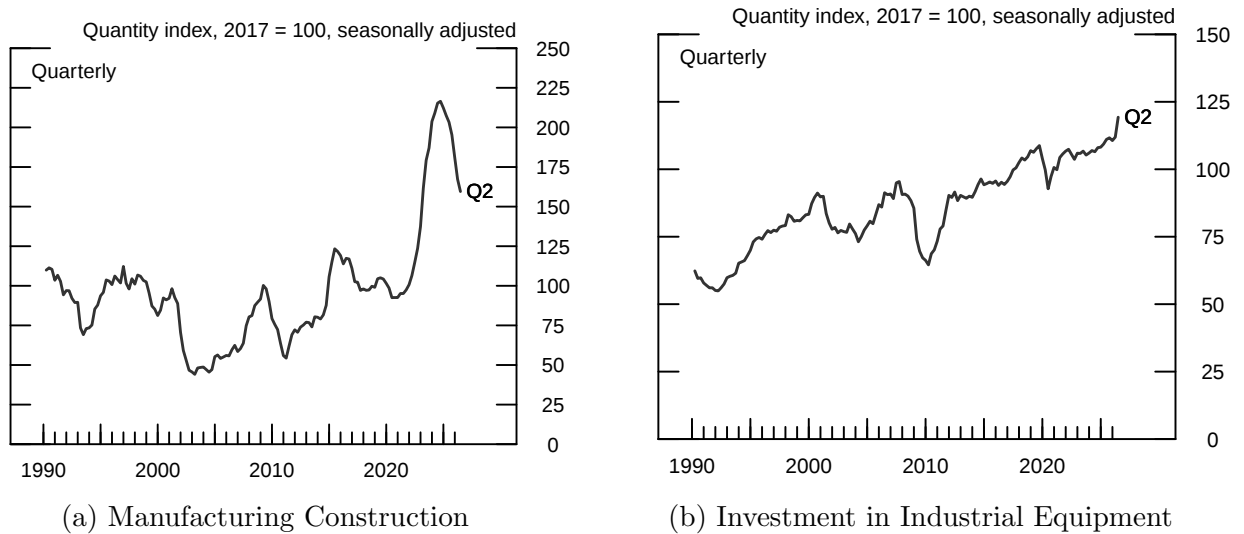
Figure 1: Indicators of the Declining U.S. Share of Global Chip Manufacturing



*Note:* The left chart shows the quarterly share of wafer processing capacity adjusted for wafer size but not product type (from 1996:Q1-2025:Q4), while the right chart shows annual U.S. chip imports of relative to U.S. chip shipments less U.S. net exports of chips (from 1979-2025).

*Source:* For the left chart, the data comes from Byrne et al. (2025), which is available at: [https://conference.nber.org/conf\\_papers/f188293.pdf](https://conference.nber.org/conf_papers/f188293.pdf), and relies on data from Gartner, Inc. and Semiconductor Equipment and Materials International. For the right chart, the data comes is ITC imports divided by Census shipments less ITC net exports (imports - exports).

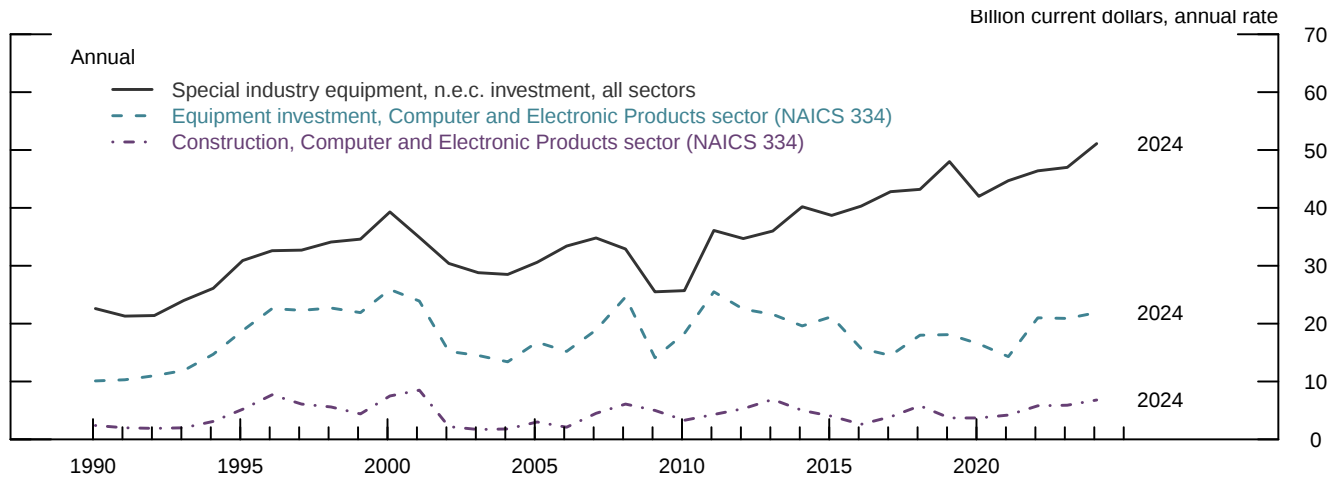
Figure 2: Fab-Related Investment Estimates from the NIPAs



*Note:* “Construction” is private fixed investment in non-residential structures. Industrial Equipment includes semiconductor manufacturing machinery as well as many other types. Both figures plot quarterly data from 1990:Q1-2026:Q2. See Appendix Table A.1 for more detail on these spending categories.

*Source:* BEA NIPAs.

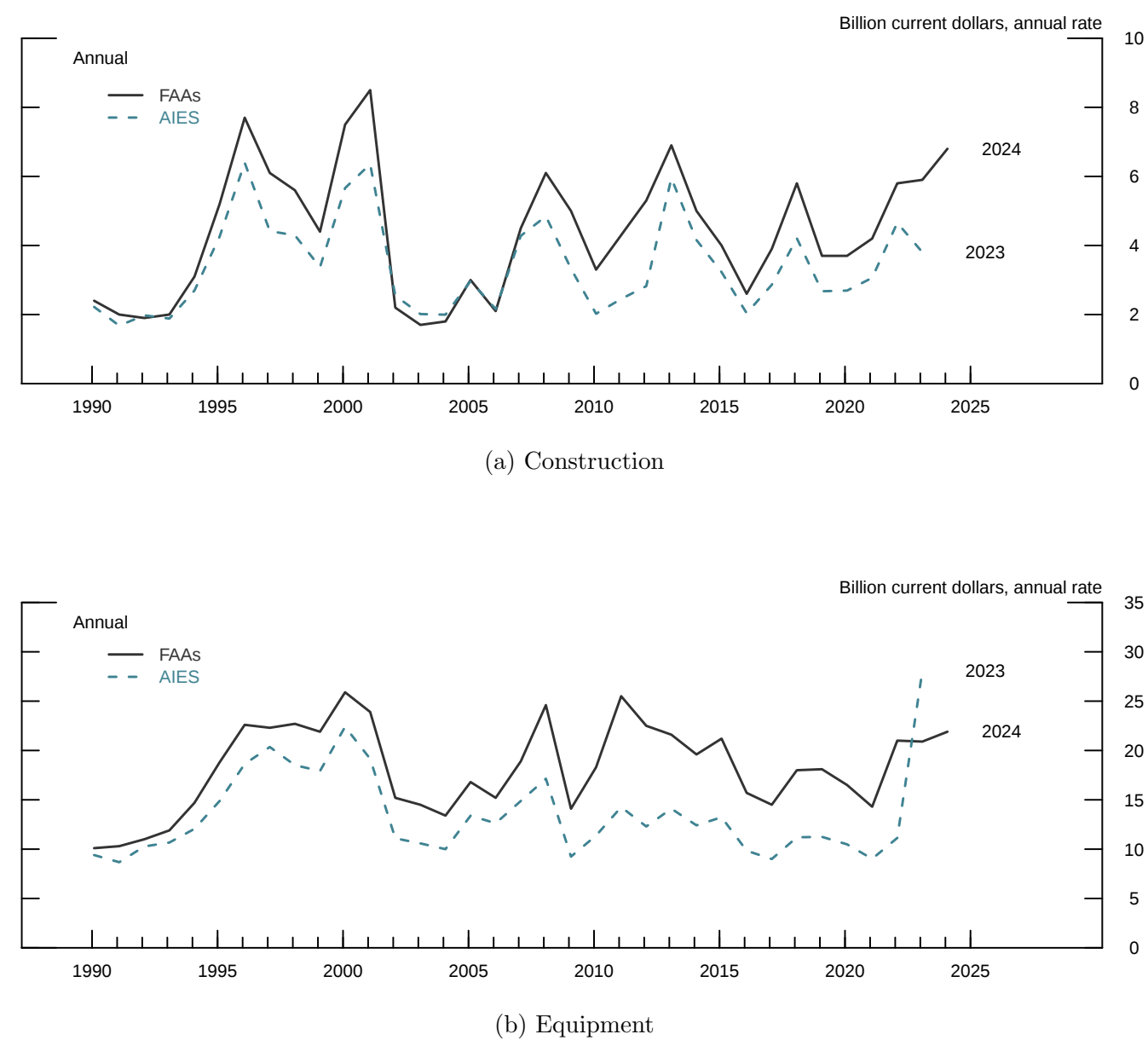
Figure 3: Fab-Related Investment Estimates from the Fixed Asset Accounts



*Note:* The data is annual and spans from 1990 to 2024. Special industry equipment, n.e.c. includes semiconductor manufacturing machinery and other machinery. See Appendix Table A.2 for more detail on the industry categories.

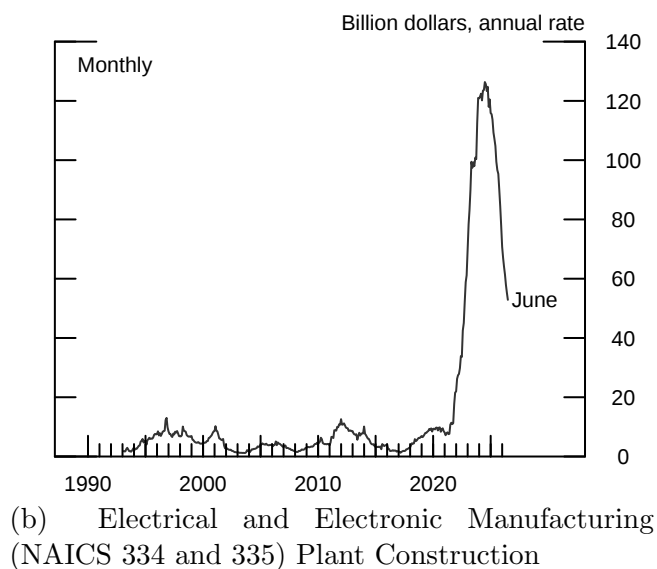
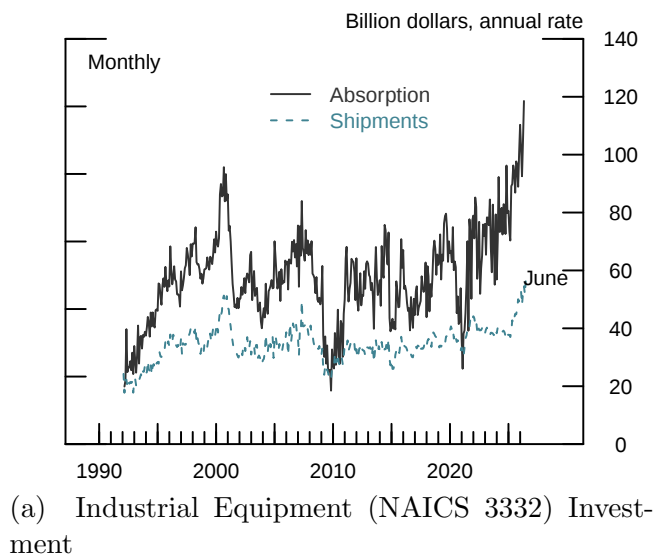
*Source:* BEA FAAs.

Figure 4: Investment Estimates for the Computer and Electronic Products Sector (NAICS 334) from Census AIES and BEA FAAs



*Note:* Data are annual from 1990 to 2023 (AIES) or 2024 (FAAs). See Appendix Table A.1 for spending definitions and Appendix Table A.2 for industry definitions.  
*Source:* Census, AIES; BEA, FAAs.

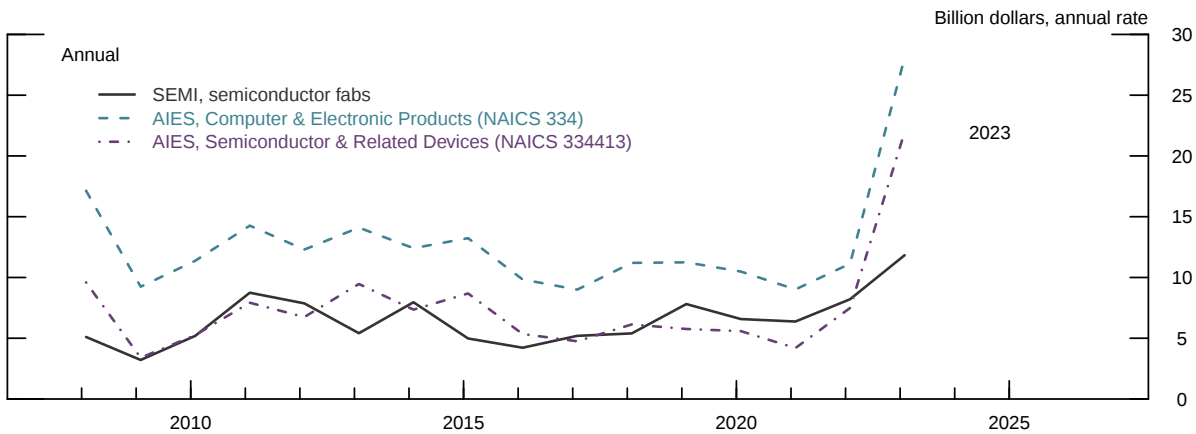
Figure 5: Monthly Measures of Equipment Investment and Construction from Census



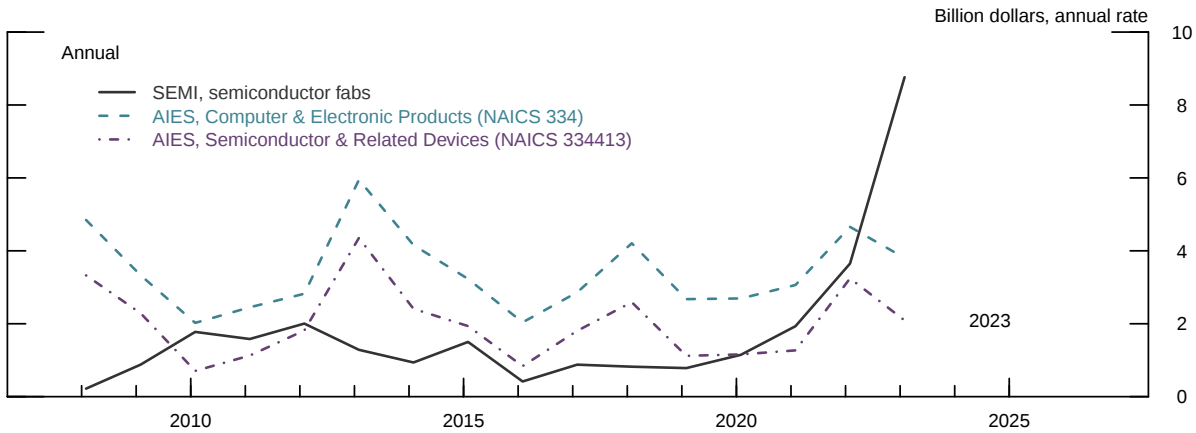
*Note:* The data are monthly and go through June, 2026. Absorption is shipments less net exports. Industrial equipment includes semiconductor manufacturing equipment. See Appendix Table A.1 for more detail on the spending categories and Appendix Table A.2 for industry definitions.

*Source:* For equipment investment, Census M3 survey and ITC data for net exports for the absorption measure. For construction, Census VIP.

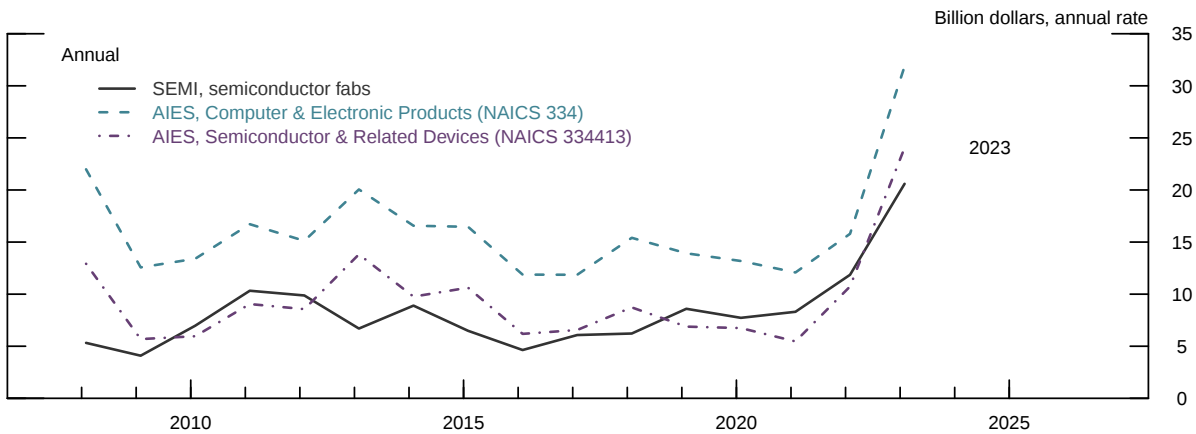
Figure 6: Investment Estimates from SEMI World Fab Forecast and U.S. Census Annual Integrated Economic Survey



(a) Equipment



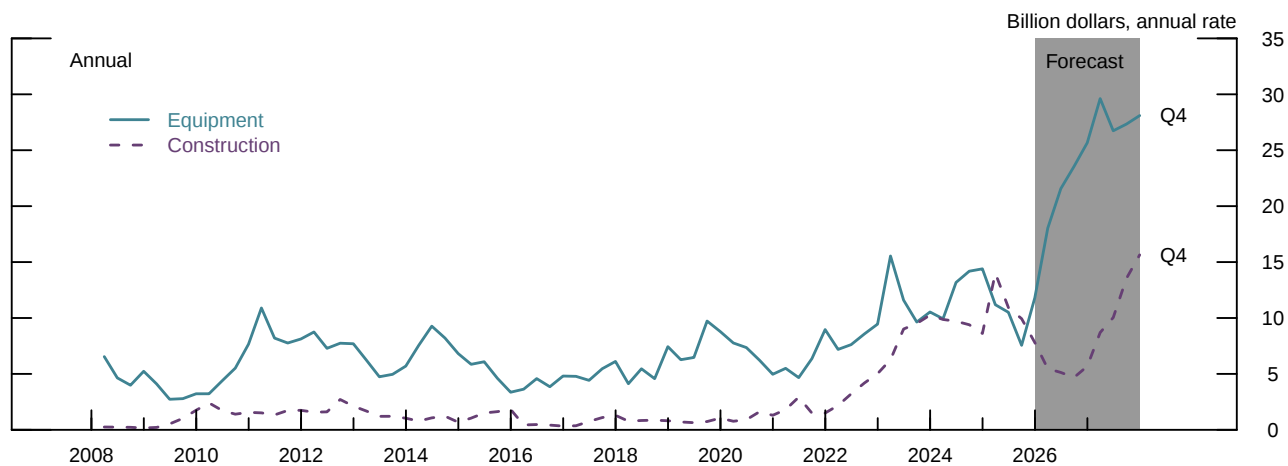
(b) Construction



(c) Total

*Note:* The data is through 2023 for comparability between sources. See Appendix Table A.1 for more detail on the spending categories and Appendix Table A.2 for industry definitions.  
*Source:* SEMI, World Fab Forecast; Census AIES.

Figure 7: Estimates of U.S. Semiconductor Fab Investment by Type from SEMI World Fab Forecast



*Note:* Front-end equipment; excludes test and assembly equipment. Last date prior to forecast is 2025:Q4. Last date of forecast is 2027:Q4. Forecast includes projects SEMI judges to have at least 50 percent likelihood of going forward.

*Source:* SEMI World Fab Forecast.

## A. APPENDIX TABLES

Table A.1: Spending Categories Referenced in the Text

| Source: Spending | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| NIPA: Investment | Structures, equipment, and intellectual property products used in production of goods and services. Creation of new productive assets, improvement of existing assets, and replacement of worn out or obsolete assets                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| NIPA: Equipment  | <ol style="list-style-type: none"> <li>1. Equipment with service lives of 1 year or more that are normally capitalized in business accounting records</li> <li>2. Includes equipment purchased by landlords for rental to tenants.</li> <li>3. Includes dealers' margins on sales of used equipment.</li> <li>4. Includes net business purchases of used equipment from governments, persons, and foreign residents.</li> <li>5. Excludes certain types of equipment that are integral parts of structures and that are included in the value of structures.</li> <li>6. Excludes parts used in the repair and maintenance of equipment, such as semiconductors, civilian aircraft parts, motor vehicle parts, computer parts, etc.</li> </ol> |

Table A.1: Spending Categories Referenced in the Text

| Source: Spending  | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| NIPA: Structures  | <ol style="list-style-type: none"> <li>1. Includes construction of new nonresidential and residential buildings.</li> <li>2. Includes improvements (additions, alterations, and major structural replacements) to nonresidential and residential buildings.</li> <li>3. Includes certain types of equipment (such as plumbing and heating systems and elevators) that are considered an integral part of the structure.</li> <li>4. Includes nonbuilding construction (such as pipelines, railroad tracks, power lines and plants, and dams and levees). Includes mobile structures (such as office trailers at construction sites and temporary trailer classrooms) and manufactured homes. Includes petroleum and natural gas well drilling and exploration, including “dry holes.” Includes digging and shoring of mines.</li> <li>5. Includes brokers’ commissions on sales of new and existing nonresidential structures and includes brokers’ commissions and other ownership transfer costs on sales of new and existing residential structures.</li> <li>6. Includes net purchases (purchases less sales) of existing structures from governments.</li> <li>7. Excludes maintenance and repair of nonresidential and residential buildings.</li> <li>8. Excludes demolition costs not related to the construction of new structures</li> </ol> |
| FAA: Equipment    | NIPA equipment investment less dealer’s margins for used equipment sales                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| FAA: Construction | NIPA construction less broker’s commissions for non-residential structures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| AIES: Equipment   | “The cost of any machinery and equipment which is an integral or built-in feature of a structure should be included as part of that structure, not as equipment.”                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

Table A.1: Spending Categories Referenced in the Text

| Source: Spending   | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| AIES: Construction | <ol style="list-style-type: none"> <li>1. “New construction, major additions, alterations, reconstruction, and capitalized repairs to existing structures.”</li> <li>2. “The cost of any machinery and equipment which is an integral or built-in feature of the structure should be included in the cost reported for that structure. For example, when constructing cellular transmission towers integral equipment should be included in the cost of the structure.”</li> <li>3. “Equipment replacements (such as transmitters located on towers) should be reported as equipment.”</li> </ol> |

Table A.1: Spending Categories Referenced in the Text

| Source: Spending  | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| VIP: Construction | <p>Construction includes the following:</p> <ol style="list-style-type: none"> <li>1. New buildings and structures</li> <li>2. Additions, alterations, conversions, expansions, reconstruction, renovations, rehabilitations, and major replacements</li> <li>3. Mechanical and electrical installations such as plumbing, heating, electrical work, elevators, escalators, central air-conditioning, emergency backup power, and other similar building services.</li> <li>4. Site preparation and outside construction of fixed structures or facilities such as sidewalks, highways and streets, parking lots, utility connections, outdoor lighting, railroad tracks, airfields, piers, wharves and docks, telephone lines, radio and television towers, water supply lines, sewers, water and signal towers, electric light and power distribution and transmission lines, petroleum and gas pipelines, and similar facilities that are built into or fixed to the land.</li> <li>5. Installation of the following types of equipment: boilers, overhead hoists and cranes, and blast furnaces.</li> <li>6. Fixed, largely site-fabricated equipment not housed in a building, primarily for petroleum refineries and chemical plants, but also including storage tanks, refrigeration systems, etc.</li> <li>7. Cost and installation of construction materials placed inside a building and used to support production machinery; for example, concrete platforms, overhead steel girders, and pipes to carry paint, etc. from storage tanks.</li> </ol> |

Table A.1: Spending Categories Referenced in the Text

| Source: Spending    | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| VIP: Construction   | <p>Construction excludes the following:</p> <ol style="list-style-type: none"> <li>1. <i>Excludes</i> maintenance and repairs to existing structures or service facilities.</li> <li>2. <i>Excludes</i> Cost and installation of production machinery and equipment items not specifically covered above, such as heavy industrial machinery, printing presses, stamping machines, bottling machines, and packaging machines; special purpose equipment designed to prepare the structure for a specific use, such as steam tables in restaurants, pews in churches, lockers in school buildings, beds or X-ray machines in hospitals, display cases and shelving in stores, and racks or servers in data centers.</li> <li>3. <i>Excludes</i> Drilling of gas and oil wells, including construction of offshore drilling platforms; digging and shoring of mines (construction of buildings at mine sites is included); work that is an integral part of farming operations such as plowing and planting of crops.</li> <li>4. Land acquisition.</li> </ol> |
| M3: Shipments       | Net shipments (sales) made during the accounting period for domestic manufacturing operations, including shipments of products to other companies, individuals, U.S. Government agencies and foreign customers, as well as shipments and transfers to other divisions or subsidiaries, net of discounts and allowances, exclusive of non-manufacturing activities.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Census/BEA: Imports | Customs value—generally the transaction price at the foreign port roughly free on board                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Census/BEA: Exports | Valued free alongside ship) at the U.S. port of export, excluding international freight/insurance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

Table A.1: Spending Categories Referenced in the Text

| Source: Spending | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| WFF: Equipment   | <p>Chip fabrication equipment includes</p> <ol style="list-style-type: none"> <li>1. “Equipment spending to increase capacity including greenfield, shell, new lines, expansions, change of wafer sizes and in some cases changes of product types. ”</li> <li>2. “Spending to upgrade technology or change product types including upgrades (such as geometries or 3D layers) and change of product types.”</li> <li>3. “General expenditure is needed to operate and maintain fabs (which includes spare parts, replacement of any type of equipment, automation, and other non-process equipment). This expenditure is still used capital expenditure for equipment suppliers.”</li> <li>4. “If SEMI cannot verify with the company directly or with other sources, any ‘capacity related’ expenditure and associated capacity is estimated also applying a matrix which considers wafer size, capacity, product type and geometry.</li> <li>5. “SEMI makes backward corrections once more information becomes available.”</li> </ol> |

Table A.1: Spending Categories Referenced in the Text

| Source: Spending  | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| WFF: Construction | <ol style="list-style-type: none"> <li>1. “Construction of the semiconductor manufacturing plant itself, including supporting facilities such as utilities, gas, and electrical infrastructure. The construction phase extends until the cleanroom is ready for equipment move-in.”</li> <li>2. “Construction expenditure can be either announced specifically as construction expenditure or it is based on total announced expenditure of the fab (including equipment). In this case, a cost model is used to determine the cost of construction. This cost model considers the cost per cleanroom square foot and the share of construction spending to total project spending and adjust using many variables such as wafer size, location, product type and size of fab.</li> <li>3. “In almost all cases SEMI uses their fab model and applies best-educated estimates for the quarterly expenditures of construction cost unless this is publicly available.”</li> </ol> |

*Note:* “NIPA” is “National Income and Product Accounts” published by BEA; “FAA” is “Fixed Asset Accounts” published by BEA; “AIES” is “Annual Integrated Economic Survey” published by U.S. Census; “VIP” is “Value of Construction put in Place” published by U.S. Census; “M3” is “Manufacturers’ Shipments, Orders, and Inventories” published by U.S. Census; “WFF” is “World Fab Forecast” published by SEMI.

Table A.2: Industry Categories Referenced in the Text

| NAICS                                           | Title                                                        | Coverage relevant to the note                                                                                                                                                                                                                                                                                                      |
|-------------------------------------------------|--------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Subsector aggregations (three-digit)</i>     |                                                              |                                                                                                                                                                                                                                                                                                                                    |
| 334                                             | Computer and Electronic Product Manufacturing                | Semiconductor fabs <i>and</i> computer, communications equipment, and electronic instrument manufacturing plants.<br>Shown as the structures and equipment lines in Figure 3, in the construction and equipment panels of Figure 4, combined with 335 as the construction line in Figure 5b, and as the AIES 334 line in Figure 6. |
| 335                                             | Electrical Equipment, Appliance, and Component Manufacturing | Combined with 334 in the VIP construction category; includes the battery-plant boom that overlaps the fab buildout.<br>Shown combined with 334 as the construction line in Figure 5b.                                                                                                                                              |
| <i>Industry group aggregations (four-digit)</i> |                                                              |                                                                                                                                                                                                                                                                                                                                    |
| 3332                                            | Industrial Machinery Manufacturing                           | Industry-specific machinery manufacturing. Excludes general-purpose machinery used in a range of industries, such as HVAC equipment. Shown as the industrial equipment absorption line in Figure 5a.                                                                                                                               |
| <i>Industry (six-digit)</i>                     |                                                              |                                                                                                                                                                                                                                                                                                                                    |
| 333242                                          | Semiconductor Machinery Manufacturing                        | Includes plants manufacturing fab equipment as well as back-end (test and assembly) equipment.<br>Included in industry equipment in Figure 3 and in Figure 5a.                                                                                                                                                                     |
| 334413                                          | Semiconductor and Related Device Manufacturing               | Includes chip fabs as well as plants manufacturing raw wafer, test and assembly plants, and solar cell manufacturing plants.<br>Shown as the AIES 334413 line in Figure 6.                                                                                                                                                         |

*Note:* Industry codes based on 2022 NAICS.