Tracing the Import Sources of Semiconductor Manufacturing Equipment

Nathan Lotze, Office of Industry and Competitiveness Analysis

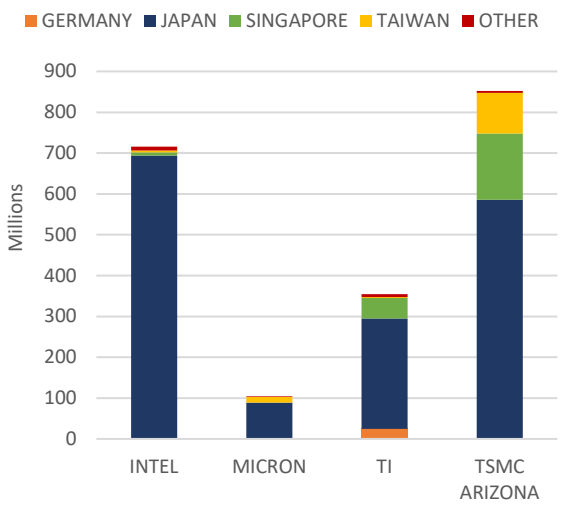
To support increased investment in U.S. semiconductor[1] manufacturing capacity, chip makers must acquire additional semiconductor manufacturing equipment (SME). Using Bill of Lading data, this EBOT traces the sources of SME imports for four domestic firms with new manufacturing projects. Japan was their leading source of SME imports by value (81 percent), driven by firms like Tokyo Electron.

Overview: As a result of COVID-19 related semiconductor supply chain shortages, both industry and policy makers have pursued efforts to increase domestic chip manucturing capacity in the United States. Public and private investment has spurred the construction of new semiconductor manufacturing facilities, also known as "fabs," as well as the expansion of existing ones. With new and expanded fabs, however, comes the need for more semiconductor manufacturing equipment (SME).

SME refers to a broad range of products used to manufacture chips. It can include goods like lithography systems, deposition and etching equipment, as well as metrology tools. The United States is one of the leading exporters of SME, accounting for 17 percent ($20 billion) of global exports in 2023. However, countries outside of the United States, such as Japan (21 percent), the Netherlands (21 percent), and Singapore (18 percent) are also major exporters. This paper seeks to understand the specific U.S. import sources, including country and supplier, used by four semiconductor firms with notable domestic fab projects: Intel, Micron, Texas Instruments (TI), and TSMC.

Supplier Analysis: A Bill of Lading (BOL) is a document used in sea transport, which serves as a contract of carriage, transport receipt, and legal title for the goods being shipped. Public access to BOL data are restricted in the U.S. to only sea-based trade, therefore this data excludes ground and air-based imports. According to data compiled from BOLs, these four firms directly imported $2 billion worth of SME 2019–2023.[2] Japan was the dominant source (figure 1), accounting for 81 percent of imports, followed by Singapore (11 percent), and Taiwan (6 percent). The largest suppliers by share of estimated import value (figure 2) were also Japanese headquartered firms: Tokyo Electron (52 percent) and Murata Machinery (12 percent). The Arizona subsidiary of TSMC, a Taiwanese foundry, imported a substantially large share of SME from Taiwan relative to the other three firms. However, 67 percent of its imports from Taiwan came from Japan's Murata Machinery, who has operations in Taiwan.

Figure 1. Sources of SME Imports by Domestic Chip Maker 2019-2023 (in millions $USD)

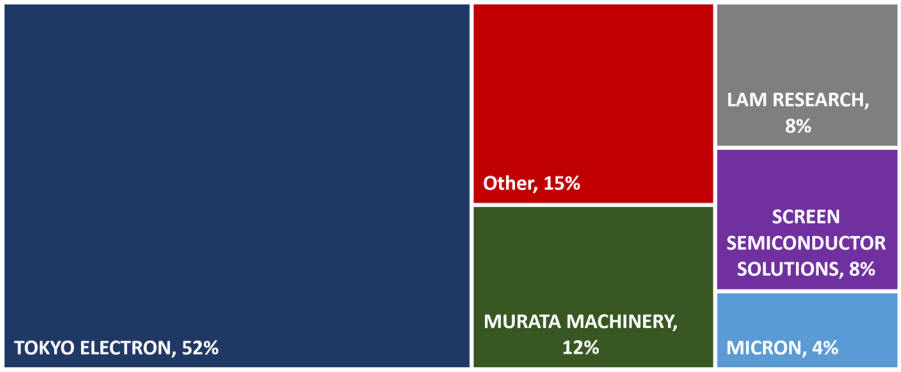


Source: S&P Global, Global Trade Atlas, accessed March 28, 2024. HS heading 8486. Note: The earliest imports in the data set occur in March 2019.

[1] "Semiconductor" and "chip" are used interchangeably in this EBOT.

[2] Data does not capture SME imported by a domestic third party before being purchased by these firms.

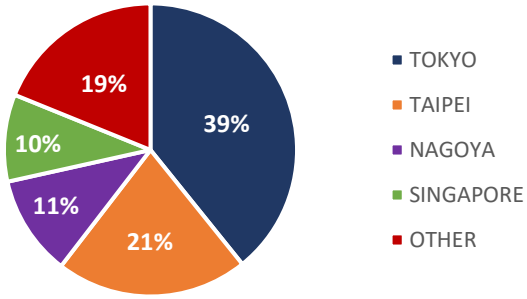
Figure 2. Share of SME Import Value by Supplier 2019-2023



Source: S&P Global, Global Trade Atlas, accessed March 28, 2024. HS heading 8486. Note: Micron is a memory chip manufacturer, not an SME manufacturer. Most transactions in the dataset where Micron was the supplier were intracompany. Intel's recent purchases of lithography equipment from Dutch firm ASML are not present in the data due to their shipment via plane.

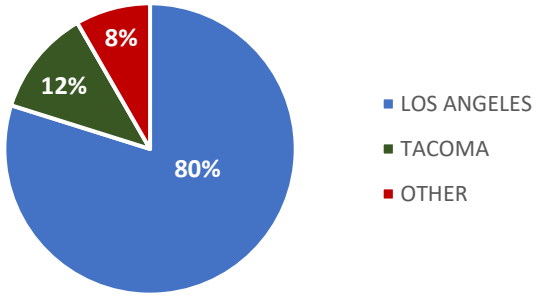
Port Analysis: Unsurprisingly, Japan contains critical ports of departure for these direct SME imports (figure 3). Tokyo (39 percent) accounted for the largest share by value and Nagoya (11 percent) accounted for the third most. Outside of Japan, the ports of Taipei (21 percent) and Singapore 10 (percent) also accounted for significant export shares. On the U.S. side, port activity was highly concentrated (figure 4), with Los Angeles serving as the port of arrival for 80 percent of these direct SME imports by value.

Figure 3. SME Import Value by Port of Departure 2019-2023



Source: S&P Global, Global Trade Atlas, accessed March 28, 2024. HS heading 8486. Note: Some imports may have a country of origin in the BOL that differs from the port of departure country.

Figure 4. SME Import Value by Port of Arrival 2019-2023



Source: S&P Global, Global Trade Atlas, accessed March 28, 2024. HS heading 8486.

Conclusion: With funding from the CHIPS and Sciences Act recently being awarded to Intel and TSMC for new and expanded fabs in the United States, this data suggests Japan and Japanese firms will likely be among the major foreign beneficiaries of increased U.S. SME demand.

Sources: VerWey, "What's Causing U.S. Semiconductor Equipment Production and Exports to Grow?," January 2019; Adams, "Where Are All the New Semiconductor Fabs in North America & Europe?," September 12, 2023; S&P Global, Global Trade Atlas Maersk; "Bill of Lading - What Is It and Why Is It Important?," October 2, 2023; Flaaen et al., "Bill of Lading Data in International Trade Research with an Application to the COVID-19 Pandemic," October 15, 2021; Shilov, "Intel Shares Biggest Unboxing Video Ever," March 4, 2024; Holland, "CHIPS and Science Act Funds TSMC, Intel Projects," April 8, 2024.