How Does Semiconductor Trade Work?

Chris Miller

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Key Points

- Trade data on semiconductors are skewed due to the underreporting of imported semiconductors found in finished products like cars and phones. Any tariffs on semiconductors must carefully consider the structure of supply chains to avoid unintended consequences.
- Much of the $40 billion of chips the US imports are actually made in the US, packaged abroad, and reimported, so tariffs would senselessly penalize domestic manufacturers. Since the US lacks packaging capacity, higher tariffs would raise costs and hurt competitiveness in key industries.
- The US should focus tariffs on Chinese-made chips while striking sectoral trade deals with allies that commit both sides to zero tariffs, reducing nontariff barriers, and continuing to invest in diversified supply chains.

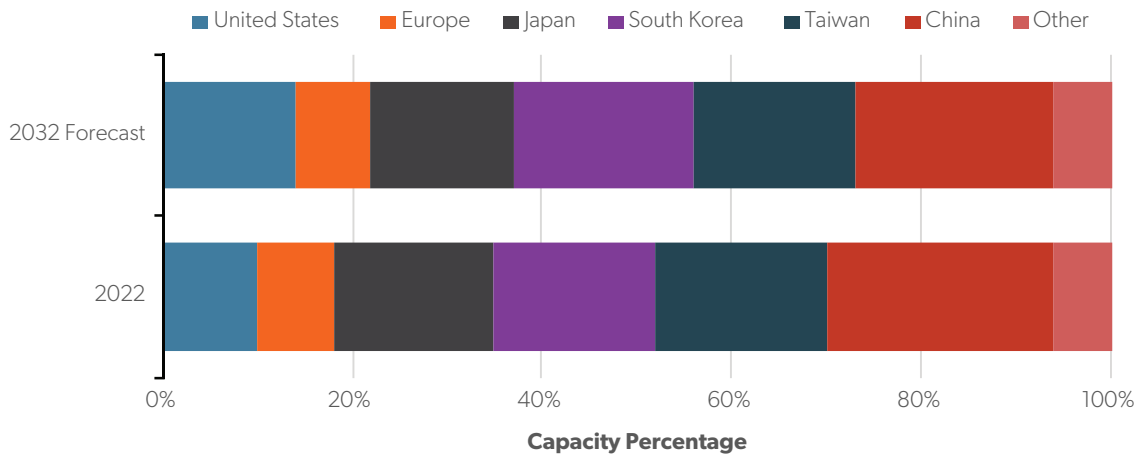
How is it that South Korea—one of the world's most important makers of the chips critical for goods from cars to computers—imports more semiconductors from the United States than it exports? Semiconductor supply chains are immensely complex. Some of the trade dynamics, like America's unexpected surplus in chip trade with South Korea and its roughly balanced chip trade with Taiwan, look puzzling. Anyone trying to understand the potential impact of tariffs on semiconductors, which President Donald Trump has repeatedly threatened, must start by examining the shape of semiconductor trade today.

To start, note that trade data—and most tariffs—refer to products crossing borders. A car shipped from Mexico to the US is categorized as a "car"; the four wheels are ignored. An iPhone shipped from China to the US is a "phone" even though batteries, cameras, chips, and speakers are all components inside.

Today, production of complex manufactured goods like electronics and machinery involves components sourced from many different countries. A typical smartphone, for example, might involve chips from Taiwan, screens from South Korea, printed circuit boards from Taiwan, batteries from China, cameras from Japan, and intellectual property from the US. (The intellectual property—designs, know-how, brands, and the like—aren't captured by tariffs, which apply only to goods, not ideas.) Trade data and tariffs therefore are a blunt instrument for reshaping trade because they "see" only the completed device, not the number of components inside or their origins.

This fact dramatically affects data on trade in chips. According to trade data, semiconductors flow primarily to countries that assemble electronics and machinery—places like Vietnam and, above all, China. These countries export completed goods, which have

Figure 1. Global Wafer Fabrication Capacity by Region



Source: Raj Varadarajan et al., *Emerging Resilience in the Semiconductor Supply Chain*, Boston Consulting Group and Semiconductor Industry Association, May 2024, https://web-assets.bcg.com/25/6e/7a123efd40199020ed1b4114be84/emerging-resilience-in-the-semiconductor-supply-chain-r.pdf.

semiconductors inside. Yet the trade data show China exporting "phones" and "computers" and ignore the chips embedded inside these devices.

As a result, most of the chips that enter the US are not captured by trade data because these semiconductors are embedded inside imported devices. Global semiconductor sales in 2024 were $627 billion, of which the US is estimated to consume 25 percent, or $156 billion.[1] The US produces 10 percent of the world's semiconductors.[2] On the assumption that US-made chips are roughly equivalent in value to the global average, the US thus produces $68 billion of chips. It imports only $40 billion.[3] In other words, around $50 billion of net imports of semiconductors are "hidden" in the trade data, imported as components of other goods.

The following figures illustrate these trends. Figure 1 is an estimate of production capacity by region. Not all chips are equal in value—those produced in China are generally lower than average; those in Taiwan and South Korea are on average higher—but this provides a rough sense of chip production by region. The US today produces a small share of the world's chips.

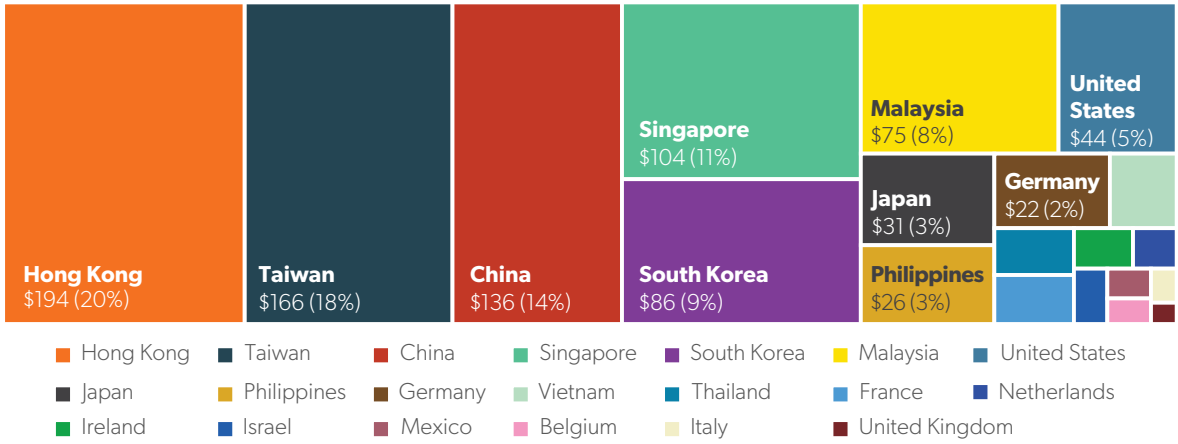
The US accounts for roughly a quarter of world gross domestic product (GDP) and—assuming GDP is broadly correlated with chip usage—thus consumes around a quarter of the world's chips. It therefore must import on net around 15 percent of global chip production which, combined with the roughly 10 percent of chips produced domestically, would sum to a quarter of the world's chips.

The trade data show nothing of the sort. Per UN data, total chip exports were around $800 billion in 2023 (Figure 2).[4] (This number is somewhat inflated by the fact that UN data consider Hong Kong and China separate for customs purposes; thus a chip shipped from Hong Kong to China is an export.) The US reports importing only $40 billion in chips.

However, the US does not report importing 15 percent of world exports. Far from it. It reports only $40 billion in chip imports—3 percent of world imports (Figure 3). Add this 3 percent of official imported chips to the roughly 10 percent of the world's chips that the US produces, and it's clear that domestic production and reported imports can account for only half of US chip consumption. (Remember, the US consumes roughly a quarter of the world's chips.) In other words, something around 10 percent of global chip production enters the US embedded in other goods—phones, computers, dishwashers, etc.—and thus isn't counted as a "chip" in trade data.

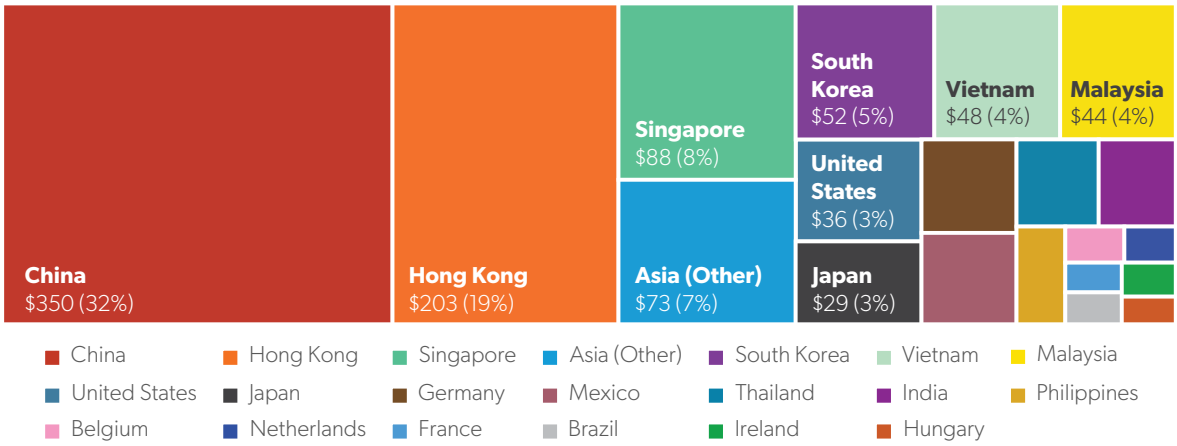
Figure 4 shows US chip imports in 2024. Two things stand out. First, as noted above, the small size—only $40 billion of imports. Second, how different the US trade partners are from the list of the world's largest chip manufacturers. As noted above, China, South Korea, and Taiwan are some of the world's largest chip manufacturers. But some of the largest exporters of

Figure 2. 2023 World Chip Exports (US Dollars, Billions)



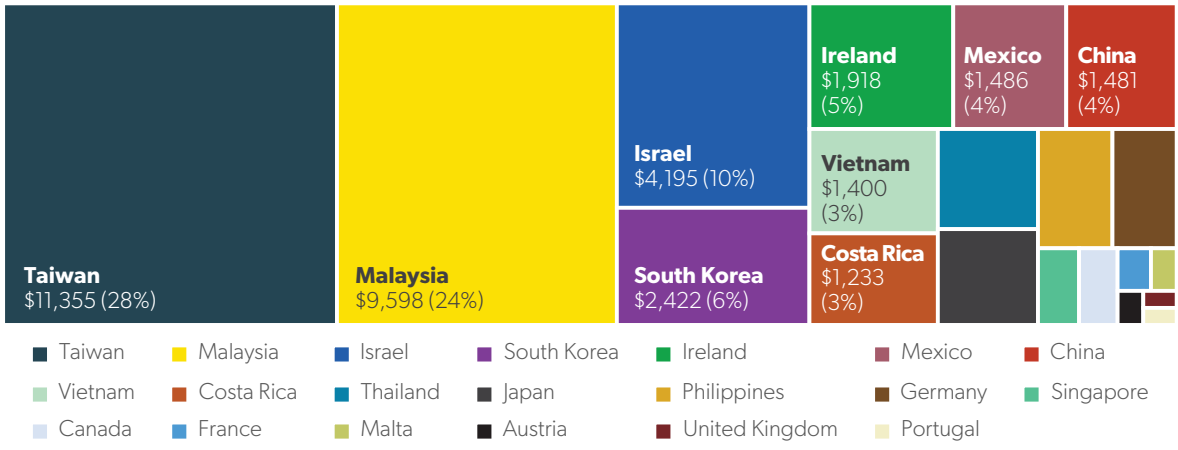
Source: UN Comtrade Database, Trade Data, https://comtradeplus.un.org/tradeflow.

Figure 3. 2023 World Chip Imports (US Dollars, Billions)



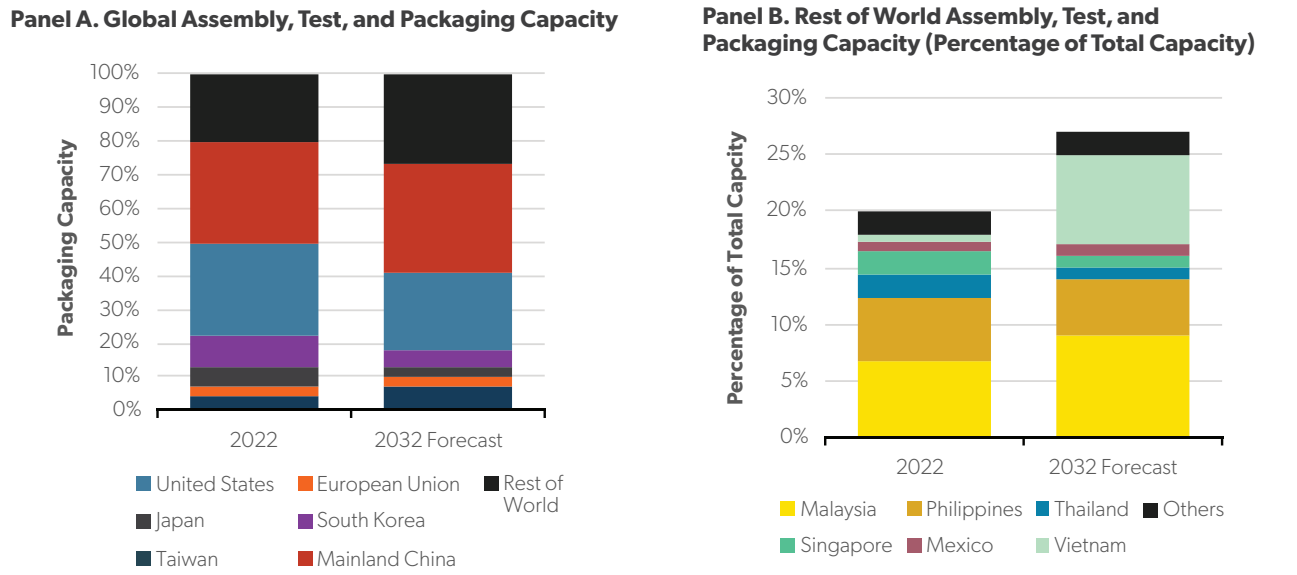
Source: UN Comtrade Database, Trade Data, https://comtradeplus.un.org/tradeflow.

Figure 4. 2024 US Chip Imports (US Dollars, Millions)



Source: UN Comtrade Database, Trade Data, https://comtradeplus.un.org/tradeflow.

Figure 5: Assembly, Test, and Packaging Capacity Distribution by Region



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chips to the US are countries like Malaysia, Mexico, the Philippines, and Vietnam, which manufacture few or no chips.

What's also striking is how few chips the US imports from China, Taiwan, and especially South Korea. Per 2023 data, the US imported $4 billion from China and less than $1 billion from South Korea. By contrast, it *exported* more—over $11 billion to China (including Hong Kong) and over $2 billion to South Korea.[5] In other words, the US runs a substantial trade surplus in chips with two of the countries that produce the world's most chips.

How can this be? It's partly, as noted above, about chips sent from Taiwan and South Korea to China that are then embedded in devices, which then enter the US counted as phones and computers, not as chips. It's also partly because chips are often manufactured in one country, then packaged and assembled in another.

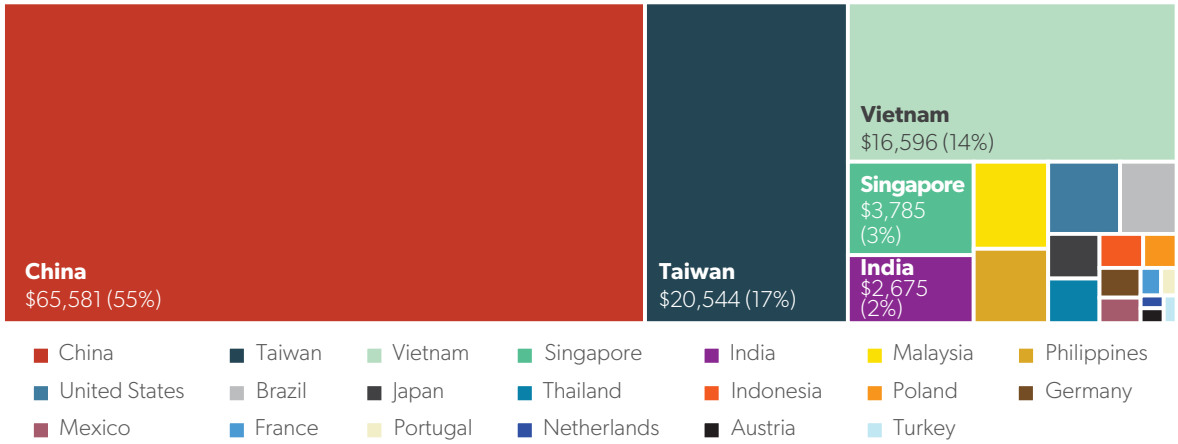
In the chip industry, packaging refers to an often complex manufacturing process of placing a completed silicon chip in a plastic package and connecting it with other devices. Packaging is much less difficult than manufacturing the chip itself and is more labor-intensive. As Figure 5 shows, most of the world's packaging occurs in Taiwan, China, and Southeast Asia. This explains why the US imports so many chips from the region—because it is importing packaged chips.

These dynamics have major implications for the trade patterns of major chipmakers like Taiwan and South Korea, too. South Korea exports most of its chips to China (including Hong Kong). But the second-most-important export destination is Vietnam, which is home to a growing packaging industry and much of Samsung's phone and other device assembly business. (See Figure 6.) As a result, Vietnam imports far more chips ($48 billion) than the United States ($40 billion).[6] Yet most of Vietnam's imports are later reported either as packaged chips or as finished smartphones and other devices.

Taiwan has similar dynamics. Over half of Taiwan's chips go to China—including chips that are then assembled into iPhones and sold worldwide. Singapore, Malaysia, Thailand, and Vietnam are also important export customers, while the US and Europe, which consume many of the world's phones, computers, and other electronics, are almost invisible in Taiwan's chip exports (Figure 7). A similar dynamic is present in Japan's chip exports, too (Figure 8).

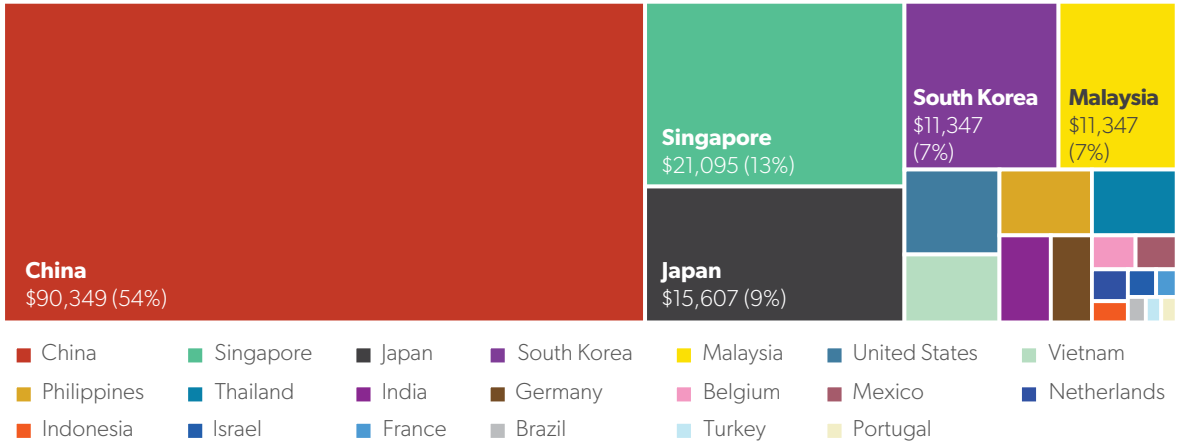
Another interesting nuance in the trade data is that some of the biggest exporters of chips to the US are also major importers of chips from the US. This is

Figure 6. 2024 South Korea Chip Exports (US Dollars, Millions)



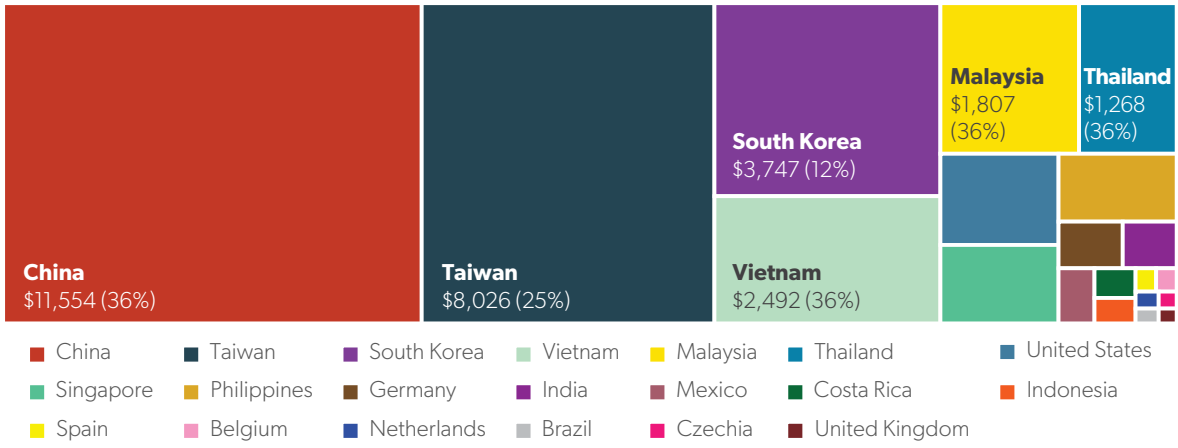
Source: UN Comtrade Database, Trade Data, https://comtradeplus.un.org/tradeflow.

Figure 7. 2023 Taiwan Chip Exports (US Dollars, Millions)



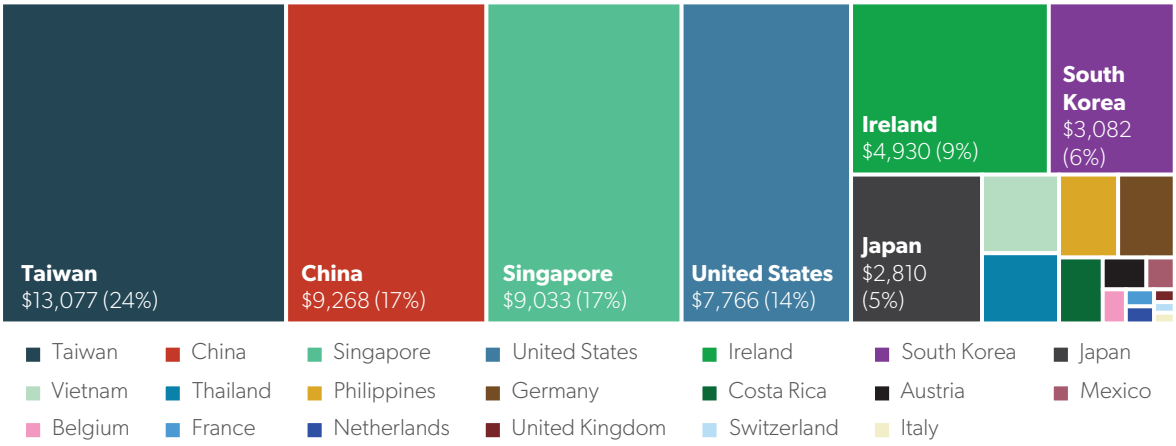
Source: UN Comtrade Database, Trade Data, https://comtradeplus.un.org/tradeflow.

Figure 8. 2024 Japan Chip Exports (US Dollars, Millions)



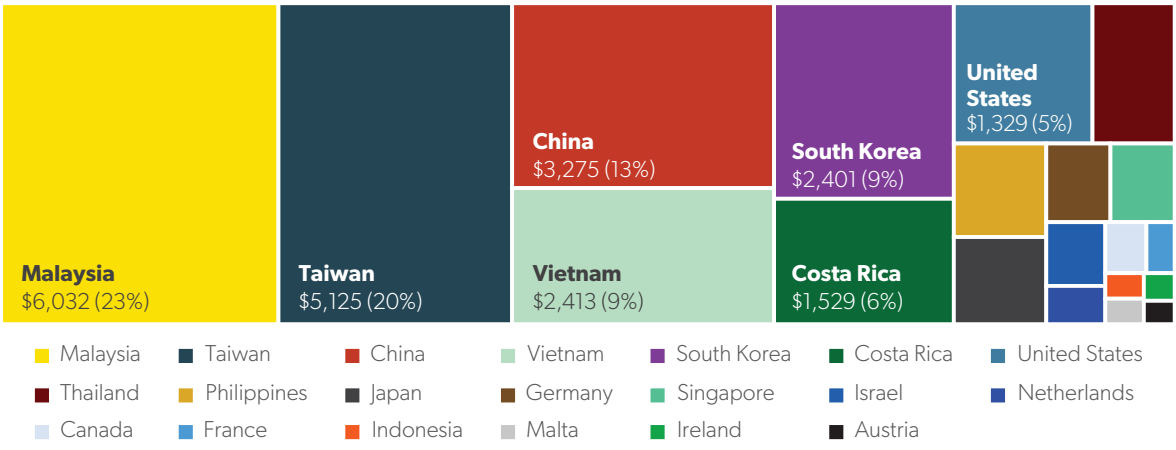
Source: UN Comtrade Database, Trade Data, https://comtradeplus.un.org/tradeflow.

Figure 9. 2024 Malaysia Chip Imports (US Dollars, Millions)



Source: UN Comtrade Database, Trade Data, https://comtradeplus.un.org/tradeflow.

Figure 10. 2024 Mexico Chip Imports (US Dollars, Millions)



Source: UN Comtrade Database, Trade Data, https://comtradeplus.un.org/tradeflow.

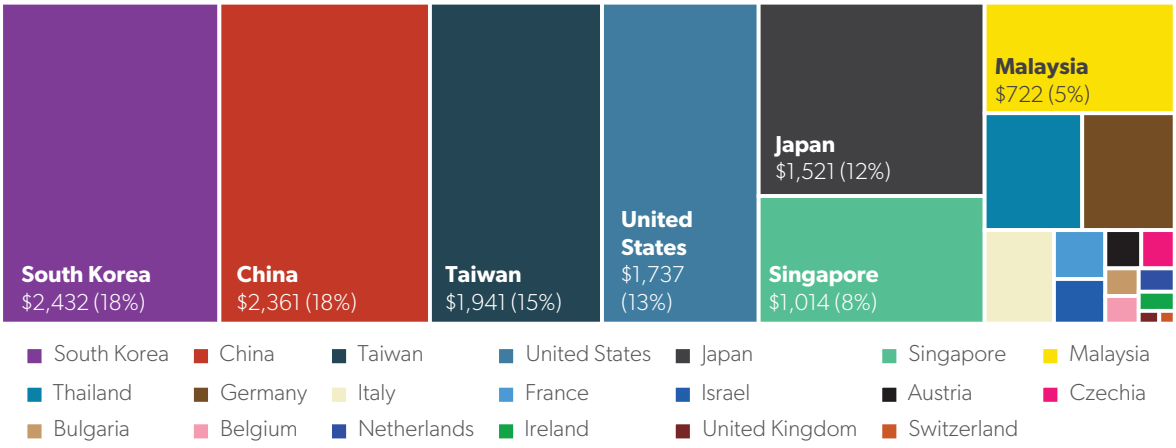
mostly evidence of chips being produced in the US and then packaged in lower-cost countries.

Some of the United States' key export partners for chips are also big importers of (unpackaged) chips from the US. Malaysia, for example, imports over 10 percent of its chips from the US, while Mexico imports 60 percent of its chips from the US. In other words, many of the chips that the US is importing are actually chips that are manufactured in the US and then packaged abroad before being imported back into the US. For example, firms like Intel and Texas Instruments have their manufacturing plants largely in the US, while they have packaging facilities in places like Costa Rica, Malaysia (Figure 9), Mexico (Figure 10), and the Philippines (Figure 11).

What does this analysis of semiconductor trade imply for debates about semiconductor tariffs? The US government is undertaking a Section 301 investigation into Chinese subsidies for its chip industry and the impact on trade and a Section 232 investigation on the national security implications of US reliance on imported semiconductors.[7] These investigations must consider the structure of chip supply chains as they prepare policy recommendations. Four conclusions stand out.

First, if these investigations focus solely on the $40 billion in chips that the US imports (i.e., the chips

Figure 11. 2024 Philippines Chip Imports (US Dollars, Millions)



Source: UN Comtrade Database, Trade Data, https://comtradeplus.un.org/tradeflow.

that cross the border as chips rather than as components in devices like phones or computers), they will miss the majority of the foreign-made semiconductors that the US consumes.

Second, many of the chips among the $40 billion in chips that the US imports are actually chips made in the US, packaged abroad, and then reimported to the US. Imposing tariffs on these chips would penalize manufacturers who are already conducting their high-value manufacturing steps in the United States.

Third, because the US has hardly any chip packaging capacity, we know that the chips imported into the US are almost all converted into final goods in the US. In other words, they are assembled into cars, medical devices, aerospace equipment, and other products. Increasing tariffs on imported chips would make manufacturing in these segments more expensive and less competitive.

Finally, for countries—above all China—that have significant trade barriers to US firms, including a track record of poor intellectual property protection and localization requirements, imposing tariffs only on imported semiconductors will miss the majority of chips that enter the US inside other devices. As a result, when it comes to made-in-China chips, the US should consider a tariff regime that looks inside devices and imposes tariffs based on the chip content inside. However, it makes sense to impose such a regime only on countries that actually have significant trade barriers in chips. Most key chipmaking countries, including Japan, South Korea, Taiwan, and Southeast Asian countries, have no such barriers and no tariffs on chips. China is the world's leader when it comes to subsidies and nonmarket practices in the chip industry, so any future tariffs should focus on China's unique market distortions rather than affecting countries that do not have significant trade barriers on tariffs. Overly broad chip tariffs would make United States–based manufacturing more expensive while punishing firms that have factories here. A China-focused chip tariff, by contrast, would have a limited impact on US manufacturers and would hit the primary source of trade distortions in the chip market.

About the Author

Chris Miller is a nonresident senior fellow at the American Enterprise Institute, where he focuses on Russian foreign policy, politics, and economics; Russia and Ukraine; Russian-European relations; and Eurasia. He also focuses on semiconductors and the geopolitics of technology.

Notes

1. Semiconductor Industry Association, "Global Semiconductor Sales Increase 19.1% in 2024; Double-Digit Growth Projected in 2025," press release, February 7, 2025, https://www.semiconductors.org/global-semiconductor-sales-increase-19-1-in-2024-double-digit-growth-projected-in-2025/.
2. Raj Varadarajan et al., *Emerging Resilience in the Semiconductor Supply Chain*, Boston Consulting Group and Semiconductor Industry Association, May 2024, https://web-assets.bcg.com/25/6e/7a123efd40199020ed1b4114be84/emerging-resilience-in-the-semiconductor-supply-chain-r.pdf.
3. UN Comtrade Database, Trade Data, https://comtradeplus.un.org/tradeflow.
4. UN Comtrade Database, Trade Data.
5. UN Comtrade Database, Trade Data.
6. UN Comtrade Database, Trade Data.
7. David Lawder, "Biden Launches New Chinese Chips Trade Probe, Will Hand Off to Trump," Reuters, December 23, 2024, https://www.reuters.com/technology/biden-launches-new-us-trade-probe-into-legacy-chinese-chips-2024-12-23/; and Patrick Wingrove and David Lawder, "US Steps Up Probes into Pharmaceutical, Chip Imports, Setting Stage for Tariffs," Reuters, April 15, 2025, https://www.reuters.com/markets/us-initiates-section-232-investigations-into-pharmaceutical-semiconductor-2025-04-14/.