

May 24, 2021

Taiwan and the Risk of Deglobalizing the World's Semiconductor Industry: Part I

(Note: Due to the upcoming Memorial Day holiday, the next report will be published on June 7.)

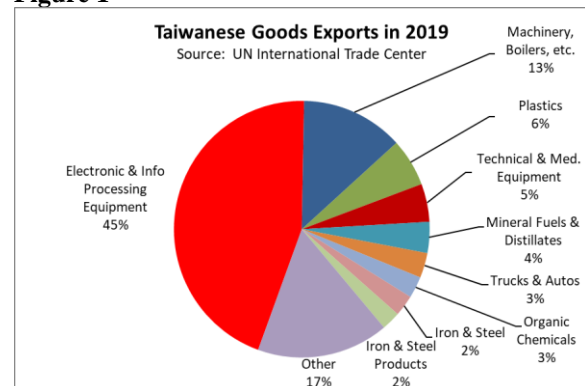
In our recent *WGR* series titled “The Geopolitics of Taiwan” (see [Parts I, II, and III](#)), we examined Taiwan’s geopolitical position in relation to China and the United States. We described how both China and the U.S. want the island in their camp, and we explored what each country might do to achieve that goal. Any friction between great powers like China and the U.S. can be dangerous, but the struggle over Taiwan is especially fraught because of the island’s unique position in the global semiconductor supply chain. In Part I of this report, we explain why Taiwan and the Taiwan Semiconductor Manufacturing Company (TSM, \$111.85) represent a key vulnerability in the global computer chip industry. Part II will discuss the economic and financial implications if Taiwan and the company are forced to deglobalize and join either a U.S. or Chinese economic bloc.

Taiwan and the Global Tech Sector

The first step in understanding a country’s place in the global supply network is to look at the volume and structure of its exports. In 2019 (the last full year before the disruptions of the coronavirus pandemic), Taiwan’s merchandise exports were valued at \$329.5 billion, ranking it just behind Spain but slightly ahead of India and Switzerland among the world’s top

exporting nations. Taiwanese goods exports in 2019 equaled 54.0% of the island’s gross domestic product (GDP), several times the shares for China and the U.S. As shown in Figure 1, some 45% of Taiwan’s goods exports in 2019 consisted of Electronic & Information Processing Equipment. If we also count the island’s advanced machinery, technical equipment, and medical apparatus, we can say without exaggeration that more than half of Taiwan’s exports consists of high-technology products. In other words, more than one-quarter of Taiwanese economic activity stems directly from selling high-technology goods abroad.

Figure 1



Naturally, Taiwan also imports a lot. In 2019, its imports had a total value of some \$285.9 billion, resulting in an overall merchandise trade surplus of \$43.6 billion. To capture Taiwan’s key trade dynamics, Figure 2 compares the dollar value of its exports and imports by product at an especially low level of detail (i.e., using the UN International Trade Center’s four-digit classification codes). The chart is designed to encompass at least Taiwan’s top five exports, imports, surpluses, and deficits.

The chart reflects three key aspects of Taiwan’s overall trade position in the world:

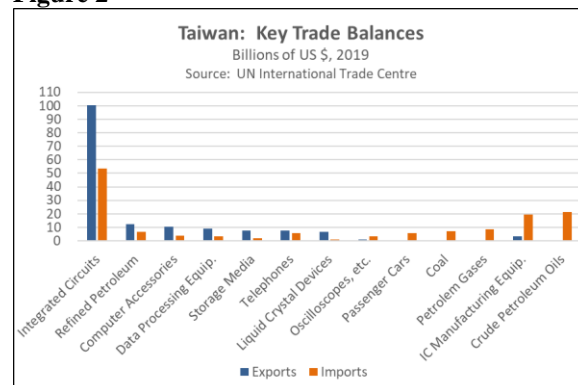
Dominance of TSMC Computer Chips.

The product that truly dominates Taiwanese international trade is the electronic integrated circuit (using the UN’s parlance). This product, also known as the “semiconductor” or “computer chip,” serves as the critical electronic brain or logic processor behind virtually all of today’s “smart” electronics. Integrated circuits or computer chips accounted for \$100.4 billion of Taiwan’s exports in 2019, representing 30.5% of the island’s total merchandise sales abroad and 68.1% of its Electronic & Information Processing Equipment exports. As we discuss below, much of Taiwan’s computer chip exports consists of highly advanced, cutting-edge semiconductors that currently can be produced profitably only in Taiwan and South Korea. [The cutting-edge chips from Taiwan Semiconductor Manufacturing Company \(also known as TSMC\) alone account for more than one-third of Taiwanese computer chip exports.](#)

Exports of Other High-Tech Goods. As Figure 2 shows, Taiwan also relies heavily on the export of other goods related to high technology, such as computer accessories, other data processing equipment, digital storage media, and liquid crystal displays. The value of those exports pales in comparison to the island’s computer chips, but they still make up an important part of Taiwan’s export sector. Since many of these goods incorporate less advanced computer chips produced in other countries, they also help explain why Taiwan imports so many integrated circuits. Taiwan may specialize in producing and exporting the world’s most advanced computer chips, but the rest of its technology sector still needs to import simpler, commodity-like chips from abroad.

Reliance on Key Imports. The final major point illustrated by Figure 2 is that Taiwan is dependent on certain key imports. Like many advanced economies, it must purchase much of its energy from abroad. Just as important, Taiwan also imports most of the advanced, cutting-edge machines needed to manufacture its computer chips. Taiwanese imports of semiconductor manufacturing equipment totaled \$19.3 billion in 2019, representing almost one-quarter of all semiconductor manufacturing equipment exported worldwide that year. TSMC, which spends some \$30 billion per year on all kinds of capital equipment, accounted for the lion’s share of Taiwan’s total imports of semiconductor manufacturing equipment. Geopolitically, these dependencies on foreign chipmaking equipment, semiconductors, oil, and the like show that Taiwan, in general, and TSMC, in particular, would be quite vulnerable to a trade blockade or similar supply chain disruption as we discuss later in this report.

Figure 2

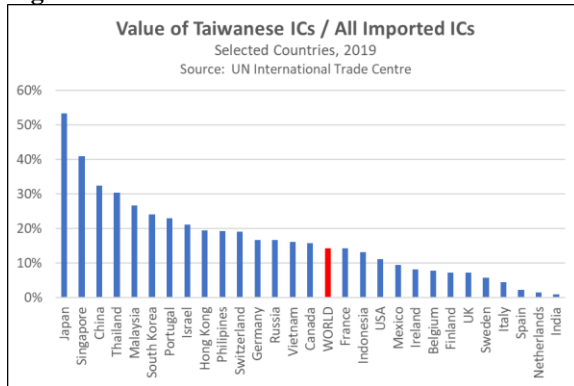


TSMC and the Global Chip Industry

We now shift our focus more directly to the global computer chip industry and TSMC. In 2019, countries around the world imported \$702.2 billion of integrated circuits, ranging from the highly advanced chips produced in Taiwan and South Korea to the older, less sophisticated chips produced in places like China, Singapore, the U.S., and Japan. Taiwan’s chip exports

of \$100.4 billion in 2019 represented a global market share of 14.3%. However, as shown in Figure 3, some countries are even more dependent on Taiwan for their computer chips, including many East Asian countries like Japan, China, Thailand, and Malaysia. As shown in the chart, Japan got more than half its computer chips from Taiwan in 2019, and China got almost one-third of its chips from the island.

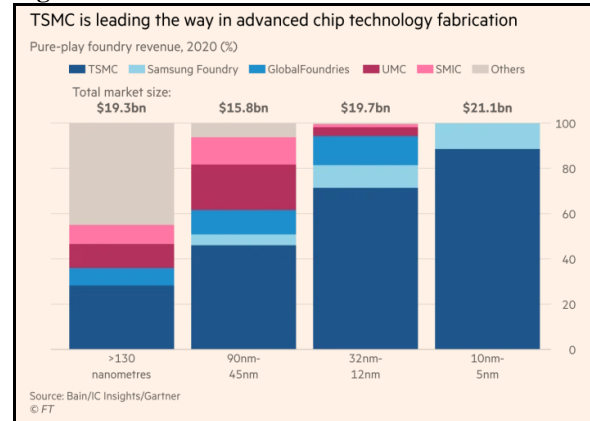
Figure 3



Taiwan’s market share was even bigger if we consider just the cutting-edge chips needed in the latest generation of artificial intelligence, supercomputing, and telecom applications. A key feature of the most advanced chips is the tiny size of their circuits, since smaller circuit widths mean more circuits can be packed onto a chip. Smaller circuit widths also mean the chip can run calculations faster, use less energy, and produce less heat that needs to be dissipated. Today, computer chips are considered advanced if they have a circuit width less than 16 nanometers (about 1/6,000th the width of a human hair). The most highly advanced chips currently have circuits as small as 5 nm, and the next generation of chips that will come into production over the next few years will have circuits as small as 2 or 3 nm. Importantly, TSMC accounts for all of Taiwan’s production of these advanced chips. TSMC accounted for only 5% of global chip exports in 2019, but, as shown in Figure 4,

the company produced almost 90% of the world’s most advanced chips.

Figure 4



The Global Computer Chip Industry

The discussion above provides a hint of just how globalized the world semiconductor industry is. Typically, semiconductors are designed in the U.S. or by U.S. firms, manufactured in Taiwan or other parts of the world, and then shipped to China for assembly, testing, and packaging. Once this process is completed, the chips are then exported by China. Taiwan and TSMC may represent only one link in the global production chain, but that link is critical.

It’s also important to understand something about the fabrication facilities, or “fabs,” needed to produce computer chips. According to the semiconductor industry publication *IC Insights*, almost 80% of global chip production comes from relatively less sophisticated “trailing edge” fabs scattered all over the world. However, more than 20% of production, generally representing the most advanced chips, is outsourced to cutting-edge “foundries,” or contract manufacturers, like TSMC.

In earlier stages of the industry’s evolution, venture capitalist-backed semiconductor start-ups would be built around a new chip. As chip technology advanced and circuits became ever tinier, the cost of the key

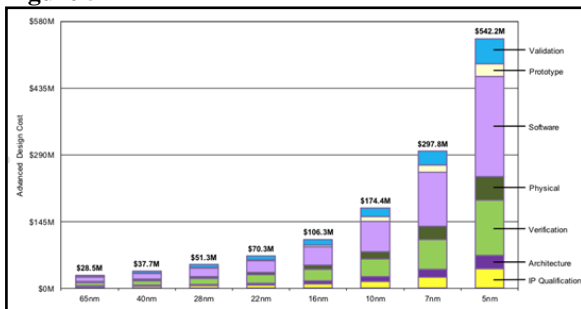
“mask set” stage, where the circuit design is first imprinted on a silicon substrate via lithography, became prohibitively expensive (see Figure 5). The costs became so great that they could deplete the firm’s capital if the chip was not successfully “taped out” the first time. Thus, it made sense for semiconductor companies to abandon their previous strategy of vertical integration, i.e., designing, manufacturing, packaging, testing, and selling their own chips. Most have now moved to a fabless model where they focus solely on chip design and rely on a foundry to produce the chip. After all, design is considered the highest-value stage in the semiconductor process.

competing chip firms are reluctant to let the company produce their designs.

Summary

In sum, Taiwan and TSMC are shining examples of the globalization of supply chains in recent decades. Both the country and the company have thrived because of their ability to export to markets around the world, import foreign supplies and expertise, and rely on international capital flows. By the same token, the world has benefited from the development of Taiwan’s chipmaking expertise and TSMC’s ever-growing operational prowess as advanced chip production consolidated there. The world has benefited from the efficiencies and cost reductions garnered as chip design firms around the world were able to share TSMC’s advanced fabs and the large network of Taiwanese suppliers who support the company.

Figure 5



(Source: *International Business Strategies*)

- TSMC pioneered the foundry industry in the late 1980s. As it gained market share, it began to monopolize the expertise needed to produce the most advanced chips, and it was able to spread the cost of its expensive plant and equipment over more and more products, giving it a practically unassailable position in the world’s advanced chip industry.
- Indeed, TSMC now accounts for more than half the world’s foundry chip market. Only Samsung in South Korea can currently produce similar products, but since it produces a broad range of its own industrial and consumer products,

Unfortunately, Taiwan and TSMC also illustrate how geopolitical tensions pose a threat to globalization. In Part II of this report, we’ll examine how the growing U.S.-China geopolitical rivalry is threatening to cut off Taiwan and TSMC from some of their foreign markets, suppliers, and sources of capital. More importantly, we’ll explore the implications that these developments might have for global economic growth, inflation, and financial market performance going forward.

Patrick Fearon-Hernandez, CFA
 May 24, 2021

This report was prepared by Patrick Fearon-Hernandez of Confluence Investment Management LLC and reflects the current opinion of the author. It is based upon sources and data believed to be accurate and reliable. Opinions and forward-looking statements expressed are subject to change without notice. This information does not constitute a solicitation or an offer to buy or sell any security.

As of the date of this report, certain Confluence Investment Management LLC strategies are invested in Taiwan Semiconductor Manufacturing Company (TSM). Opinions, estimates, and forward-looking statements included in the report are as of a certain date and subject to change without notice. This report is published for informational purposes and is not an offer or solicitation to buy or sell any security. Past company performance is no guarantee of future results.

Confluence Investment Management LLC

Confluence Investment Management LLC is an independent Registered Investment Advisor located in St. Louis, Missouri. The firm provides professional portfolio management and advisory services to institutional and individual clients. Confluence's investment philosophy is based upon independent, fundamental research that integrates the firm's evaluation of market cycles, macroeconomics and geopolitical analysis with a value-driven, company-specific approach. The firm's portfolio management philosophy begins by assessing risk and follows through by positioning client portfolios to achieve stated income and growth objectives. The Confluence team is comprised of experienced investment professionals who are dedicated to an exceptional level of client service and communication.