

SEMICONDUCTORS—PART I (U.S. INITIATIVES)

How will the U.S. address the challenges of semiconductor chip shortages that have hampered production for various industries?

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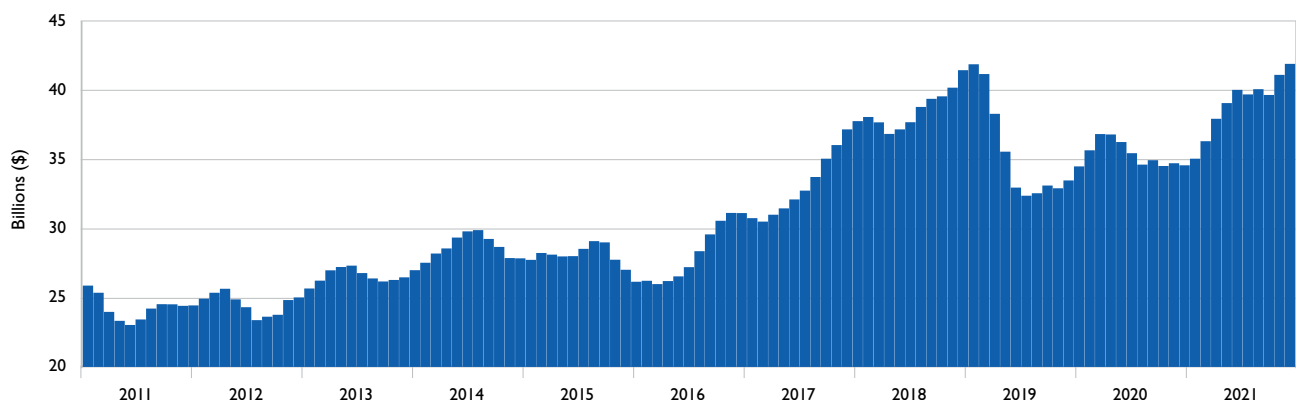
Key Takeaways:

- How will the U.S. address the challenges of semiconductor chip shortages that have hampered production for various industries?
- U.S. lawmakers realized the importance of domestic semiconductor manufacturing capabilities to the economy and national security and are actively looking at approaches to incentivize development. However, the U.S. will need to educate its workforce in addition to building the capital-intensive production facilities.
- Should those incentives come to fruition, the benefit may not be to growth stocks; some major chip manufacturers such as Intel are considered value companies.

Supply-Chain Bottlenecks

As internet connectivity crept into everything from cars to coffeemakers as well as cryptocurrency mining and cloud computing, demand for semiconductors has surged during the past decade. Therefore, there's reason to believe the need for the chips will continue growing to meet consumers' and businesses' insatiable thirst for technology. However, restrictions related to the coronavirus and the trade war contributed to a shortage of semiconductor chips, leading to supply-chain bottlenecks that disrupted production across industries and stoked inflation.

Semiconductors, Month-on-Month Global Sales



Source: FactSet as of 5/31/21.

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The recent chip shortage revealed the vulnerability of many sectors that depend on semiconductors. This revelation may lead to growth in semiconductor manufacturing as countries such as the U.S. seek to be more self-sufficient in this critical industry. While media focused intensely on former President Donald Trump's trade war with China, underreported was the global semiconductor manufacturing industry quietly engaging in fierce competition that has led the U.S. to become dependent on foreign powerhouses.

While U.S. semiconductor manufacturing used to represent nearly 40% of the global market in the 1990s, much of America's manufacturing has since been outsourced to foreign companies due to the tremendous expense of building semiconductor fabrication facilities. Furthermore, it should be noted that while companies such as Apple claim to make their own chips, they are just designing the chip blueprint. The actual manufacturing of such chips is outsourced to foreign fabricators.

The overwhelming capital costs encouraged Western companies to outsource the manufacturing process (midstream or fabrication) offshore and instead focus on chip design (upstream or fabless) and/or packaging (downstream). While Asia dominates the midstream manufacturing activity, the U.S. and Europe lead upstream activity. This gradual shift to the foundry model left only a select few players to dominate the global manufacturing segment of the semiconductor supply chain.

Nonetheless, U.S. politicians now recognize the importance of self-sufficiency for national security and the broader economy. While resurrecting semiconductor manufacturing in the U.S. became a key initiative, achieving success will be a Herculean task. This is something China has learned firsthand recently. We will review China's efforts and some of these non-U.S. manufacturers in Part 2 of this Insights article.

U.S. Initiatives

Chip plants are expensive to build, costing \$10 billion or more. Recently, Intel and Samsung committed to new fabrication plants in Arizona and Texas, respectively. These plants likely will start producing 5-nanometer chips, while future facilities could focus on even more advanced chips.

Costs and chip size have an inverse and exponential relationship; a plant to fabricate 3-nanometer chips could cost upwards of \$25 billion. To help ease the burden of private enterprise, a bipartisan group of U.S. lawmakers are looking to propose spending billions of dollars to boost domestic production of semiconductors. These efforts include proposals to create a 40% refundable-investment tax credit related to domestic semiconductor production.

Additionally, President Joe Biden's infrastructure plan seeks to allocate \$50 billion to build out U.S. chip manufacturing. Nonetheless, aside from capital intensity, challenges to manufacturing in the U.S. include a delayed return on investments and limited skilled labor. These plants can't function without many specialized employees who know how to run the assembly lines, and training initiatives for these new jobs must move quickly enough to keep pace with the rapid continued advancement of semiconductor fabrication.

U.S. Investments

Even as the U.S. is beginning to allocate resources to incentivize domestic manufacturing, its efforts are dwarfed by nations already leading the industry. For instance, South Korea recently announced a \$450-billion investment into the country's semiconductor initiatives through 2030.

That's nine times more than what's in the current Biden infrastructure proposal. Moreover, governments such as South Korea have incentivized domestic producers with tax breaks, lower borrowing costs, eased regulations, and improved infrastructure, including water treatment systems. Water is an important part of the manufacturing process, as these plants use millions of gallons of ultraclean water daily.

The semiconductor manufacturing industry spends roughly \$1 billion on water and wastewater treatment per year. More recently, Taiwan has struggled with a significant drought driven by climate change. This may disrupt the process of the Taiwan Semiconductor Manufacturing Company (TSMC), which is the largest semiconductor manufacturer in the world with roughly 50% of global market share. TSMC already spends approximately \$25 million per year to reduce water use through water recycling and purification techniques. The severe drought in Taiwan may have been another factor that encouraged TSMC to look to build foundries in other parts of the world, such the one underway in Arizona.

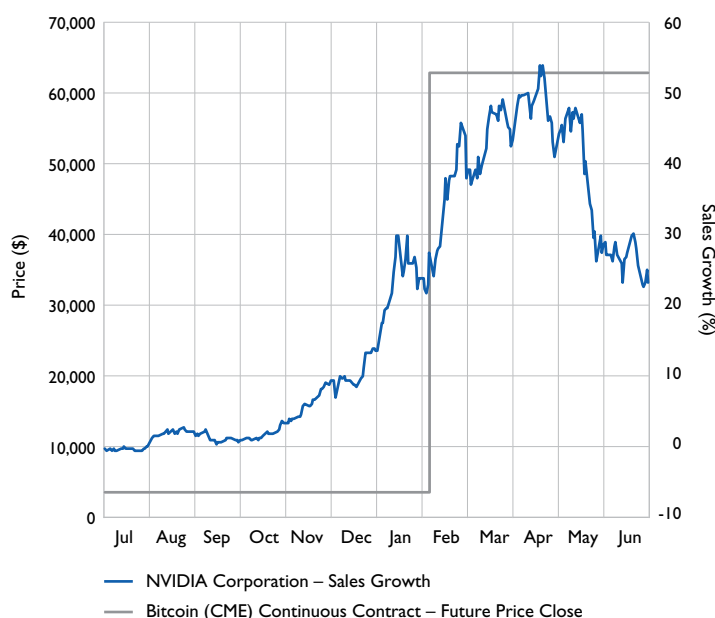
To attract TSMC, Phoenix city officials approved \$205 million in funding for critical infrastructure, with \$37 million on water infrastructure improvements and \$107 million in wastewater improvements. This is part of TSMC's plan to build a \$12-billion semiconductor facility the company will use to mass-produce 5-nanometer chips by 2024.

The global race to produce semiconductors may benefit several companies that can produce chips efficiently. While planned facilities in the U.S. will produce advanced semiconductors, domestic production will need to strive to be as efficient as Taiwan's production capacity as it dominates the global foundry market.

Market Impact

It is unlikely that President Biden's semiconductor push alone will lead to a sustained reversion to large-cap growth stocks in the near term. For starters, these new projects may take about three years before the investments become profitable. Moreover, some chip manufacturers, such as Intel, that are likely to gain from these political tailwinds are in the Russell 1000® Value Index. Intel could possibly benefit from future incentives and subsidies the U.S. government could provide, which may help large-cap value rather than large-cap growth companies.

Although Nvidia (which is represented in the Russell 1000® Growth Index) had experienced solid sales growth, the company likely benefited from the rush into cryptocurrency mining that utilizes its advanced graphics cards.



Source: FactSet as of 6/25/21.

More recently, Chinese regulators have increased enforcement against cryptocurrency mining activity. A slowdown in cryptocurrency mining could reduce demand for processors made by Nvidia, which in turn could flood the market with its products, eroding its margins.

Conclusion

Semiconductors have become an essential component to many products used today and will remain vital in the future. We have learned that a lack of access to these technological goods can cause disruptions to an economy. This vulnerability has led to U.S. initiatives to become self-sufficient in order to secure both national and

economic security. Given the Biden administration's priority on national security, we believe companies such as Intel that make chips for a wide array of industries are likely to receive federal incentives over companies such as Nvidia that design products used for gaming and cryptocurrency mining.

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