Investment Insights

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Investing in semiconductors

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IN A NUTSHELL

- Semiconductors encapsulate a wide range of components integral to the functionality of a broad array of technological devices
- As technology continues to expand its scope in our daily lives, our reliance on semiconductors necessitates growth and expansion in this important industry. Semiconductor use covers a wide range including electronics, industrial equipment, autos, networking and communications, and data processing
- Experts predict the size of the global semiconductor market could exceed US$750bn by 2030, driven by key use areas such as data storage, wireless communication, and automotives/autonomous driving.
- While recent U.S. and European legislation has positioned for semiconductor production onshoring, semiconductor fabrication spans across regions.

What are semiconductors?

Semiconductors are a broad term used to describe devices that have an electrical conductivity level between a conductor and a non-conductor or insulator[1]. In more practical terms, semiconductors refer to a wide range of components that are integral to the functionality of technological devices spanning phones, computers, energy production and electricity, transportation, and healthcare among other use cases. Semiconductors play an essential role in our day-to-day lives, and Intel estimates[2] that the average American spends over 12 hour a day on electronic devices that are powered by semiconductors.

Semiconductor materials are commonly manufactured with silicon, the Earth's second most abundant element. Silicon comprises approximately 28% of the Earth's crust[3], and provided a stable single crystal structure that provides the foundation for orderly arrangement of other elements. In silicon, at low temperatures, no electricity passes, but at high temperatures, electricity passes through easily.

The semiconductor industry is highly dependent on ongoing research and development, which has helped drive tremendous advancements in computing power and other across other applications. The exponential product advancement, commonly referred to as "Moore's Law", can be illustrated with a simple anecdote from the Semiconductor Industry Association ("SIA"): "a single smartphone today has more computing power than the computers used by NASA to land a person on the moon in 1969"[4]. According to the SIA, research and development is an integral component of semiconductor manufacturing, accounting for nearly one-fifth of revenue reinvestment, second only behind pharmaceuticals in the United States.

The strategic importance of semiconductor technology and manufacturing is evident at a global level, with countries across North American, Europe, and Asia engaging in the raw materials mining and fabrication of semiconductor components. In the coming decades, one might expect the geographical landscape to reflect geopolitical and supply chain considerations. Nonetheless, we believe growth in demand for semiconductor components is likely to be realized across the globe for the foreseeable future.

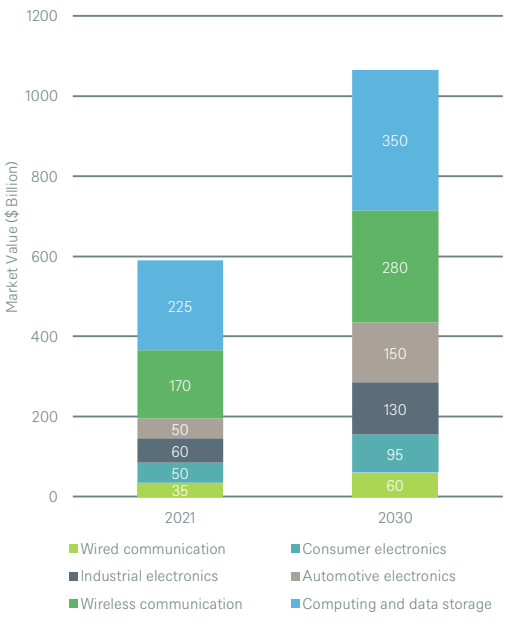
[1] https://depts.washington.edu/matseed/mse_resources/Webpage/semiconductor/semiconductor.htm#:~:text=What%20is%20a%20semiconductor%20%3F,gallium%20arsenide%20or%20cadmium%20selenide.
[22] https://www.intel.com/content/www/us/en/architecture-and-technology/semiconductors-primer.html
[3] https://www.hitachi-hightech.com/global/en/knowledge/semiconductor/room/about/silicon.html
[4] https://www.semiconductors.org/industry-impact/#:~:text=The%20rapid%20pace%20of%20innovation%20has%20enabled%20the,moon%20during%20the%20Apollo%2011%20mission%20in%201969.

Cyclical pricing, structural demand growth

As with many consumer products, there is an element of cyclicality to the prices of semiconductor components. Memory prices can fluctuate with a wide range of supply and demand factors, resulting in restocking and destocking phases for semiconductor manufacturers. Production and logistical issues can arise as well, as witnessed during the COVID-19 crisis. With the significant high fixed cost nature of the Semiconductors industry, margin pressures have the potential to be higher, particularly during periods of demand weakness.

Although semiconductor pricing may experience shorter-term price volatility as a function of cyclical trends or supply chain disruptions, we believe the strategic outlook for semiconductor demand is quite robust. According to McKinsey, the overall growth in the global semiconductor market is expected to nearly double over the next decade, driven by key use areas such as data storage, wireless communication, and automotives/autonomous driving. Figure 1 illustrates McKinsey's growth projections for the global semiconductor market across verticals.

Figure 1: Projected growth of global semiconductor market

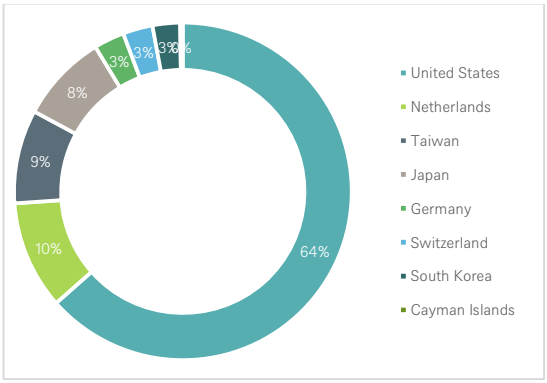


Source: McKinsey & Company estimates. Data as of April 2022.

Geography of semiconductors industry

Strategic demand for semiconductor technology is also reflected in the globalization of the industry. As of 2023, the global semiconductor industry spans across North American, Europe, and Asia as shown in Figure 2.

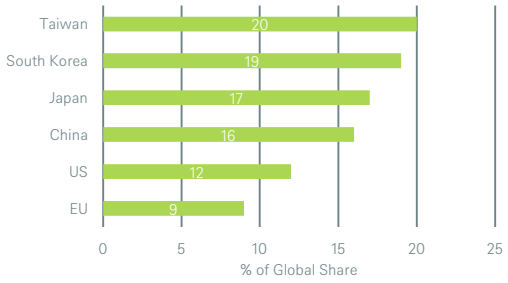
Figure 2: Semiconductor industry country composition



Source: Solactive as of 31 March 2023.

While efforts to onshore semiconductor supply chain have been put forth in the U.S. and Europe via the CHIPs Act and the European Chips Act, Asia's importance to semiconductor manufacturing remains an integral component of meeting growing semiconductor demand. Figure 3 illustrates that fabrication capacity is still heavily concentrated in North Asia, although supply chains are expected to diversify in the coming years.

Figure 3: Semiconductor fabrication capacity (global share %)

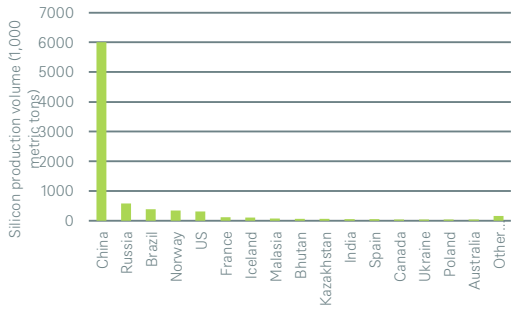


Source: S&P Global, US White House (June 2021 report).[5] Data as of 2019.

Beyond the significant fabrication capacity of Taiwan and South Korea, China remains by far the largest silicon producer globally (see Figure 4).

[5] https://www.spglobal.com/marketintelligence/en/mi/research-analysis/the-shifting-global-semiconductor-landscape-in-asiapacific.html

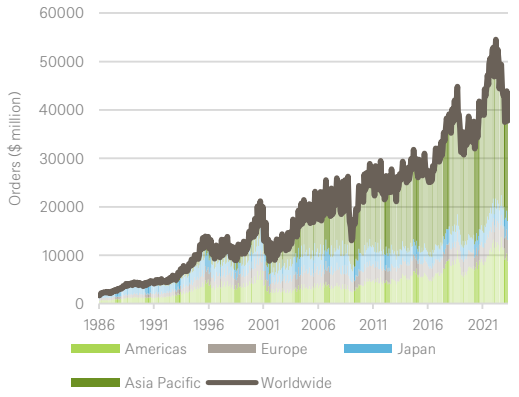
Figure 4: Silicon production volume (1,000 metric tons)



Source: Statista as of January 2023.

Furthermore, Asia-pacific semiconductors still constitute the majority of global demand fulfillment, (see Figure 5).

Figure 5: Semiconductor industry historical billings ($ million)



Source: World Semiconductor Trade Statistics. Data as of June 2023.

While trade conflict and supply chain rationalization has driven countries around the world to shift toward greater production autonomy and less reliance on foreign semiconductor imports, we expect this shift in the semiconductors landscape to be gradual.

Key trends in semiconductors

Looking beyond shorter-term pricing volatility, we believe the strategic case for semiconductors remains quite strong given their importance across nearly every sector of the global economy. As technological growth is intrinsically linked to future economic growth, semiconductors have the potential to become a foundational component of technological evolution over the coming decades. Automotive, industrial, and computing growth will depend heavily on the continued demand and reinvestment into the global semiconductor industry.

- Automotives: four main trends across the automotive industry should drive semiconductor content by as much as ten-fold: autonomy, electrification, connectivity, and mobility as a service (MaaS) [6] According to KPMG, automotive semiconductor sales could exceed US$200bn by 2040, with growth potential as well in automotive infrastructure such as chargers and cloud computing
- Computing and data: semiconductor memory currently accounts for the largest single segment of the semiconductor market. Temporary and permanent memory storage and microprocessors require advancements in semiconductor technology
- Industrial electronics: industrial electronics help to improve efficiency and productivity across a wide range of industries. [7] Monitoring devices, automation equipment, and sensors are all integral components to improving industrial production and rely heavily on the use of semiconductors.

Conclusion

The semiconductor industry serves an integral role in the strategic growth of essential technologies including data storage, wireless communications, and autonomous driving among other sectors. Global demand is expected to nearly double by 2030, driven by a diverse mix of industry verticals. Although profit margins can be volatile in the shorter term, driven by volatility in memory pricing and significant high fixed-cost nature of the industry, we believe the robust strategic demand for semiconductor components paints a sanguine long-term outlook.

Furthermore, semiconductor technology demand remains significant across regions. While efforts by various governments to onshore semiconductor supply chain will gradually change the production landscape and reduce cross-border dependencies, we expect demand across different regions to be quite strong over the long term.

The strategic importance of semiconductors for technological growth positions semiconductor manufacturers quite favorably for revenue and profit growth over the long term. High barriers to entry and a broad and diverse mix of technological application has the potential to provide a strong positive backdrop for the semiconductor industry for years to come.

[6] https://kpmg.com/be/en/home/insights/2022/02/aut-automotive-semiconductors-the-new-ice-age.html#:~:text=Automotive%20semiconductors%20are%20already%20one,Internet%20of%20Things%20(IoT).
[7] https://www.mdpi.com/journal/electronics/sections/Industrial_Electronics

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