

Macro Insight

Semiconductor chips in short supply

The semiconductor chip shortage should begin to ease in the coming months

Global supply chain diversification and regional cooperation should support Asia's industrial sector, trade and growth outlook

Our views

The chip shortage highlights the structural theme in semiconductors

It also underscores the importance of allocating selectively to growth stocks, despite their sensitivity to the risk of higher bond yields

In H2, we need to remain realistic about what kind of investment returns are achievable, and open-minded to more barbell approaches to building equity portfolios

The widespread shortage of semiconductor chips that began in late 2020 highlighted how indispensable these specialised components are in today's economy. They power a range of electronic devices – everything from smartphones and cloud servers to modern cars, industrial automation, digital infrastructure and defence systems. The global shortage of semiconductors has drawn attention to the impact on the corporate sector and raised questions on the sustainability of existing supply chains, as well as issues surrounding national tech sovereignty.

What is causing the global chip shortage?

The semiconductor chip shortage is the result of rapid demand recovery colliding with underestimated supply schedules and production disruptions. In particular:

1. Pandemic-induced demand for consumer electronics has been strong, driven by working-from-home arrangements, online learning and entertainment.
2. A faster-than-expected recovery in auto sales has also added to a short-term demand-supply imbalance for semiconductors. Reflective of that, the inventory-to-sales ratio across the US domestic auto sector has plunged to historical lows due to production bottlenecks.
3. The uncertainty of Covid-19, natural disasters* and even power outages, combined with the "just-in-time" management process to keep inventories low, have driven firms to stockpile components and prompted double-booking of orders to mitigate future shocks.
4. Precautionary inventory stockpiling has also played a role, given the intensifying US-China technology rivalry. Chinese companies have ramped up their purchases of integrated circuits (IC) and equipment for making them, given US restrictions on China's access to US technology.

While many companies have been agile to address the present shortage, addressing structural imbalances in supply and demand will take time. Semiconductors are highly complex products to design and manufacture, and require the need for deep technical know-how, high R&D and capital requirements. Meanwhile, technologies in fast-growing industries like 5G, artificial intelligence (AI), and cloud computing are driving up long-term demand for semiconductors.

Semiconductor supply chain concerns over geographic concentrations

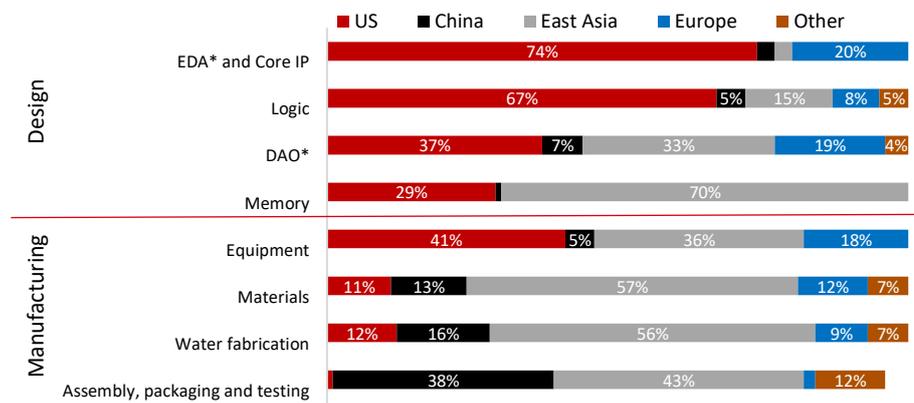
The complexity of scaling has resulted in a highly specialised global semiconductor supply chain, in which regions perform different roles according to their comparative advantages. The semiconductor supply chain is characterised by deep interdependencies, high divisions of labour and close collaboration throughout the entire production process. In fact, a semiconductor product could cross international borders approximately 70 or more times before finally making it to the end customer.

In 2001, there were 30 companies manufacturing leading-edge chips but as chips became more difficult and more expensive to produce, today, only three companies are able to manufacture the world's most advanced chips, located in the US, South Korea and Taiwan. The US leads in the most R&D-intensive activities such as chip designs, while East Asia (include South Korea, Taiwan and Japan) is at the forefront in wafer fabrication (Figure 1). In terms of the advanced chips below 10nm, Taiwan and Korea account for more than 80% of production.

*1) In February, a severe winter storm in Texas forced chip companies to shut down operations temporarily; 2) The third-largest maker of chips for automobiles, had its production in Japan disrupted by an earthquake in February, and a fire incident in March; and 3) A Taiwanese chip giant's output was affected by a power outage in April.

The industry's market share is now more heavily concentrated in the hands of a few

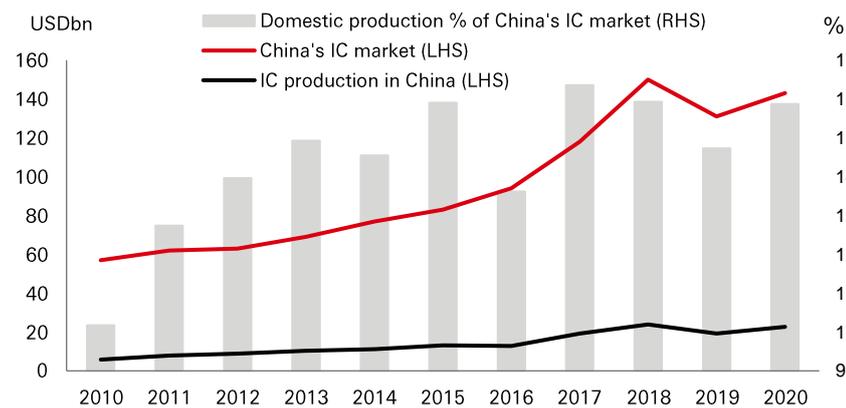
Figure 1: Semiconductor share by region (% of worldwide total, 2019)



Source: Semiconductor Industry Association 2021, HSBC Asset Management 2021 Key: DAO = Discrete, Analog and Other (including optoelectronics); EDA= Electronic design automation

Through policy support and various initiatives, China has made rapid progress in its capabilities across semiconductor segments and is a leader in assembly, packaging and testing. However, it still relies heavily upon foreign technology and is not able to produce the most advanced semiconductor chips. China's IC production accounted for ~16% of its USD143.4bn market in 2020 and only 6% of the market was made by China-headquartered firms with most of the ICs produced domestically made by foreign companies.

Figure 2. China still heavily depends on foreign IC supply



Source: IC Insights, HSBC Asset Management, July 2021

Increasing focus on chip self-sufficiency...

The recent chip shortage has intensified efforts in the US and EU to boost domestic capacity and cut their reliance on Asian producers, as the pandemic highlighted the potential vulnerabilities in the global supply chain of semiconductors.

But this does not mean a 're-nationalisation' of supply chains¹. Instead, many countries are assessing the feasibility of achieving chip self-sufficiency, providing incentives for re-shoring/ on-shoring of production and inviting major foreign players to increase investments locally or to form alliances. The Biden administration has proposed a USD50bn package to boost semiconductor infrastructure in the US and announced USD1.5bn for 5G innovation. Furthermore, the US has been looking to form a regional chip alliance with countries such as South Korea and Taiwan, strengthening the potential for further investment abroad in the medium-term.

However, it can take 18-24 months for a plant to open after starting construction and chips themselves are not easy to make, with advanced semiconductors taking up to six months to produce. So while this investment will help to increase supply further out - and could eventually lead to oversupply, especially in less sophisticated chips - for now, those firms that are able to produce chips look set to be running at full steam.

In China, "scientific and technological self-reliance" is a major pillar of the 14th Five-Year Plan and the country has continued to encourage foreign direct investment (FDI) within the "dual circulation"

More countries are recognising the risk that an inability to secure chips may also compromise national security...

... with ambitious plans to boost domestic investment and production

¹ Global Supply Chains in the Pandemic, NBER Working Paper April 2021

strategy. Additionally, China's localisation push has accelerated following US restrictions on the supply of US-made equipment and semiconductor chips containing US technology to China.

Nonetheless, the technology gap between China and the world's leading chip-producing economies looks likely to remain sizeable for some time, as it needs to overcome challenges such as the talent pool of experienced engineers and the ability for indigenous cutting-edge basic research and innovation.

Figure 3: Key strategies on semiconductors by country

Strategy	Details
To provide support, to foster local chip manufacturing, to increase self-sufficiency	US: CHIPS for America Act aims to boost chip manufacturing by establishing a USD50bn fund to subsidise domestic manufacturing and chip research.
	Europe: EU members signed a joint declaration to double Europe's semiconductor manufacturing to 20% of worldwide output by 2030. It will require using funds from the Recovery and Resilience Facility, of which members are calling for 20% to be earmarked for the digital transition (EUR145bn over the next 2-3 years).
	China's 14th Five-Year Plan (2021-2025) steps up support for its chip manufacturing industries, including reducing or exempting tax and helping to build supply chains and cultivate talent. Chinese government pledged it will invest an estimated RMB1.4trn by 2025.

Source: HSBC Asset Management, July 2021

ASEAN markets set to benefit as companies diversify their manufacturing activities to enhance supply-chain resilience

... and supply-chain resilience

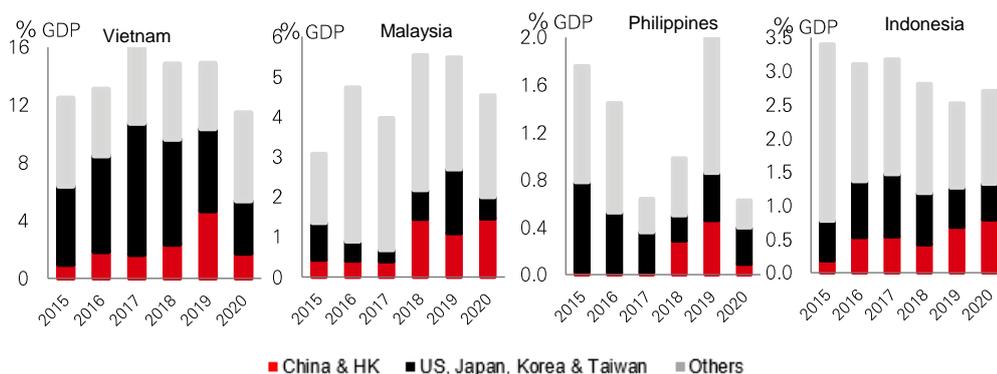
The pandemic and geopolitical uncertainties have incentivised companies to diversify their manufacturing activities, as a longer-term strategy to enhance supply chain resilience. In particular, the "China plus One" strategy is gaining momentum, with multinational companies retaining production sites in China for the local market, while moving some capacity elsewhere to serve the US and other markets.

ASEAN - a key producer of low-to-medium range semiconductor chips - is a major beneficiary. FDI into ASEAN has risen, with Chinese companies especially active. This strengthens the supply chain integration and boosts trade flows between China and its ASEAN neighbours. Meanwhile, rather than reduce their reliance on Asian supply chains, US importers have looked to producers in Asia except China, and US companies have also increased investment in India and ASEAN.

Asia's supply chains have proven to be resilient and remain highly competitive. In 2020, barring initial shocks from the pandemic between February-April 2020, manufacturing output across the region quickly rebounded. In our view, strategies adopted by many countries to switch to nearby suppliers in the longer term could drive down international trade flows and shift demand away from selected high-growth sectors in Asia. However, efforts to diversify markets - via trade deals - could help to buoy regional tech-related trade and investment flows as well as Asia's growth potential.

Chipmakers globally are scaling up investment, but it is unlikely to resolve near-term supply issues

Figure 4. Increasing FDI to ASEAN from China in recent years



Source: CEIC, HSBC Asset Management, July 2021, Note: Registered FDI capital for Vietnam; approved FDI capital for Malaysia and Philippines; FDI investment realization for Indonesia

Chip shortage should ease but supply will remain tight

The chip shortage is expected to subside from Q3 2021, as semiconductor foundries normalise production lines, new capacity increases; and as demand for consumer electronics moderates, with the impact of fiscal support fading in the US and consumer spending shifts towards services. In particular, the impact on the global auto sector is expected to have reached a peak in Q2 2021 before normalising. However, tightness in the supply of chips is expected for at least 1-2 years, especially for industrial applications, as capacity is built out.

Leading players have announced large scale investment plans that are expected to be completed over 2022-2023. Among the announcements include Taiwan's leading chip company's plans to

The chip shortage has driven up prices of autos and consumer electronics...

... but part of the spike in prices is likely to be transitory

Solid demand supports upstream chipmakers' pricing power as downstream manufacturers may face some margin pressures...

... but corporate strategy to adjust product mix and improve cost efficiency helps

spend USD100bn on capacity expansion in 2021-2023 and a leading US chipmaker earmarking USD20bn for new facilities. These dynamics suggest that tightness in chips could persist for some time, that is even after assuming these companies deliver at maximum utilisation. Any delivery below expectations is set to prolong supply-demand issues further.

What does this mean for inflation?

The shortage has driven up chip prices by an average 10-20% over the year, affecting various industries from automobiles, consumer electronics and even home appliances, compounding the current supply-demand imbalance. In the US, since the beginning of this year, prices for cars and light trucks have risen sharply. Prices for home appliances, TVs and audio & visual equipment have also increased.

More broadly, fiscal stimulus has pushed demand for durables to levels well above pre-pandemic trends, while a sharp rebound in oil and other commodity prices, labour shortages, and problems in the global shipping industry have put upward pressure on goods prices in the near term.

That said, the relative price increases of selected goods and services caused by distortions from supply bottlenecks and reopening pressures may have overstated a more moderate underlying inflation. Goods demand should eventually revert to pre-pandemic levels, as demand shifts towards services over time, reducing pressure on supply chains. As such, part of the current spike in price pressures is likely to be transitory and could eventually become a one-off disinflationary force, in our view.

In Asia, the inflation impact appears less evident, contained by a more gradual recovery of consumer demand and firm pricing power. We see few reasons to expect labour markets to tighten sufficiently in Asia to drive up wage pressures. Some governments have also taken administrative measures to manage inflation. For example, the Chinese government has rolled out various measures to curb commodity price spikes, to ensure domestic supply and crack down speculation. Removal of import restrictions and tax cuts on selected food items by India, and reduction in pork import tariffs by Philippines, has helped manage food price inflation.

The interplay between productivity/ cost efficiency, profit margins and pricing power will influence whether the current increase in measured inflation, will be longer-lasting.

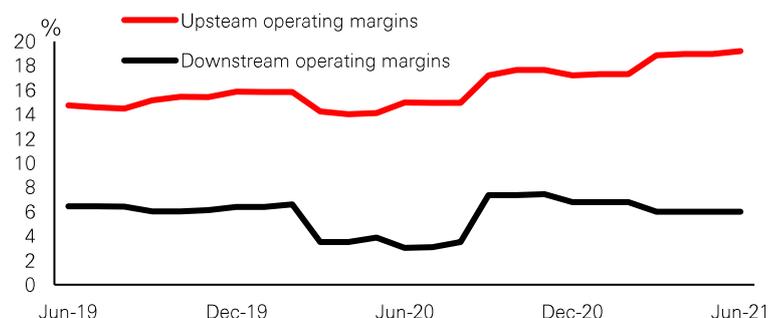
What does this mean for corporate profits?

Semiconductor companies' fundamentals are likely to remain strong in the coming year, as solid demand supports an improved pricing environment, while low inventories and backlogs point to robust future production. Higher utilisation rates could benefit margins over the next couple of quarters. The current low inventory may for the time being help cushion some concerns over inventory correction related to smartphone demand.

There have been some early signs of margin uplift in *upstream chipmakers* (Figure 5), though the longer term looks supported as well. Chipmakers may enjoy better bargaining power over their customers given the growing structural demand and high barriers to entry. Semiconductor equipment used to produce complex chips will also have strong pricing power given demand from large investment for self-sufficiency in many countries.

The impact on profit margins of *users of semiconductors* is mixed across industries, however. Downstream manufacturers (e.g. in consumer electronics, autos and household appliances) may face higher pressures to either absorb costs (at least partially) to retain market share and run the risk of hurting profitability, or allocate scarce components to more profitable and higher margin products, and reduce or even suspend production of low-margin models.

Figure 5: Early signs of diverging operating margins



Note: Within MSCI ACWI constituents, upstream include technology hardware, semiconductors, semiconductor equipment; downstream includes consumer electronics, electrical components and autos

Source: Bloomberg, HSBC Asset Management, July 2021

Chipmakers stand to benefit from structural demand, while supply chain shifts boost opportunities more broadly in Asia...

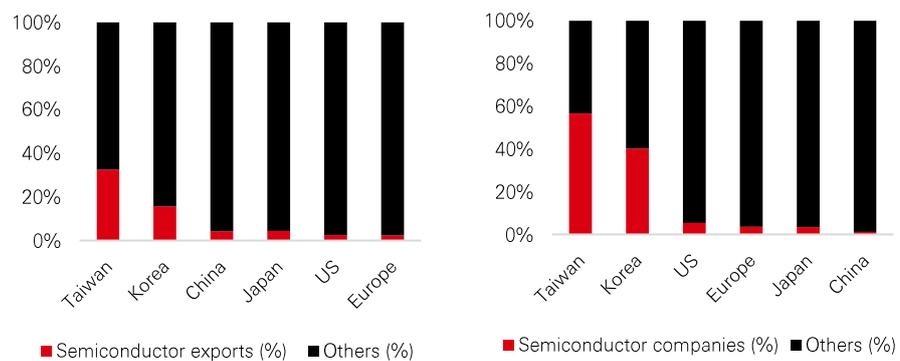
... although growth stocks are sensitive to the risk of higher bond yields, they should continue to be an important feature in our portfolios

Automakers in particular, may be in an unfavourable position, where automotive electronics are set to account for an estimated 45% of a car's manufacturing cost by 2030, according to a Deloitte report². Consequentially, higher chip costs add pressure to operating margins. For now, though, some automakers, especially these with strong brand recognition, have been able to pass along some higher input costs to customers via higher vehicle prices, given the strong demand.

Investment implications

While chip shortages have caused production disruptions and increased cost pressures for a wide range of industries, we see current tightness easing over the coming months, and the semiconductor chip dynamics unlikely to derail an ongoing global economic recovery. Where structural demand for semiconductors to provide innovative new features remains robust, Asian chipmakers stand to be beneficiaries.

Figure 6: Semiconductors as % of merchandise exports and exposure in equity index



Given the semiconductor industry's weight in major Asian markets (Figure 6), we expect the sector to provide structural support for corporate profit growth, in particular for markets such as South Korea and Taiwan where semiconductors represent 32% and 16% of goods exports and 56% and 40% of the local equity index respectively. We note that the earnings outlook for the semiconductor sector in Asia remains constructive with 12-month forward earnings growth rates broadly above regional markets, with forecasts having been revised higher over the last several weeks. This is because global semiconductor demand continues to expand faster than the rate of supply growth, resulting in pricing power.

We see two key long-term risks; first, an expansive investment cycle in semiconductors potentially creates an over-supply, but we expect this to be more pronounced in the less-advanced chips. Second, increasing capital intensity for the more advanced chips could pressurise chipmakers' profit margins.

The current "expansion phase" of the global business cycle implies strong economic and profits growth, and points to a phase of gradually-rising US bond yields. That backdrop would typically favour value equity markets, such as the UK, Europe, or ASEAN. But the uncertainty over the macro recovery path, the strong performance of risk asset classes in H1, not to mention the important structural themes in semiconductors that we have discussed above, all remind us that parts of "growth equities" should continue to be an important feature in our portfolios. As we head into H2, we need to remain realistic about what kind of investment returns are achievable, and open-minded to more barbell approaches to equity portfolio construction – blending the best bits of growth, value, quality, and other factors.

Alfred Hong, Rabia Bhopal and Renee Chen, Global Investment Strategy Team

² <https://www2.deloitte.com/content/dam/Deloitte/cn/Documents/technology-media-telecommunications/deloitte-cn-tmt-semiconductors-the-next-wave-en-190422.pdf>

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