

Fixed Income Group Research

The chip shortage will increasingly be about demand

January 2022

- Shortages of semiconductor chips are contributing to severe global supply-chain disruptions and higher consumer prices for everything from cars to toothbrushes. Those disruptions are unlikely to ease in the near term.
- Part of the imbalance has been driven by supply, which can't be ramped up quickly. Chip manufacturing is highly inelastic and building out new capacity requires substantial capital and time.
- The pandemic has accelerated some secular trends, including remote work and cloud computing, that are likely to translate into permanent increases in chip demand. However, COVID-related pent-up spending and overordering by manufacturers to avoid production shutdowns should normalize.
- From a credit perspective, we are cautious on semiconductor companies. "Bond valuations have become extremely tight, driven by excellent operational performance metrics and plentiful free cash flow," said Vanguard senior credit analyst Scott Miles. "Looking ahead, chip supply is likely to eventually overshoot demand growth—the semiconductor industry is prone to boom and bust cycles. We see more value among their customers, industrial OEMs (original equipment manufacturers), many of which have proven adept at navigating both the chip shortages and inflationary pressures."

Chip shortages defy expectations

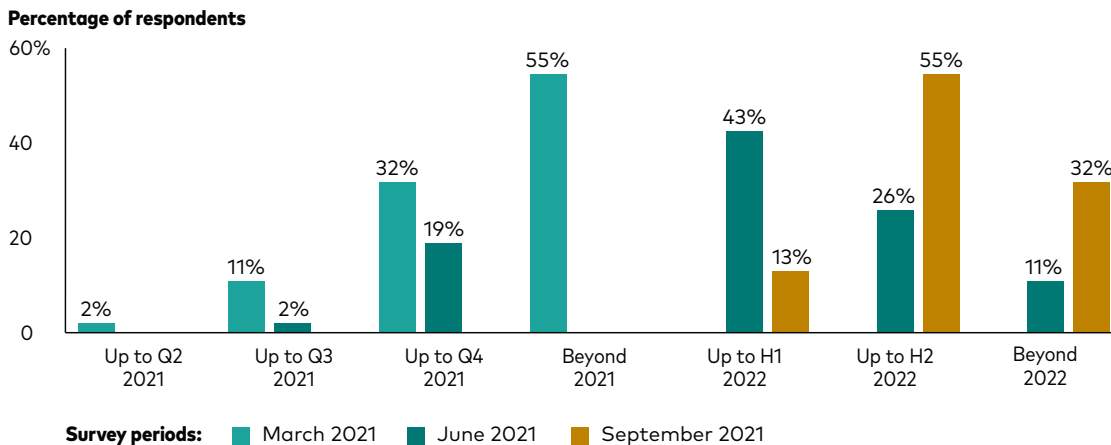
Since the shortage hit, industry participants have had a hard time assessing how long it will last.

A survey of semiconductor distributors conducted by AlphaWise in March 2021, shown in the figure below, found that 45% of respondents believed the shortages would be over by the end of 2021. In another survey conducted just six months later, expectations were pushed out over a year, with 32% of respondents believing the shortages would last into 2023.

Our view is that the shortages are likely to last another year or more, in line with the survey's latest central tendency of respondent expectations.

FIGURE 1.
Expectations for market normalization keep getting pushed out

Expected time frame for semiconductor shortages to last



Note: Percentages may not total 100% due to rounding.

Sources: AlphaWise and Morgan Stanley Research.

How we got here

Demand for chips initially fell sharply at the onset of the COVID-19 pandemic. Government-mandated lockdowns and dire predictions of a prolonged recession led to sharp cuts in industrial manufacturing and a buildup in chip inventories. Auto production in the United States, for example, fell by 23% in the second quarter of 2020 even though chip sales to that end market only declined by 6%.

Overly bearish demand forecasts led some of the hardest-impacted industrial customers to go so far as to use contractual language about natural disasters or other "acts of God" to extricate themselves from further chip deliveries.

Then the economy began to recover far more quickly than anticipated, and a surge in demand followed. Chip manufacturers struggled to respond accordingly due to both the length of the manufacturing process and the inelasticity of supply. The process begins with wafer fabrication, which is highly capital-intensive, and building new capacity often requires three or more years. Taiwan Semiconductor Manufacturing Company, for example, is in the process of raising \$13.5 billion for a new facility in Arizona which is not expected to ship product until 2024.

Supply chain challenges exacerbated chip shortage

While chip manufacturers have been able to use spare capacity to increase supply over the last 12 months, other factors have prolonged the recovery in chip availability. For example, the finishing stages of testing and packaging chips typically occur in Southeast Asian markets such as Malaysia, where more than 50 chip makers operate fabrication plants. This past summer, however, lockdowns triggered by the COVID-19 Delta variant resulted in widespread chip supply disruptions, leading to steep cuts to auto production volumes during the third quarter of 2021. The recent spread of the Omicron variant represents a similar challenge going forward.

"While the auto industry has seen improving semiconductor availability in recent weeks," said Vanguard credit analyst Min Fang, "The Omicron variant represents a distinct risk to the recovery of the sector, which may cause another wave of supply disruption this winter."

In addition, U.S. chip customers have felt the effect of global shipping logjams since the start of the pandemic. Chips are usually shipped by air, so the loss of belly space in commercial flights due to drastic cuts to plane travel reduced air freight capacity by as much as 75% in April 2020. This year, alongside soaring demand, air cargo rates have climbed to record highs. Still, the slow return of air cargo capacity in some regions could mean prolonged supply chain congestion well into 2022.

"While the industry is using spare capacity and increasing supply at the margin," said Scott Miles, "There is unlikely to be material new supply brought online in 2022 beyond expansion plans that were already in the works pre-COVID."

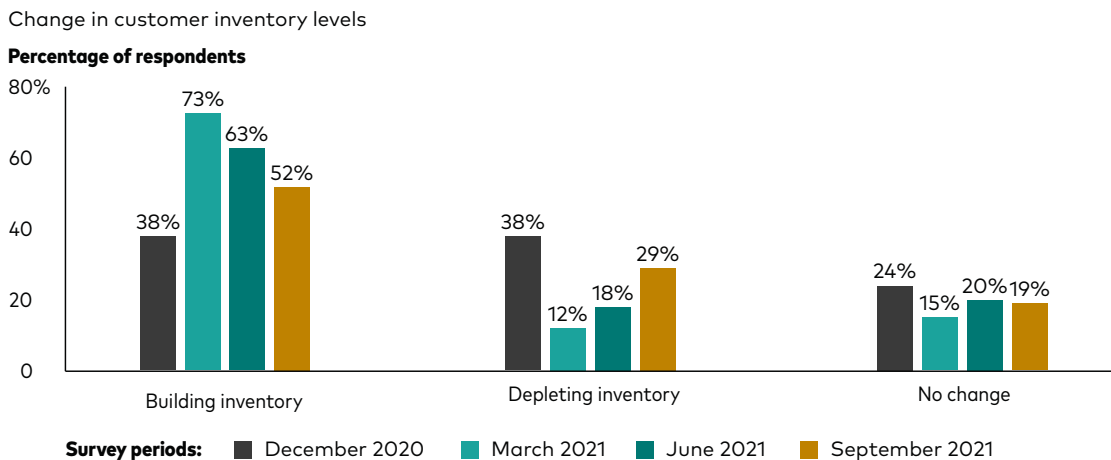
There will be an additional challenge for industrial OEMs: Most capacity set to come online over the next several years will be for advanced, higher-margin chips, rather than the older chips these manufacturers rely on.

Looking ahead, demand will be key

"We're expecting a permanent increase in chip demand from PCs and other semiconductor end markets like networking equipment for remote work and learning," said Mr. Miles. "Cloud computing apps and associated data center equipment should remain growth vectors as well. On the other hand, demand related to pent-up spending on consumer electronics is likely to prove more transitory."

An even more worrisome development will be the winding down of widespread overordering and inventory hoarding on the part of distributors and OEMs—behavior that has aggravated chip shortages. The AlphaWise survey of chip distributors showed that inventory-building was prevalent throughout 2021, and even the latest reading shows that more than half of their customers are continuing to amass inventory. Those survey results, shown in the figure below, fit with reports of double- or even triple-ordering on the part of OEMs. Such widespread overordering is a trend which is unlikely to end well for chip manufacturers.

FIGURE 2.
An end to inventory hoarding by OEMs could lead to a sharp downturn in demand



Note: Percentages may not total 100% due to rounding.

Sources: AlphaWise and Morgan Stanley Research.

A wind-down in overordering may have already started. Data from the Semiconductor Industry Association indicate that while trailing 3-month sales growth remains elevated at around 28%, the growth rate inflected in August and shows some pullback.

Our credit outlook for semiconductor manufacturers and industrial OEMs

Current credit valuations of semiconductor chip manufacturers' securities reflect supportive market trends. Market data and research provider WSTS estimates that for 2021, revenues will have risen by 25%, units sold will have climbed 17%, and the average selling price of a chip will have risen 6%. That compares favorably to averages for the preceding decade (2011–2020), when revenues grew by just 5%, units sold rose by 7%, and the average selling price of a chip declined by 2%.

The future is unlikely to be as bright as 2021, however. As chip shortages persist into 2022, they will continue to add to global inflationary pressures. Double-ordering and inventory hoarding are likely to contribute to significant oversupply when the cycle turns. So too will recent substantial capacity expansion efforts.

We see more value downstream in the debt securities of industrial OEMs, many of which have managed to successfully navigate supply shortages and rising input costs, including for labor. Moreover, supply constraints have enabled OEMs to raise prices to protect their margins, adjust their product mix to focus on their most profitable offerings, and improve their cash flow.

"Auto manufacturers and many other industrial OEMs are also in the midst of a cyclical upturn thanks to strong demand coming out of the pandemic," said Vanguard credit analyst Andreas Nagstrup, "And we would expect production volumes to accelerate as the semiconductor shortages eventually normalize."

Active Fixed Income at Vanguard

Taxable bond \$336.9B in AUM <i>14 funds*/1 ETF</i>	Municipal bond \$228.0B in AUM <i>5 national funds/7 state-specific funds</i>	30+ Portfolio managers	30+ Traders	35+ Credit research analysts	110+ Dedicated team members
--	--	-------------------------------------	-----------------------	--	---

* Includes funds advised by Wellington Management Company LLP.

Note: Data are as of September 30, 2021.

Connect with Vanguard® • advisors.vanguard.com • 800-997-2798

For more information about Vanguard funds, visit vanguard.com to obtain a prospectus or, if available, a summary prospectus. Investment objectives, risks, charges, expenses, and other important information about a fund are contained in the prospectus; read and consider it carefully before investing.

Vanguard ETF Shares are not redeemable with the issuing Fund other than in very large aggregations worth millions of dollars. Instead, investors must buy and sell Vanguard ETF Shares in the secondary market and hold those shares in a brokerage account. In doing so, the investor may incur brokerage commissions and may pay more than net asset value when buying and receive less than net asset value when selling.

All investing is subject to risk, including the possible loss of the money you invest.

Diversification does not ensure a profit or protect against a loss.

Investments in bonds are subject to interest rate, credit, and inflation risk.

Vanguard®

© 2022 The Vanguard Group, Inc.
All rights reserved.
U.S. Patent No. 6,879,964.
Vanguard Marketing Corporation, Distributor.

Investment Products: Not a Deposit • Not FDIC Insured • Not Guaranteed by the Bank • May Lose Value • Not Insured by Any Federal Government Agency