

June 8, 2021

Dear Client:

Recent monthly and quarterly communiqués have examined the pandemic-driven disarray in supply chains and demand dynamics. While the supply imbalances we highlighted in those letters will catch up to the demand, the impact of a broad, global economic reawakening has caused a bottleneck for which there is no short-term fix: semiconductors.

It's been six months since reports began to emerge that the world's automakers faced a production squeeze because of a looming shortage. At the time, the chip shortfall was blamed on the automakers themselves, as they scaled back orders in response to the pandemic, only to be taken by surprise at the strength of the rebound in demand for new cars. As the modern vehicle requires anywhere from a few hundred to over one thousand chips in each vehicle, manufacturers had no choice but to curtail production. The shortage, we were told, was highly idiosyncratic in nature, and would be brief. It was a simple enough narrative, but many months on it is clear it was woefully wide of the mark, and it is increasingly apparent that today's semiconductor supply constraints are not simply the result of a colossal misreading of demand, poor ordering, and the fragility of auto industry supply chains. It is widespread and structural.

Demand for chips has been growing for many years, with the growth in smartphone, appliance, and automobile functionality, online gaming, cloud computing, and rollout of 5G infrastructure. Pandemic-mandated quarantine sent orders through the roof for home entertainment, personal computers and all the ancillary electronic devices needed to work from home, as well as for the data center hardware required to support a scattered workforce in the cloud. As demand-stricken industries like auto's bounce back, and manufacturers attempt to rebuild their chip supply, they find themselves at the back of the line in a market facing tight supply constraints -- and in competition with myriad chip consumers along the electronics supply chain hindered by similar shortages (broadband providers are reportedly facing delays of more than a year on router orders).

Today's hand-held gadgets are prolific -- roughly 1.4 billion "bleeding edge" smartphone processors were manufactured last year, and the global semiconductor industry produced more than one trillion, mostly older generation chips in total, but they have reached maximum capacity for chip architectures of all types. Making chips is incredibly difficult and getting tougher (as detailed in a recent quarterly letter). After science and engineering, the two most important variables are time and cost. It can take four years to build the latest facilities capable of cramming ever-more submicroscopic transistors onto bigger and bigger wafers of silicon. Furthermore, building a facility able to produce 50,000 wafers per month costs ~\$15 billion and, once all that money is spent, facilities can become obsolete in just five years, meaning few companies can afford to keep up.

As technology has advanced, semiconductors have spread from computers and cars to toothbrushes and tumble dryers. Like other supply constraints we have discussed over the past year, this bottleneck will lessen with time. But unlike those earlier examples, fixing the semiconductor imbalance will be neither even nor orderly. Production of low-margin processors, such as those used in most gadgets and appliances, will remain at a disadvantage -- as will much of the auto sector because, while they consume chips in high volume, they don't require the most advanced, high-margin next generation chips that fabricators are fixated on. Manufacturers will eventually adapt to longer lead times, but we should expect the near-term to remain challenging.

Regards,



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