AMATI GLOBAL INVESTORS

When the chips are down

Our view on the global semiconductor sector

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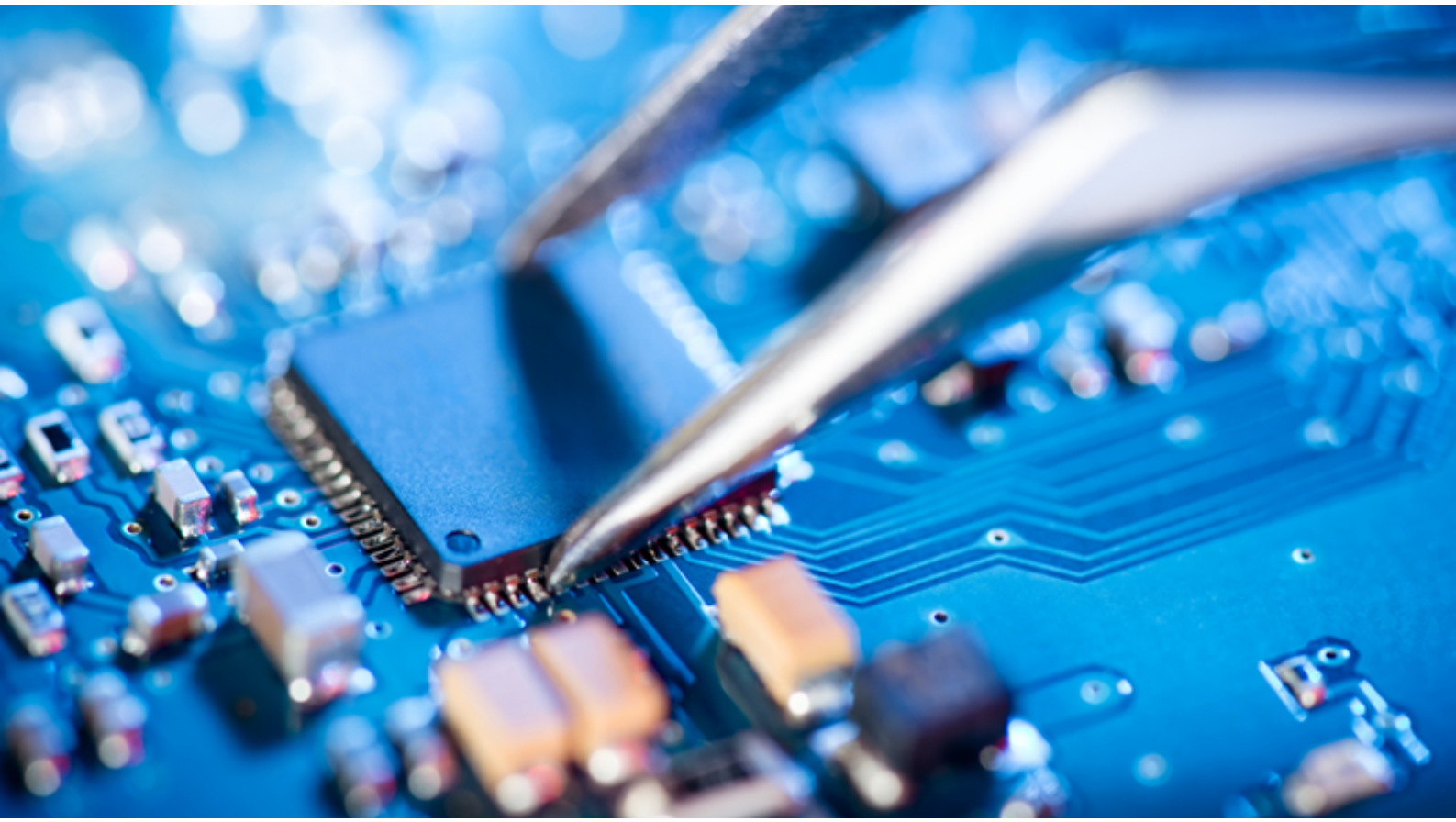


On what do the Chinese Communist Party, US Republicans, US Democrats and European Union agree? Not many things, but one of them is their shared view on the strategic importance of semiconductors.

US has just signed the CHIPS Act, a $52bn package to support semiconductor investment, with strong bi-partisan support. EU is adding Eur15bn to its Eur30bn spending programme. China is investing aggressively, with estimated commitments in hundreds of billions.

Heightened geopolitical tensions are adding the sense of urgency. Bellicose rhetoric between Taiwan and China, combined with worsening Sino-American relations, is one such factor: Taiwan accounts for over 60% of contract semiconductor manufacturing. South Korea, which has ongoing tensions with its Northern neighbour, accounts for another 20%.

The policymakers are discovering the importance of semiconductors for the global economy. This has been obvious to the industry for some time. The critical role of semiconductors to all corners of the economy was brought home to everyone by the recent crippling shortages and escalating costs. From domestic appliances to telecommunication equipment to autos, manufacturers had to stop or reduce production due to disruption in semiconductor supply chains post-COVID.

To take one example, General Motors earnings conference calls had no references to semiconductors until recently. However, since early 21, when the chip shortages became acute, it was mentioned 20-30 times in a typical quarter.

In our conversations with companies, we hear stories about much closer relationships between

end users and semiconductor manufacturers, with Fortune 500 CEOs wooing suppliers several steps up the supply chain.

Ford has recently signed a strategic partnership with GlobalFoundries, a semiconductor manufacturer, reflecting both the importance of chips supplies and the increasing content of semiconductors in its vehicles.

These closer relationships are likely to come with longer-term supply agreements, more predictable pricing and terms of business, bigger order books and more revenue visibility. This feels like a lasting positive change for the industry.

"Semiconductors run the world" says Pat Gelsinger, Intel CEO, in his recent article. He may be biased - he runs the world's biggest chipmaker after all – but more investors and policymakers are coming round to this view.

Computing problems are becoming harder, requiring more computing power. Data volumes continue to increase, and consumers and businesses find more useful things to do with that data. This requires more semiconductors to store and process it.

The average user had about 600 photos stored on their phone in 2015. By 2022 this has increased to 2,000 photos, in much higher resolution. And we're not stopping, photos are becoming videos, demanding ever more memory capacity and computing power.

Semiconductor content reflects this trend: in 2015 iPhone started with 16Gb of flash memory. Latest iPhone models start at 128Gb and go up to 1 Terabyte. No wonder iPhone 5S started at $199, whereas the new iPhone 14 starts at $799. Consumers are happy to absorb this since the phones are so much more powerful and essential to our digital lives. As a result, Apple is selling more smartphones and the semiconductor market value continues to grow.

This is not just about human behaviour. Devices and appliances are becoming "smart" and connected, creating data and computing power demand without any human intervention.

According to GE, each of its aircraft engines produces around one terabyte of data per flight.

This data is used to optimise engine performance and drive predictive maintenance algorithms, detecting the problems before they occur. This drives the demand for semiconductors – both the sensors inside the engine that capture the data and the chips in the data centres that process it.

Machines now perceive the physical world through their own sensors, rather than relying on human instruction. They communicate with each other and the broader networks in which they operate through a growing array of means – over near-field wireless connections if they are in proximity, over cellular networks if further afield or via optical fibre if they need to transmit large amounts of data.

All this sensing and communication is powered by specialist chips, with a bewildering range of acronyms and technical terms – VCSEL lasers, CMOS image sensors, low power modems, RF filters – to name a few.

When it comes to action – opening a valve, moving a robotic arm, accelerating an electric car – this is increasingly enabled by semiconductor components as well. More and more energy that we use in industrial applications is electric – displacing internal combustion or hydraulics. This energy needs to be managed by a special class of chips – power semiconductors, capable of handling high voltages. The market for these is growing as well.

Industry estimates that the transition from internal combustion to electric car adds about $500 worth of semiconductor components, and we're in the early stages of this transition. Similar increase in content is happening in industrial automation, renewable energy and other high-power applications.

All this adds up to a very large market. Gartner expects the semiconductor market to double from $500bn in 2021 to $1 trillion by 2030.

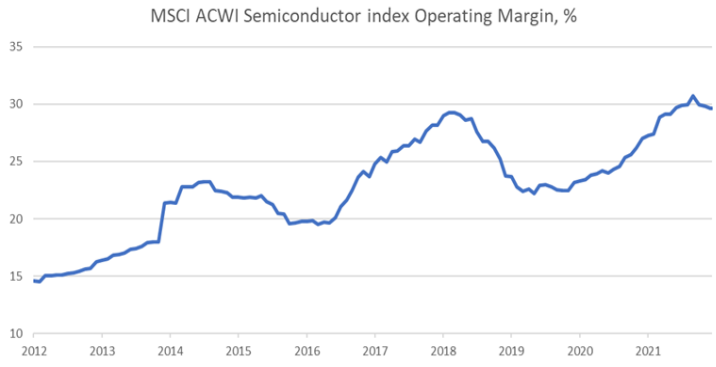
This growth comes with increasing diversity. The variety of jobs that chips are called upon to do is resulting in what industry calls a "Cambrian explosion" in semiconductor market. This term originally referred to a prehistoric period about 540 million years ago.

During that period, for yet unexplained reasons, the variety of life on earth exploded and new species rapidly evolved.

The same explosive increase in variety is now happening in semiconductor world. A decade ago, the typical data centre would be dominated by one-size-fits-all Intel microprocessors. Now there are chips tailored to specific jobs. We have NVidia GPUs handling complex artificial intelligence and machine learning work; so-called FPGA accelerator chips handling specialist tasks that require particular speed and performance; and networking chips, such as Broadcom's Tomahawk, handling data transfers within the datacentre and further afield.

This growth and diversity give rise to a multitude of specialist companies, often with dominant positions in their niches, with high and rising profit margins. Among the better-known stocks, ASML has an effective monopoly on some critical semiconductor manufacturing equipment; Nvidia is the dominant supplier of graphics and AI chips. TSMC dominates contract manufacturing of the largest and most sophisticated semiconductors. Samsung Electronics, SK Hynix and Micron are an oligopoly of three in the DRAM memory market. Infineon leads the market in power semiconductors for EVs and renewable energy.

Chart 1: Industry margins increased through the cycles



Source: Bloomberg

Niche areas have even more appeal in terms of being relatively undiscovered by the mainstream investor community. Lumentum is a leading provider of optical communications chips for telecom and data networks; its lasers also power Apple's FaceID and sensors for cars and smart buildings.

Nordic Semiconductor leads the market in low power connectivity chips, enabling Internet of Things for smart home or connected industrial equipment. Qorvo and Skyworks chips process radio signals in devices ranging from 5G smartphones to military radars. Ambarella image processing semiconductors enable computer vision in security cameras and autonomous vehicles.

The semiconductor industry continues to grow its capacity. As it does, it requires ever more sophisticated manufacturing techniques, and there is a crop of specialist equipment makers that enable this progress. Aiding established players like ASML and Applied Materials are niche firms pursuing new specialist areas. ASM International leads in atomic layer deposition, a particularly precise technique that helps build more sophisticated semiconductor structures.

BE Semiconductor and Onto Innovation help package chips into miniaturised and complex multi-functional systems and inspect their quality.

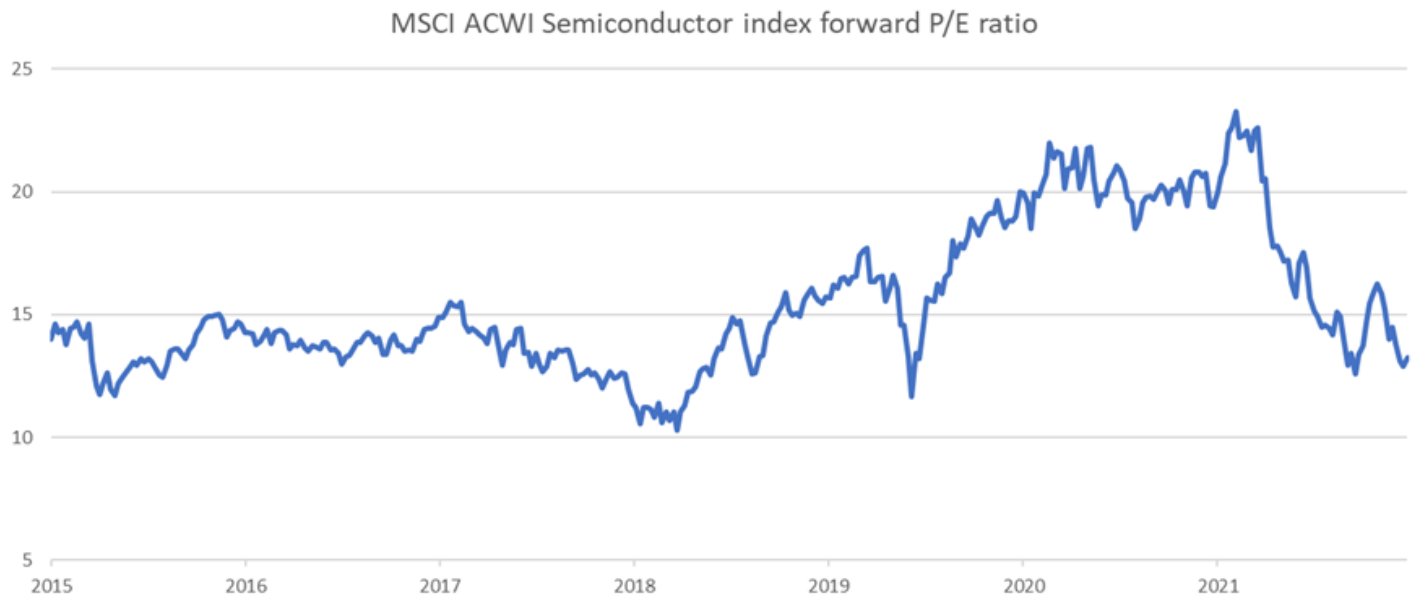
Aixtron machines move the industry beyond silicon, making compound semiconductors from new materials that expand what chips can do in handling power, radio signal and light.

A profitable, growing sector; with high barriers to entry; containing companies with strong competitive positions; policymakers stimulus packages to fund investment; stronger strategic relationships with customers - this could be a stock-picker's heaven.

And yet across the board this isn't reflected in market valuations.

The MSCI ACWI Semiconductors and Semiconductor Equipment index is down over 40% since its peak at the start of the year and is on the forward P/E ratio of 14x, in line with the broader global market - offering no premium for this growth. It is on free cash flow yield of around 4% and even has a dividend yield of over 2%. Not bad in comparison with other, more expensive parts of the tech sector and, frankly, broader stock market.

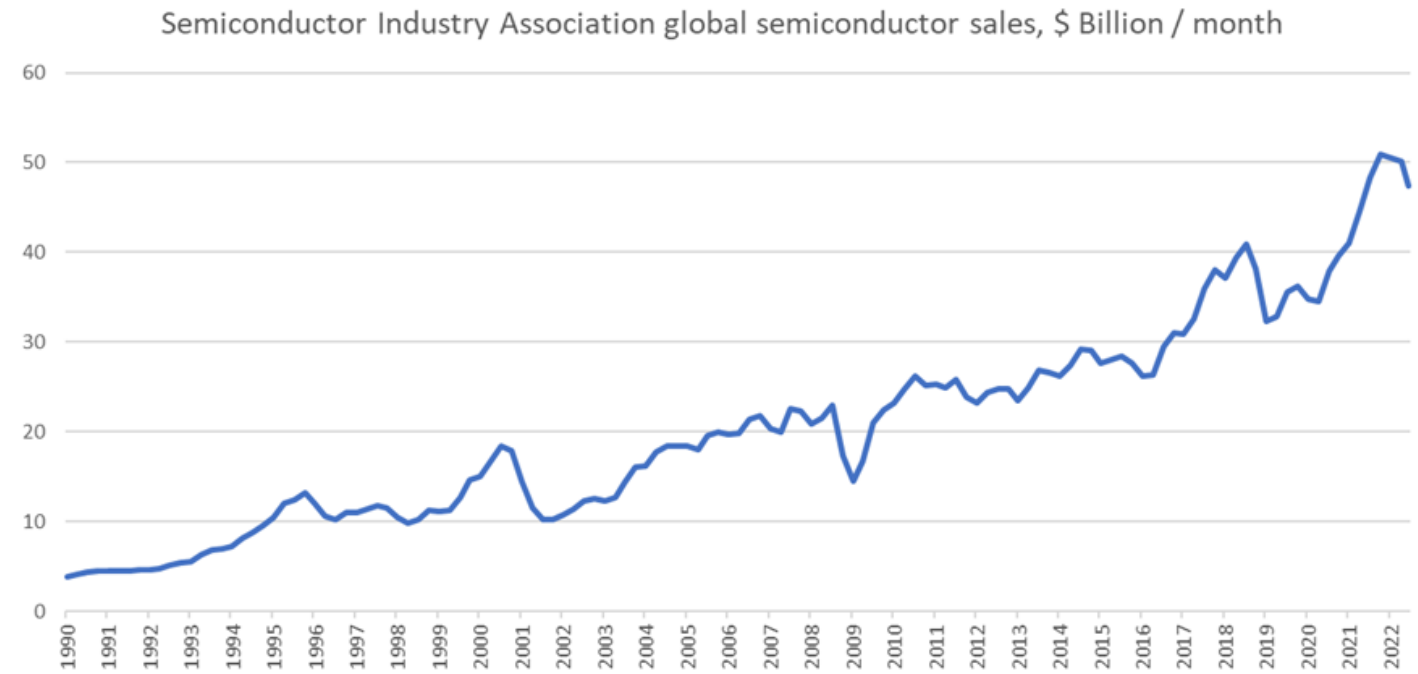
Chart 2: Sector de-rated to below historical average



Source: Bloomberg

Why? Semiconductors are cyclical and in the past these cycles could be steep. Long-term trend growth was punctuated by periods of booms and corrections. The market's muscle memory is that when the cycle is turning down, as it is now, you get out of the stocks

Chart 3: Global semiconductor sales grew through the cycles



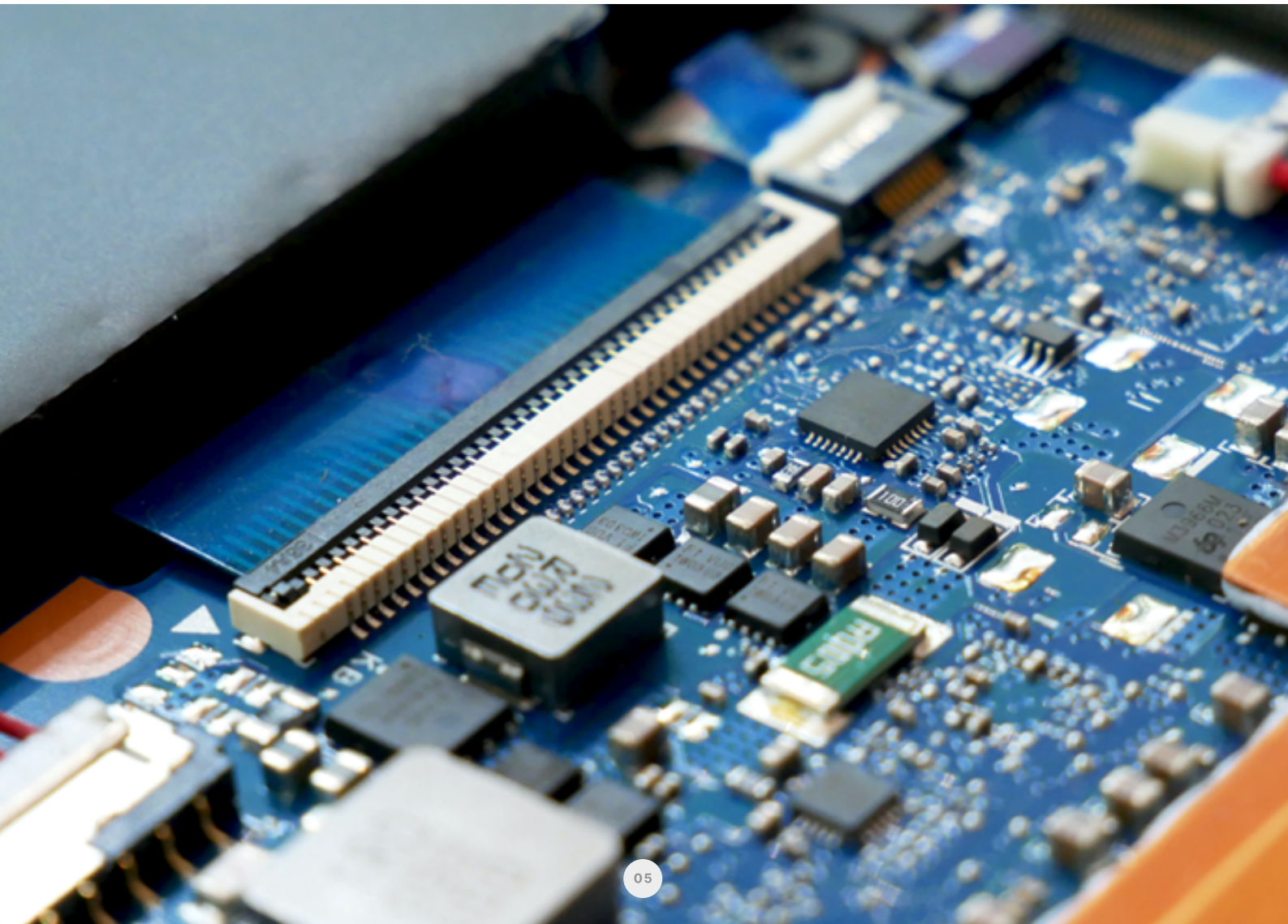
Source: Bloomberg

There is no doubt that in the short-term things are turning south. PC markets and part of smartphone markets are weak - consumers upgraded their phones and their home IT during the pandemic, there is excess inventory in some parts of the market. Companies like Samsung Electronics, AMD and Micron had signalled that clearly. Recession may dampen the demand further (albeit offset by strong order backlogs and ongoing shortages in some product categories).

Sector share prices suggest that a lot of that is in the price. Companies in more vulnerable areas had already seen double-digit downgrades to their earnings expectations. Many analysts and investors are on the side-lines waiting for an opportunity – some talk about "Buying the Confession" - investing as soon as the downcycle is reflected in downgrades and company guidance. Focusing on such short-term dynamics overlooks the bigger picture.

The industry has become more consolidated and has emerged from previous cyclical downturns with better cash generation and higher profit margins. Demand sources have diversified - no longer relying on the PC market as its sole source of demand, as it was 15 years ago. Autos, industrials, data centres, enterprise and telecom networks, consumer electronics and smartphones all have cycles, but they do not cycle in sync, reducing the cyclicality of the whole complex. Semiconductors had become more mission critical in more places, increasing visibility, improving terms of doing business and underpinning that multi-year revenue growth.

In trying to time the short-term cycle, or avoiding this cyclicality altogether, investors are at risk of missing compelling long-term opportunities in semiconductor space. It is time to consider putting some chips back on the table.



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