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to inform your decision-making.



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Global Technology **SEMICONDUCTOR STOCKS: BUYING WHEN THE CHIPS ARE DOWN**

KEY POINTS

- Semiconductor stocks have come under pressure due to concerns about economic growth and trade tensions, as well as supply and demand imbalances.
- The market overlooks the extent to which industry consolidation, supply-side discipline and constraints, and secular demand growth can soften downcycles and drive long-term earnings upside.
- Over the longer term, the semiconductor industry should benefit from content growth in the automotive and industrial end markets as well as investment in data centers and artificial intelligence.

While the semiconductor industry is cyclical, negative sentiment and relatively low valuations suggest that the market may have overlooked the extent to which industry consolidation, the increasing capital intensity of capacity additions, and, critically, broadening demand should help to soften the inevitable downcycles and drive long-term earnings growth. In our view, undemanding valuations could limit near-term downside if our demand-side thesis takes longer to play out, while the potential for trough margins to surprise to the upside during this correction creates compelling risk/reward propositions in high-quality semiconductor stocks.

INTO THE SILICON CHIPPER

Over the six months ended September 30, 2018, the semiconductor and semiconductor equipment industry lagged other technology industries dramatically, barely eking out a positive return at a time when the MSCI All Country World Index Information Technology posted the second-largest gain among the 11 economic sectors.

The pronounced weakness in this group reflected a perfect storm of fundamental and technical factors that weighed on share prices and investor sentiment. To a degree, semiconductor stocks had become the victims of their own success. An extended upcycle where semiconductor stocks outperformed increased the potential downside risk when industry profit margins approached cyclical peaks—traditionally a point where market participants reduce their exposure to the group.

Semiconductor demand tends to track global growth. Accordingly, economic uncertainty stemming from escalating trade tensions between the U.S. and China appeared even more threatening against a backdrop of peaking auto sales and declining prices for memory chips. Meanwhile, the high penetration rate in the smartphone market and an extended handset-replacement cycle raised concerns that this key growth driver had started to fade. A wave of downward earnings guidance revisions across the industry ostensibly

confirmed the market's worst fears, prompting many investors to head for the exits.

As of September 30, 2018, semiconductor stocks were trading at their lowest valuations in five years and were closer to levels seen during a severe, cycle-ending contraction. Our outlook calls for a midcycle correction moderated by several years of industry consolidation and secular growth trends, not a bear market collapse.

SUPPLY-SIDE DISCIPLINE

Improving competitive dynamics should lead to more rational behavior on the supply side, helping to mute cyclical price fluctuations and support profit margins. The memory business is furthest along in this regard, with three players dominating this commoditized market. Industry heavyweight Samsung Electronics demonstrated these improving competitive dynamics when it responded to the recent slide in memory prices by scaling back its planned capital expenditures for 2019. Significant consolidation has also occurred among providers of semiconductor capital equipment, while the number of high-quality analog chipmakers has halved relative to a few years ago.

Rising capital intensity should result in additional supply-side discipline. Moore's law has encountered resistance because of technological limitations and the increasing complexity of the manufacturing process. This rule of thumb holds that the number of transistors on a chip should double every two years, causing costs to the end consumer to decline. Lam Research findings, embraced by memory supplier Micron Technology at its May 2018 analyst and investor day, indicated that the cost of expanding DRAM supply by 20% had increased by three to four times over the previous five years.

DEMAND-SIDE TAILWINDS

On the demand side, the semiconductor industry finds itself at the nexus of a

FIGURE 1: Big Investments to Monetize Big Data

Facebook, Annual Capital Expenditures
Through June 30, 2018



Source: T. Rowe Price calculations using data from FactSet Research Systems Inc. All rights reserved.

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mutually reinforcing feedback loop where low-cost data storage and advances in artificial intelligence unlock opportunities to exploit big data.

Nowhere is this more evident than in the massive investments that leading Internet platforms have made to build out their data centers and artificial intelligence capabilities as part of the ongoing push to monetize their rich troves of information on users and their behaviors. For example, in the first half of 2018, Facebook increased its capital expenditures by more than 150% from year-ago levels. Even if this torrid pace of investment were to moderate, this powerful secular trend remains in its early stages.

This arms race extends beyond the leading online platforms to the offline world, where the emergence of the Internet of things creates new opportunities in industrial and consumer end markets. For example, in the utilities sector, machine learning promises to improve efficiency by balancing electricity supply and demand in a

more dynamic fashion and identifying potential maintenance issues before they lead to system outages.

The auto market arguably offers the most compelling growth opportunity on the consumer side, in our view, even if U.S. vehicle sales have peaked for this cycle. The opportunity set reflects the migration of in-dash infotainment consoles and advanced driver-assistance systems from luxury vehicles to mid-market cars, as well as the electrification of additional automobile subsystems and the push for autonomous driving.

Semiconductors are at the heart of all these innovations, from the memory chips that are essential to training advanced neural networks on massive data sets to the analog semiconductors that process real-world phenomena into digital signals and enable local devices to communicate with the cloud. As chips proliferate in more and more devices to enable data collection and monetization, the semiconductor industry benefits from volume growth

and the improved profit margins that come from dealing with higher-quality customers than PC manufacturers.

At its investor day in September 2018, NXP Semiconductors, a leading provider of analog chips, projected that the automotive end market for semiconductors would grow at a compound annual rate of 5% to 7% through 2021. Semiconductor companies with significant exposure to this end market and the right business mix should be able to grow at an even faster pace. NXP Semiconductors, for example, called for its automotive revenue to increase by 7% to 10% annually through 2021.

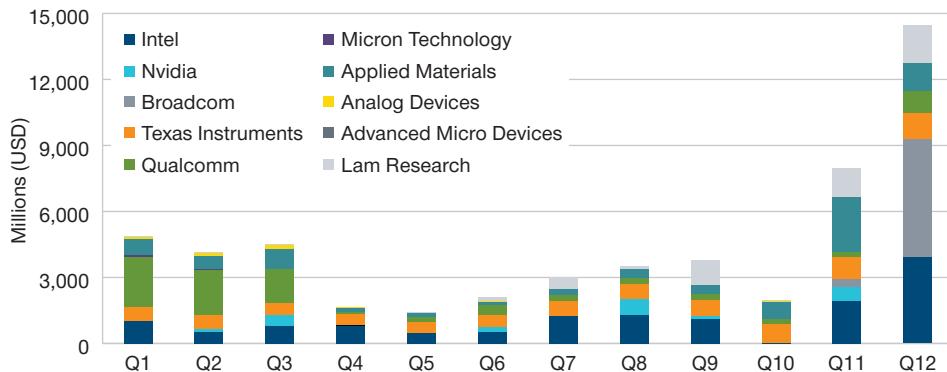
Although valuations and sentiment indicate otherwise, the wave of stock buybacks by prominent semiconductor companies is unusual in the tech sector and suggests that management teams have a degree of confidence in the near-term outlook. Lower share counts also improve earnings leverage when these supply- and demand-side tailwinds become more prominent and start to drive the narrative again.

RISKS AND OPPORTUNITIES

Selectivity in semiconductor stocks remains key, especially if economic uncertainty leads to further deterioration in the near-term demand outlook. We prefer high-quality semiconductor companies whose valuations have priced in the worst-case scenario in

FIGURE 2: Semiconductor Companies Step Up Buybacks

Quarterly Share Repurchases for 10 Largest Companies in S&P 500 Semiconductors & Semiconductor Equipment Index
As of September 30, 2018



Source: T. Rowe Price calculations using data from FactSet Research Systems Inc. All rights reserved.

the short term and fail to reflect the structural and secular trends that should moderate this downcycle and support long-term earnings growth.

Within the commoditized memory market, we've focused on companies with low production costs, healthy balance sheets, and a commitment to returning capital to shareholders. This segment offers leverage to the ongoing boom in data center spending as the push to accumulate and monetize big data sets continues.

Analog semiconductors stand to benefit from content gains in a wider array of industrial end markets and the ongoing push for factory automation.

We prefer businesses that trade at attractive valuations and offer superior exposure to end markets with the strongest secular growth trends.

We also like companies pushing the envelope on next-generation technologies that could make Moore's law relevant again on the performance front, as well as semiconductor capital equipment companies that should benefit from the confluence of increasingly expensive capacity additions and demand growth that is at or above the run rate for global gross domestic product.

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