THE SEMICONDUCTOR CYCLE

REGIONS
ASSET MANAGEMENT

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Semiconductors are at the heart of all electronic devices like personal computers (PC), laptops and mobile phones and are central to information technology. The worldwide semiconductor market was estimated to be $470 B in 2018 after it grew 14% over 2017 (Table 1).

The semiconductor industry is capital intensive as it requires large investment for manufacturing as well as for R&D. Innovation is necessary to keep up with the ever-changing needs of the end consumer. Semiconductors have a relatively short life and become obsolete when new and faster applications are developed. This industry is very cyclical. The upturns occur during periods of high demand which cause supply shortages. Tight supply leads to higher prices and revenue growth. The down turns are caused by inventory buildup which result in falling prices and negative or zero revenue growth (Table 1).

Table 1: Semiconductor Industry Revenue ($, B)[1]

Year	Semiconductor Revenue ($B)	Revenue Growth (Y/Y)
2005	$227.5	7%
2006	$247.7	9%
2007	$255.6	3%
2008	$248.6	-3%
2009	$226.3	-9%
2010	$298.3	32%
2011	$299.5	0%
2012	$291.6	-3%
2013	$306.0	5%
2014	$335.8	10%
2015	$335.0	0%
2016	$338.9	1%
2017	$411.9	22%
2018	$470.1	14%
2019 E	$462.5	-2%

The major factors causing this cyclicality are

1. *Inventory*: Inventory buildup can occur either due to increased supply or slowing demand. In periods of high demand (1998-2000, Figure 1), profitability of semiconductor manufacturers is high. Profits are usually invested to increase capacity. When capacity comes on line, supply tends to overtake demand resulting in an inventory buildup and falling prices. This leads to falling revenue growth and the industry downturn. Similarly, weak product demand (2015-2016, Figure 1) can also result in inventory buildup and the inevitable downturn.

2. *Worldwide Economic Growth*: There is a significant correlation between GDP and semiconductor industry cycle. GDP growth leads to increased industrial output and related demand for semiconductors, triggering an upturn in the semiconductor cycle. On the flip side, decelerating or stagnant economies, (2008-2009, Figure 1) result in lower IT spending by corporations and reduced consumer spending which leads to a downturn.

The Investment Case

The Philadelphia Semiconductor Index (SOX) is the most widely used index to track this industry. It is a market capitalization weighted index that represents the entire chain of the industry including design, manufacture, distribution and sales (Figure 1). A major upturn in the 1998-2000 period was driven by increased demand in personal computers (PCs) during the dot-com era. Since the dot-com crash, there have been three downturns including the one in 2007-2009, which was caused by the financial crisis. The latest upturn, which started in 2016, was due to increased worldwide demand for cell phones, improved graphics, increased use of electronics in heavy equipment and autos as well as the advent of Cloud Computing. In fact, due to this diverse demand, this upturn is considered a super cycle. However, commercial and consumer demand started to slow in 3Q2018 when, over 50% of semiconductor manufacturers missed growth forecasts, triggering a downturn. Trade tariffs, imposed in mid-2018 between the U.S. and China exacerbated the downturn.

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Figure 1 : Philadelphia Semiconductor Index, SOX[2]

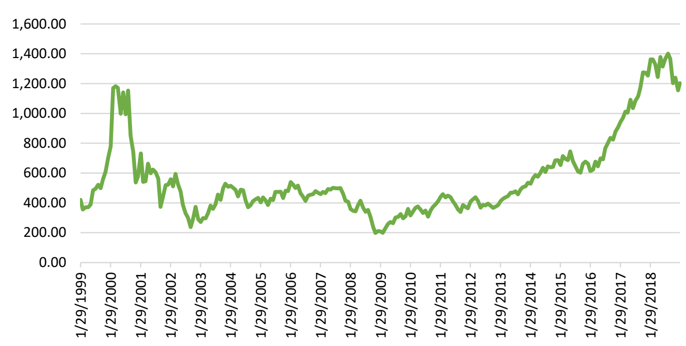
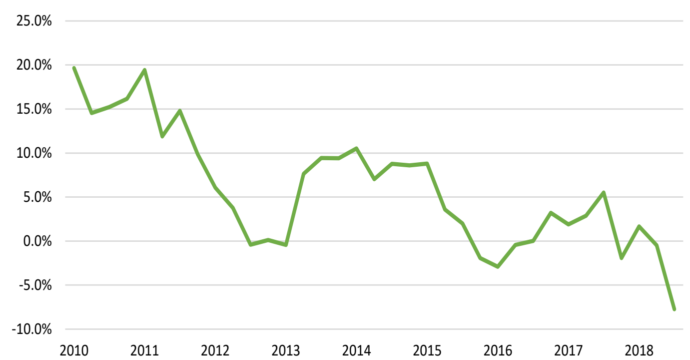


Figure 2: Global Handset Growth Y/Y[3]



1. *Cell Phones*: Cell phone market appears to be saturated as global handset growth turned negative in 3Q2018 (Figure 2). This was reinforced by Apple (AAPL) when it reduced revenue guidance for the upcoming quarter due to weak demand for iPhones.

2. *Automobiles*: Automobile demand in the U.S., China and Europe has slowed down.

3. *Industrials*: Industrial demand has been affected by continued economic slowdown in China as well as Europe.

4. *Cloud Infrastructure*: Spending on cloud infrastructure has been strong since 2016 due to the continued migration of data storage, software and applications from enterprise/local servers to the Cloud. While spending in 2019 is expected to be higher than that in 2018, the growth rate is expected to slow down as companies enter a period of digestion following strong growth in 2016-2018 period (Figure 3).

In a typical cycle, semiconductor stocks lead the upturn as well as the downturn in profitability by 1-2 quarters. The trough occurs 5-6 months after the peak with an average sell-off of 30% (peak to trough). In the current downturn, SOX sold off by about 26% from its peak in October 2018 to lows in December 2018. Despite a 14% increase in 2018 industry revenue, SOX declined 8% in 2018 and underperformed the S&P 500 by 200bps. It is trading at near trough valuation of PE of 13.5x compared to its 10-year average of 17.5x (Figure 4). Most analysts expect additional downward revisions following 4Q2018 earnings leading to another 6-15% sell-off. They also expect earnings to bottom in 1Q2019 followed by marginal growth in 2nd and 3rd quarters of 2019. Semiconductor revenue for 2019 is expected to be below that of 2018 (Table 1). Analysts expect a pickup in growth from 4Q2019, as the roll out of 5G accelerates in 2020 and spurs an upgrade in cell phones.

While it is always difficult to predict cyclical turns, based on consensus assumptions, any potential sell- off due to additional downward revisions after 4Q2018 earnings may provide a good entry point to invest in semiconductor companies that are the current innovation leaders.

Figure 3: Cloud Service Provider Spending ($M)[1]

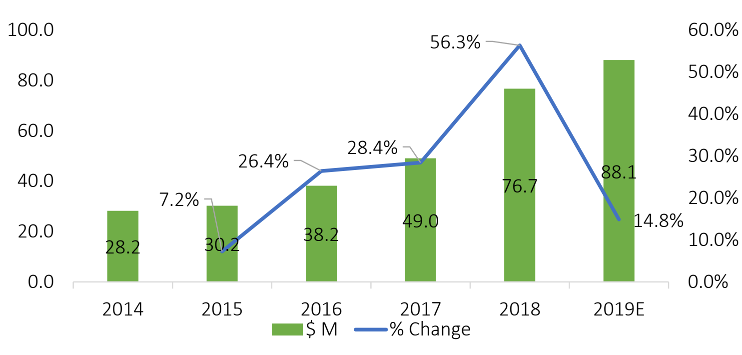
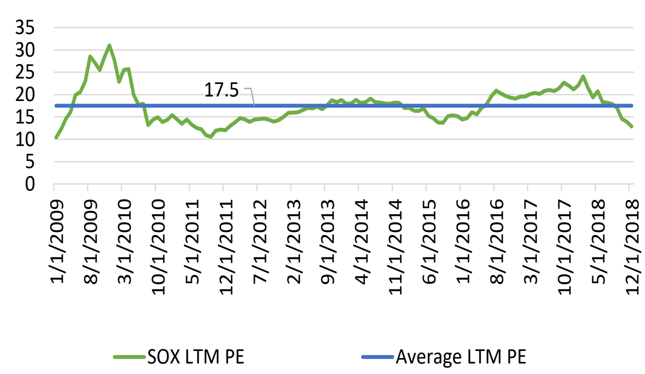


Figure 4: SOX LTM PE[2]



The major risks to these assumptions are

1. *Slowing Global GDP*: The Chinese economy continues to slow down. While China is 19% of global GDP, it accounts for 25% of PC, 24% of cell phone, 30% of auto and 22% of Cloud infrastructure spending. The U.S. economy, which was already expected to slow down from 2018, may slow down even further if the partial government shutdown drags on. Also, IMF has officially lowered its Global GDP forecast for 2019 due to increased geo-political risks.

2. *Trade Tensions*: In mid-2018, U.S. imposed 25% traffic on Chinese imports of semiconductor goods including machines and flat panel displays. China retaliated by imposing its own 25% tariff on U.S. exports of semiconductor goods like test equipment.

If these risks materialize, the downturn could be prolonged with further downside to SOX.

Summary

The semiconductor industry is central to electronic devices and information technology. It is a cyclical industry. The industry cycles are driven by inventory as well as world economic growth. The 2016 super cycle has been driven by diversified semiconductor demand from cell phones, automobiles, industrial equipment as well as advent of Cloud Computing. The downturn for this cycle began in 3Q2018 and is expected to continue till 3Q2019. As a result of this downturn, SOX has sold off and is trading at near trough valuation. Therefore, following any further potential downward earnings revisions, certain semiconductor stocks may present good value with limited downside risk.

References:

1. Semiconductors: 2019 Outlook, J P Morgan, December 21, 2018
2. FactSet, RIM
3. Bernstein Semi Cycle Tear sheet, Sanford Bernstein, December 11, 2018