Semiconductor Growth Resumes in May

Chinese Tariff Theatre and Huawei Trade Ban Get Reprieves

The semiconductor industry finally resumed month-to-month growth according to statistics for May released earlier this week. Specifically, the industry grew by an above-average sequential gain of +1.9% after sequential declines since December—and the third worst 1Q in the last 28 years.

The 1Q earnings season is now complete and the outlook for the 2Q seasonal recovery is anemically-mixed. The weighted sequential revenue gain across my Universe based on guidance (and mostly negative, Huawei-related preannouncements) so far reflects a gain of +1.9% which pales in comparison to the +3.8% average. However, the growth rate accelerates to +6.4% if I exclude Intel and Micron from the calculation. In the meantime, chip sector share prices rallied and outperformed broader equity markets last month.

Clearly the semiconductor sector has risk at this juncture: business weakness from memory products, the lack of growth from PCs and smartphones, and on-again/off-again Chinese tariffs and trade bans. Nevertheless, opportunities persist. See my latest Semiconductor Investment Ideas piece offering specific potential opportunities.

Memories Whack Growth: DRAM and NAND memories drove semiconductor industry growth last year, but are expected to drag the industry into a ditch this year. According to market researcher IC Insights, 2018 total industry sales of $469B was primarily driven by memory product growth of +26%, accounting for six points of +13.7% total growth. DRAM was the largest product category that accounted for 21% of total industry sales while NAND accounted for 12.7%. For 2019, memories are expected to *drop* by -24%, thereby dragging otherwise flat-ish non-memory revenue down to an overall industry decline of -13% (recently lowered from -9%). The SIA lowered its industry forecast early-June to a decline of -12.1% from +2.6% previously, aggravated by a memory drop of -30.6%. IDC dropped its 2019 forecast mid-May to -7.2% from +2.9% with logic products +1% and memories declining.

However, DRAM and NAND are very different products. I believe DRAM will continue to deliver bit-growth and largely maintain its profitability over the next few years due to its limited supplier base, fragmented end-markets, and technological complexity below 20nm line-widths. NAND, on the other hand, will probably experience much more volatility as short-term supply dynamics risk adverse market price erosion. Compared to DRAMs, NAND has twice as many suppliers supporting a market almost half the size that is less fragmented by application—with twice the expected bit growth rate.

Chinese Tariff Theatre: My opinion of the tariff-related trade war with China remains that it might cut around 10% out of worldwide semiconductor industry sales—if, indeed, it persists after the partial reprieve last weekend. The supply side of the semiconductor equation in China is quite small, while Chinese consumption is significant but largely mitigated by the export of final assemblies. The pain to Chinese electronics businesses would be significant and possibly catastrophic, while it would be significant but manageable to businesses outside of China.

Last year China accounted for 33.8% of total semiconductor industry sales, according to the SIA. According to Gartner, the largest China-based customers included Huawei at 4.4%, Lenovo at 3.7%, Xiaomi at 1.5% and BBK Electronics at 2.9% (for Vivo and OPPO). Lenovo is the former IBM personal computer business, and Huawei, Xiaomi, Vivo and OPPO are top-6 smartphone makers world-wide. However, the lion's share of consumption was then exported as finished product (smartphones) which will struggle to remain competitive in world markets without state-of-the-art semiconductor components—which mostly come from the US.

Unfortunately for China, its companies only account for 3% of worldwide semiconductor supply compared to the US at 52%, according to IC Insights. Most of that 3% comes from fabless, in-house operations at Huawei, ZTE and Datang, but also standalone fabless companies that include BitMain, ISSI and Allwinner. China does better with wafer foundries like SMIC at 4.5% of 1Q worldwide foundry business and Hua Hong Semiconductor at 1.5%, according to TrendForce—but half of SMIC's output goes to the US and only one-third stays in China. Last year China only covered 15.3% of its semiconductor needs from domestic sources, according to DigiTimes, with the difference between that and 3% filled by multi-national companies with facilities in China. Those include assembly operations that purchase chips like Foxconn, Pegatron, Wistron, Quanta, Inventec, and Sony, as well as wafer fabs from Samsung, Intel, SK Hynix, TSMC and joint-ventures with UMC and Alpha and Omega Semiconductor.

During Act I when the US-China Tariff War was first rumored, many Taiwanese and other non-Chinese companies with significant operations in China began moving and/or expanding to other locations mostly around Southeast Asia to avoid US tariffs. Such diversification had been under consideration for some time due to rising labor and environmental costs in China, but geopolitics proved to be the final straw. An Applied Materials executive counted 61 Taiwanese companies through May that had been approved by the Taiwanese government to

relocate Chinese operations back to Taiwan totaling an investment of $310B and 30K jobs. Last year, according to the Taiwanese Ministry of Economic Affairs, 47% of 2,734 sampled Taiwan-based manufacturers operated in China for exports, with 16% of them considering shifts to other countries over the next couple years. Act I concluded with the actual levying of tariffs, the US trade ban on Huawei (a series spin-off with its own unique storyline), and specific trade restrictions against Chinese supercomputers.

Act II: Scrambling of the Supply Chain. According to the Wall Street Journal, the Chinese government summoned a number of multi-national corporations with Chinese operations for a 'cordial but unusual' summit in early-June threatening repercussions if they were too aggressive with trade restrictions. Companies included Intel, Qualcomm, SK Hynix, ARM, Microsoft, Samsung, Dell, Nokia and Cisco. Shortly thereafter some firms (Apple, Foxconn, Inventec, and un-named Taiwanese printed circuit board companies) kowtowed to Chinese officials by emphasizing the *unique value* of their respective operations in China; how costly and time-consuming it would be to replicate such operations in other locations (with *greatly inferior* infrastructure and labor); and how they are really only *expanding a portion* of production to better diversify. I would argue that operations are leaving China—as much as realistically possible—amid heavily contorted diplomatic language specifically intended to placate Chinese government officials.

Non-Chinese companies seeking to diversify out of China, according to TrendForce, include: big names Apple, Dell, HP, Microsoft, Amazon, Google and Sony; PC makers Lenovo (China, actually), Acer and Asustek; flat panel maker Innolux; Quanta, Wiwynn, Inventec, and Foxconn all adding to existing production lines in Taiwan; Wistron to India; HDD makers Cal-Comp and Quanta Storage to Thailand, as requested by clients Seagate and Western Digital; Nintendo to Vietnam; and Compal and Quanta, both to southeast Asia.

In addition, Chinese companies are seeking Taiwanese alternatives to replace their US-based suppliers. Specifically for discrete power devices from: Lite-On (with factories in Taiwan, Vietnam, Thailand, Malaysia and Mexico), Taiwan Semiconductor (*not* TSMC), Panjit, Eris, HY Electronic and Actron. Second-tier wafer foundries in Taiwan are also hoping to benefit, including: Mosel Vitelic, Episil Technologies, Vanguard International Semiconductor (VIS) and Powerchip Semiconductor.

Act III opened last weekend with tariffs on hold pending resumption of trade negotiations, along with a partial reprieve of the trade ban on Huawei.

***Huawei Gets Whacked*:** Prior to last weekend's partial reprieve, the US trade ban on Huawei triggered an unprecedented event by the publicity-shy head of the company mid-June providing rarely-available information on corporate operations. CEO Ren Zhengfui hosted a 'coffee with Ren' roundtable with George Gilder and Nicolas Negroponte where he disclosed the trade ban would cost his company $30B in revenue over the next two years; last year revenues were $107B while this year's will probably be $100B down from original expectations of $125B; and that $11B of the $70B in total procurements last year came from the US. The original expectation for next year's revenue was not disclosed.

Huawei is the world's largest telecommunications equipment company and now the second largest smartphone maker behind Samsung, although it has very limited business in the US. According to Gartner, it was the third largest consumer of semiconductors world-wide behind Samsung and Apple last year, accounting for $21.1B or 4.4% of total industry sales. HiSilicon, its in-house fabless chip operation, accounted for as much as 38% (or 1.7%) of that 4.4%, according to TrendForce. IHS tagged it as the fourth-largest chip consumer at $15.9B including $1.7B of DRAM and $1.1B of NAND. The data inconsistency could be explained by HiSilicon.

Huawei claims it has built months of inventory and is seeking increased chip purchases from Taiwan-based companies due to the US ban. While its rollout of 5G infrastructure in China will proceed (assuming it can get parts), Taiwanese suppliers have scaled back expectations for its smartphones to 180-200Mu from 280Mu this year; Huawei cancelled launches of a PC and its foldable smartphone; and competitors seeking to take share include Chinese telecom equipment company ZTE and smartphone makers Samsung, Sony Mobile, Xiaomi and Vivo.

Potential expected Taiwanese chip company beneficiaries, according to DigiTimes, include: smartphone chip maker MediaTek; analog IC suppliers On-Bright Electronics, Richtek Technology and Silergy; MEMS microphone specialist ZillTek Technology; networking IC company Realtek Semiconductor; power amplifier suppliers Airoha Technology and Richwave Technology; server management SoC provider Aspeed Technology; and silicon IP providers Andes Technology, eMemory Technology and M31 Technology.

US chip company exposure to Huawei includes: ADI at 5%-ish of sales, IPHI at 14%, LSCC under-10%, NPTN at 46% (!), SMTC 7%, SWKS 12%, AVGO 4.3%, MU 13%, MTSI 10%-ish, and MXL where it has been immaterial but was expected to be a source of growth this year. MU, INTC and QCOM resumed some portion of shipments within the confines of the ban over the last few weeks.

Structural Differences: Recall that my US-equity Tokeneke Universe does *not* include some three-quarters of industry DRAM and NAND business from Samsung, Hynix and Toshiba. While my Universe does include Micron, it will more closely track flat-ish growth this year rather than -12%. Other structural differences in my Universe include the lack of very large international players (Samsung, Hynix, Toshiba, MediaTek, Infineon), although it does include wafer foundries (TSMC, UMC, SMIC, TowerJazz) and IP companies (Rambus, Xperi, Ceva, and InterDigital) that count as costs associated with manufacturing rather than industry sales. I also normalize fiscal quarters to the best fitting two out of three months. Unreported acquisition stub-periods can also be a difference.

The bigger problem is that most US-based investors in the semiconductor sector experience the industry from the Tokeneke Universe perspective. The Philadelphia Semiconductor Index Option (SOX) is similarly under-represented in memories, although this is mitigated by the inclusion of equipment firms supplying to memory firms.

Above-Average May Gains: Worldwide semiconductor industry revenues for May grew by an above-average +1.9% sequentially on a three-month rolling average basis, according to statistics released by the Semiconductor Industry Association (SIA) earlier this week. The industry's monthly performance has been below-average since July of last year and declined since December, although it appears that April was revised to a slight gain from a slight loss. May has averaged a gain of +1.6% with a high of +6.5%, a low of -7.5%, and five declines in the last 29 years—including only one in the last 14. China led with a demanding gain of +5.4% followed by The Americas with +1.4% and Japan at +0.9%. The rest of the world lagged with declines of -0.4% from Europe and -1.1% from Asia-Pacific.

Next month's release of June stats may be below-average given weak weighted company guidance for 2Q and Huawei-related negative preannouncements—but then again, maybe not. June has averaged a gain of +0.6% with a high of +5.3%, a low of -9.2%, and 12 declines in the last 29 years—including only three in the last 11.

Anemically-Mixed 2Q Recovery: The 2Q revenue outlook based on management guidance across my Tokeneke Universe is a relatively weak mixed-bag at +2.1%—after the third worst 1Q in the last 28 years of -15.5%. The original specific weighted-average guidance for revenue called for a gain of +2.1% ranging from +0.0% to +4.3%, although the mid-point has declined to +1.9% after five negative Huawei-related preannouncements from IPHI, MTSI, MXL, NPTN, QRVO and SWKS (and upside from MX). However, Intel and Micron are adversely affecting an otherwise healthy 2Q rebound that would be weighted at +6.4%. The 2Q typically recovers after the 1Q trough: the chip industry has averaged 2Q sequential revenue growth of +3.8% with a high of +20.0%, a low of -19.9%, and only five declines in the last 29 years—including only one in the last 11, according to industry statistics.

M&A is Back: ON closed its deal to acquire QTNA for $24.50/share in cash. Pending deals include: Infineon out of Germany to acquire CY for $23.85 per share in cash; MRVL to acquire AQ for $13.25/share in cash; and NVDA to acquire MLNX for $125/share in cash. Renesas out of Japan previously closed its deal to acquire IDTI for $49.00/share in cash and SMI has announced its intention to delist its ADS' from the NYSE. Other deals have included NXPI taking over MRVL's wireless business, MRVL getting IBM's former in-house chip design operation from GlobalFoundries, and Dialog Semiconductor in the UK getting SIMO's mobile communication product line.

Chip Sector Rally: Chip sector share prices reversed their declines and outperformed broader market indices last month. During June the Philadelphia Semiconductor Index Option (SOX) gained +12.6% while 47 out of 58 stocks in my Universe grew by an average of +8.4% compared to advances from the NASDAQ, S&P500 and DOW at +7.4%, +6.9%, and +7.2%, respectively. Year-to-date chips maintain their outperformance, per the tables below.

June

Winners *(47/58)*		Losers	
MX	27.6%	QUIK	-16.5%
CY	24.8%	NLST	-13.5%
POWI	23.1%	SMI	-9.2%
NVDA	21.2%	MOSY	-6.9%
SMTC	20.6%	INFN	-6.4%
average stock +8.4%		*SOX +12.6%*	

2Q

Winners *(29/58)*		Losers	
PI	70.8%	NLST	-35.3%
CY	49.1%	NPTN	-33.5%
AQ	43.8%	INFN	-32.9%
MX	39.9%	PXLW	-24.7%
IOTS	34.7%	SQNS	-19.2%
average stock +3.2%		*SOX +4.5%*	

YTD

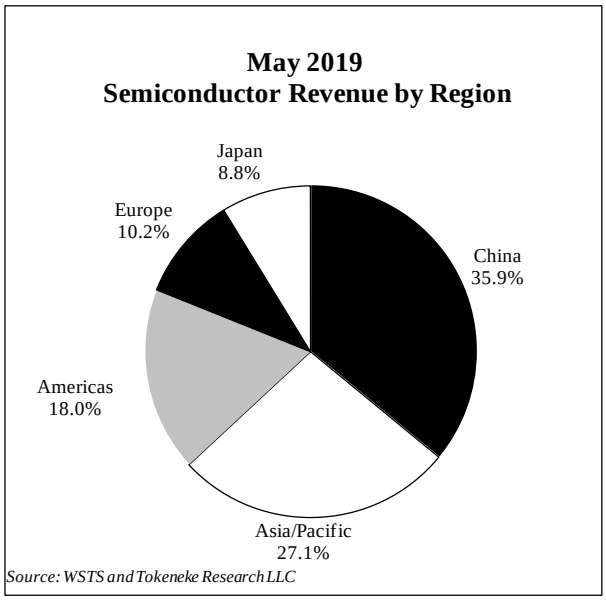
Winners *(50/58)*		Losers	
LSCC	110.8%	NPTN	-35.5%
PI	96.7%	INFN	-27.1%
IOTS	85.2%	QUIK	-21.6%
CY	74.8%	NLST	-11.1%
GSIT	66.7%	AOSL	-8.3%
average stock +24.1%		*SOX +26.3%*	

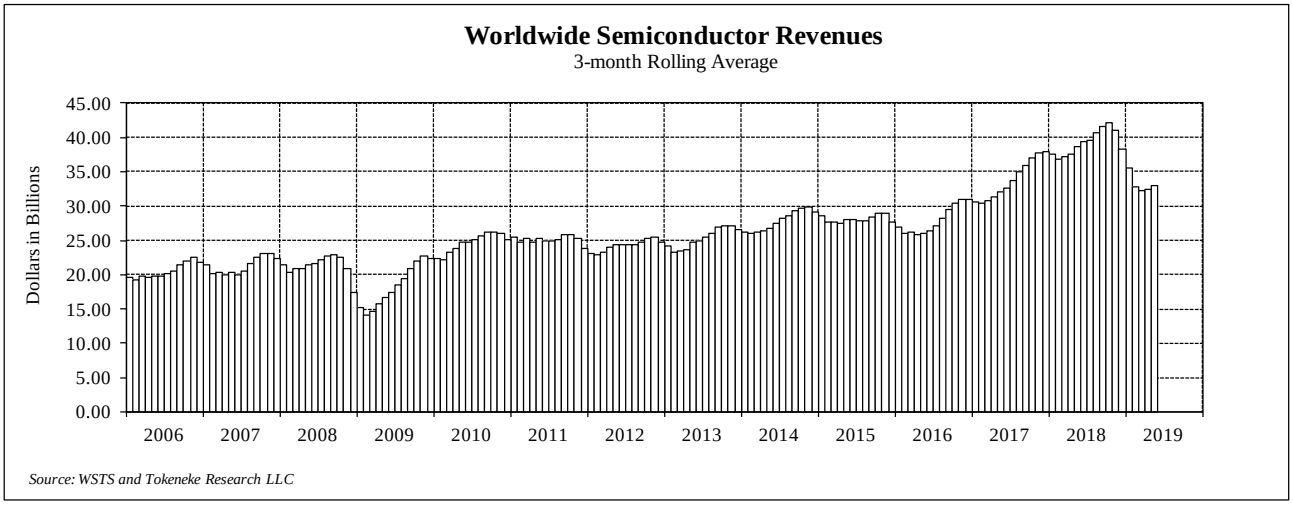
Indices

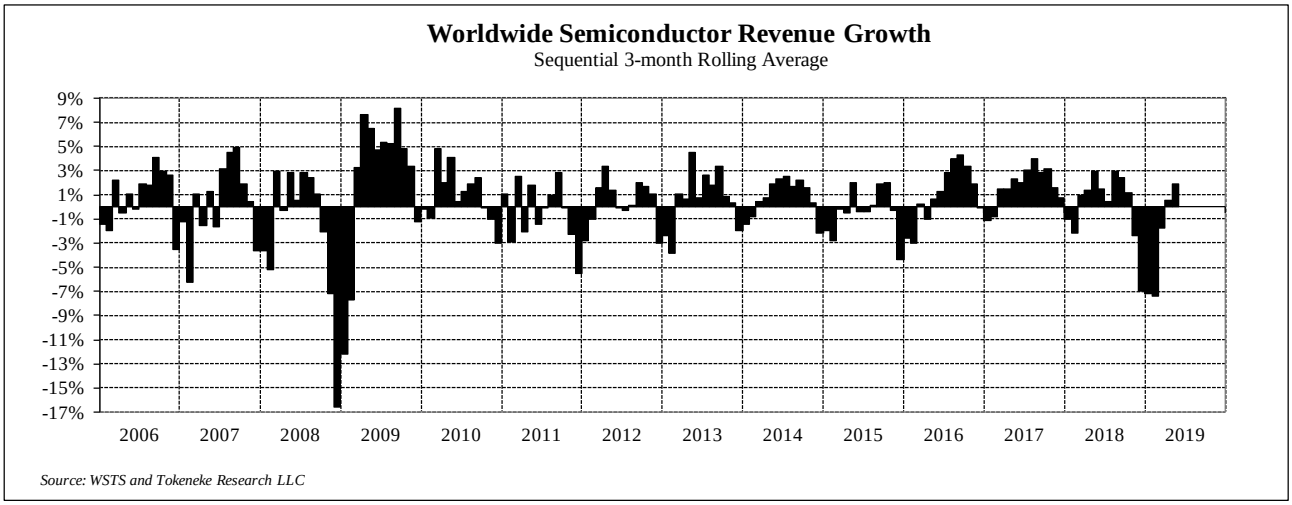
	Jun	*2Q*	*YTD*
SOX	12.6%	4.5%	26.3%
SMH	12.2%	3.6%	26.2%
NASDAQ	7.4%	3.6%	20.7%
S&P500	6.9%	3.8%	17.3%
DOW	7.2%	2.6%	14.0%

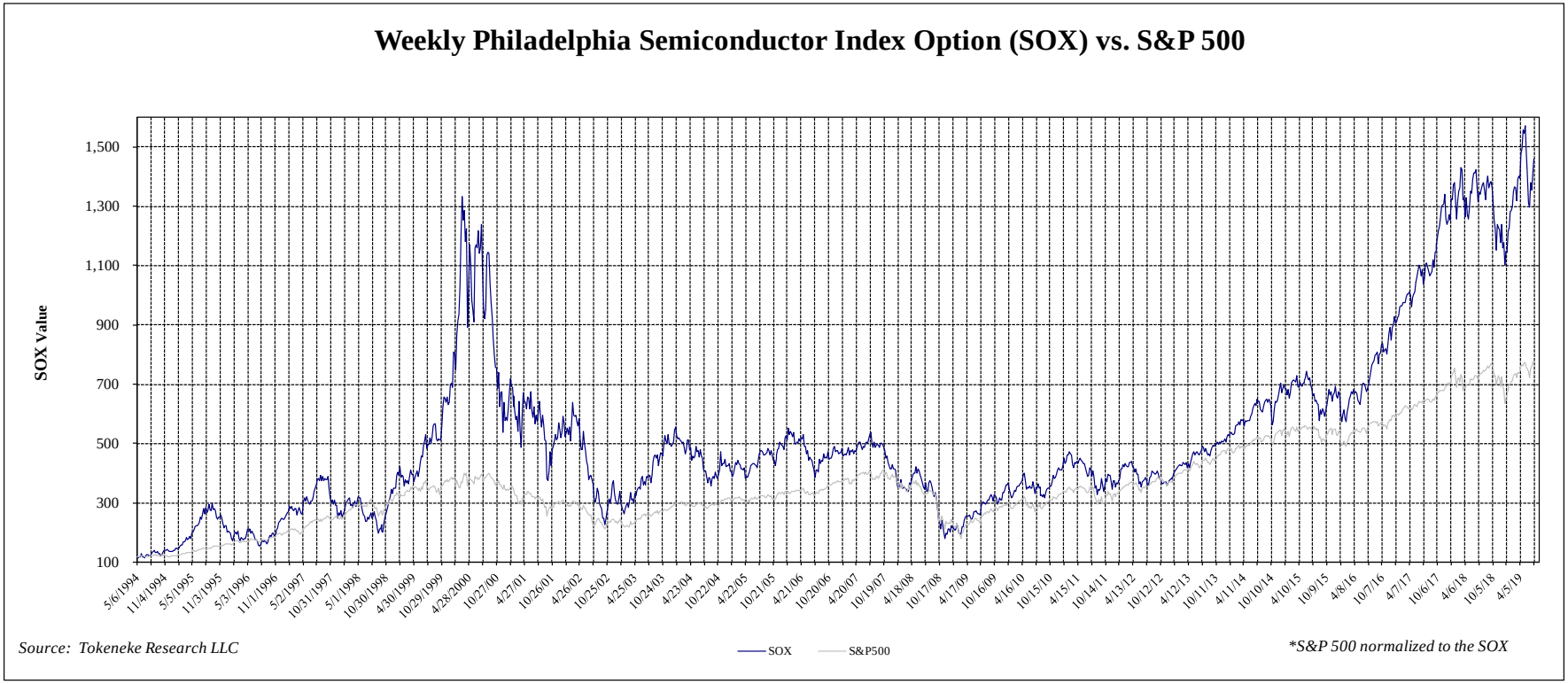
Sector Volatility Persists: Volatility measured by daily cycles of advances and declines was unchanged during June, but the trend nearly completely reversed the prior month's decline. The SOX index rallied last month and once again cycled over five times: +4.6%, -0.8%, +5.4%, -2.3%, +0.6%, -3.2%, +5.4%, -0.7%, +0.1%, -1.5% and then +4.9% to finish with a net gain of +12.6% at a value of 1,459.0.

—Dan K. Scovel
Semiconductor Analyst









Tokeneke Research LLC — *Company Overview*

Semiconductor Industry Analysis and Insight

The Company

Tokeneke Research is an independent research firm specializing in semiconductor industry business issues, providing fundamental research focused on US equities across all market capitalizations within the sector to investors. The company was founded in 2005 and is based in Connecticut.

The Offering

- *Monthly Newsletter:* A summarized review of noteworthy industry business developments, sales statistics, and sector equity market performance, as well as a near-term and annual outlook for sector business fundamentals and share prices. This report typically includes two pages of text and a handful of recurring charts and tables. It is intended for relatively broad-based distribution.
- *Industry Reports:* Publications offering insight and perspective to industry-wide, multi-year forecast updates; periodic sub-sector product type and end-market reviews; fundamental and valuation perspectives on sector equity relationships; and industry introductory overview. These are more detailed reports with varying shelf-lives, and are intended for narrow distribution to interested clients.
- *Company Reports:* Fundamental equity research including earnings estimates and customized valuation analysis.
- *Consulting:* Special projects of limited or extended duration, as well as periodic access of varying frequency.

Publications are distributed via email in .pdf format, unless otherwise requested. Client confidentiality and customized research exclusivity accommodated. Rates vary with the nature, duration, and terms of offerings.

My Background

I have an electrical engineering background, nearly 12 years of semiconductor industry experience, and was on Wall Street for nearly eight years where I was selected as the Best On The Street semiconductor analyst for 2002 by The Wall Street Journal, and third-rated Best of the Best across all sectors.

I obtained my undergraduate BS degree in electrical engineering from the University of Washington, and my MBA from Santa Clara University. My industry experience consists of nearly 12 years in various technical sales and marketing roles at four different semiconductor firms located in Silicon Valley beginning with Advanced Micro Devices in 1984, followed by two small start-up companies, and ending at Cirrus Logic where I supported the firm's Japanese market development. I joined Fahnestock & Co. as a senior semiconductor analyst in 1996 and was recruited by Needham & Co. in April 2000.

My formal coverage list as a sell-side analyst included the following equities: AMD, ALSC, ALTR, ARTI, ATML, CUBE, CY, ESST, GNSS, INTC, ISSI, LSI, MOSY, MU, OIIM, OVTI, RMTR, SIII, SMSC, STEC, SVTG, TDFX, TSRA, TXN, and ZRAN.

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