Memory Boosts 2024 Industry Growth

AI Boosts Memory and Logic, While Everything Else Declines

Okay, I was wrong. The forecast for this year went up to +16% from +13.1% instead of down. While I underestimated the strength of AI—especially its disproportionate impact on memory—I was in the ballpark with the rest of the semiconductor industry excluding memory, whose forecast came down to +3.1% from +6.5% and is pretty flat. The big picture this year remains that AI is hot, but the rest of the chip sector is struggling.

The forecast was up, but the April industry statistics released at the same time last week were below average as expected due to soft 2Q guidance during the 1Q earnings season. 1Q weakness and anemic 2Q guidance improved as the 1Q earnings season progressed with AI-standout NVDA giving both a nice boost two weeks ago. The last hold-out AVGO is scheduled to announce this Wednesday. The good news is that the semiconductor sector outperformed broader equity market growth last month and so far for the year, but the bad news is that half of the companies reporting 1Q earnings missed expectations and the chip sector's strength lacks breadth across my Universe. I continue to hope that AI cap ex euphoria ahead of revenue streams and profits lasts long enough for PCs, smartphones, automotive and the rest of the end-markets to correct themselves and return to growth.

In the meantime, the SOX index remains over-extended versus the S&P500 and most fundamental valuations across the sector are not attractive. I would still be very careful and extremely selective approaching potential chip sector opportunities at this time. Memory is looking pretty darn good, though.

Forecast Increase: The SIA/WSTS raised its annual semiconductor industry sales forecast for growth last week to +16.0% from its previous +13.1% from last November. While the headline is certainly good news, the details are discouraging. AI is driving some upside in logic and a ton of upside in memory while every other product type has declined—significantly, in fact, per the adjacent table. Expected memory upside more than offset expected declines in non-memory products.

WSTS 2024 Growth Forecast

	Nov '23	*Jun '24*
Discrete	4.2%	-7.8%
Opto	1.7%	-1.0%
Sensors	3.7%	-7.4%
Analog	3.7%	-2.7%
MPUs	7.0%	1.6%
Logic	9.6%	10.7%
Memory	44.8%	76.8%
Total Semi	13.1%	16.0%
Non-Memory	6.5%	3.1%

Recall that AI uses a lot of very high-performance HBM (High Bandwidth Memory) DRAM in stacked die configurations going from 8 to 12 layers. Industry-wide, HBM3E consumes three-times as many wafers as DDR5 (whose die is twice the size of DDR4); includes a logic interface chip; and has a complex packaging stack that hurts yields. This means the ramp of high-priced HBM constrains overall industry DRAM bit supply thereby supporting broader market prices—and the ratio for next-generation HBM4 is even higher. Hence the significant memory forecast upgrade to +76.8% from +44.8%.

WSTS Semiconductor Industry Revenue Forecast

	2023 act	2024 fcst		2025 fcst
		Nov '23	*Jun '24*	*Jun '24*
Total Semi	-8.2%	13.1%	16.0%	12.5%
$ billions	526.9	588.4	611.2	687.4
Memory Only	-28.9%	44.8%	76.8%	25.2%
$ billions	92.3	129.8	163.2	204.3
% of industry	17.5%	22.1%	26.7%	29.7%

Geopolitical Gymnastics: Recall the new normal of the chaos of every semiconductor company preserving its supply chain and sales in a variety of ad hoc fashions skipping around US and Chinese technology sanctions, embargoes and tariffs. This month's vocabulary word is 'De-Sinicization' as Chinese companies expand operations out of China (OOC) to more politically neutral countries like Singapore, as well as Taiwanese firms expanding out of Taiwan (OOT) for similar reasons. Thank DRAMeXchange/TrendForce for this one. Last month's phrase was 'Geopolitically Dependable Capacity' as TXN management described automotive customer supply requirements.

'Indigenization' includes the US CHIPS grants and loans incentivizing domestic semiconductor operations to the tune of $52B, China's Big Fund of $150B, as well other incentives from Japan and India. Last month South Korea added $19B, Malaysia $5.3B, and China another $47.5B into the mix.

The Chinese grow-your-own category of 'Huawei-ization' added a specification of Chinese semiconductor industry standards while the US prohibited Intel and Qualcomm from selling to Huawei. Previously China had banned Intel and AMD processors for Chinese telecom companies beginning in the next year or two.

An interesting factoid emerged from ASML last month. Apparently, they have a 'kill switch' that can disable remote equipment operations from their headquarters. Pretty cool, huh?

Memories Matter: Recall that my US-equity-based Tokeneke Universe does *not* include some three-quarters of industry memory business from Samsung, SK Hynix and Kioxia. While my Universe does include Micron and Western Digital, it will probably under-perform expected industry growth in 2024 due to under-representation of more robust expected memory growth now over +75%. My Tokeneke Universe also does *not* include very large international players (aforementioned memory guys plus MediaTek, Infineon, Renesas, Rohm, Winbond, Macronix, Nanya, Novatek, Realtek) although it does include wafer foundries (TSMC, UMC, GlobalFoundries, Skywater

Tech, Tower Semi) and IP companies (Rambus, Xperi, Ceva, InterDigital, Arm, Adeia) 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 and mergers exiting the sector can also make a difference.

While these differences are significant, most US-based investors experience the sector from the Tokeneke Universe perspective. The Philadelphia Semiconductor Index Option (SOX) is similarly under-represented in memories, although this is sometimes mitigated by the inclusion of equipment firms supplying to memory firms.

Below-Average April Growth: Worldwide chip industry revenues for April grew by +1.1% sequentially on a three-month rolling average basis, according to statistics released by the Semiconductor Industry Association (SIA) last week. This below-average growth was not unexpected based on soft 2Q company guidance during the 1Q earnings season. April has averaged growth of +1.5% with a high of +8.3%, a low of -4.7%, and 12 declines in the last 38 years, including five of the last 15. The Americas led with growth of +4.2% followed by Japan at +2.4% and China at +0.2%. Asia-Pacific declined by -0.5% and Europe fell by -0.8%. See the Charts on Page 3 of this report.

Next month's release of May statistics is likely to be weaker than normal as well, in my opinion, based on weak 2Q company guidance during 1Q earnings season that is nearly complete. May has averaged growth of +1.8% with a high of +6.5%, a low of -7.5%, and only six declines in the last 38 years, including one in the last 19.

Weak 1Q and 2Q Outlook: 1Q revenue declined sequentially by a very weak -5.7% according to industry statistics, which was not unexpected given abysmal company 1Q guidance during the 4Q earnings season announcements and 1Q reports so far. The specific weighted average revenue guidance for 1Q across my Tokeneke Universe called for a sequential decline of -4.6% ranging from -7.0% to -2.2% after only one preannouncement (from SIMO that happened to be positive). The weighted average reported results to-date have come in at a decline of -2.9% (or -7.9% excluding NVDA), although only AVGO has yet to announce. The 1Q is seasonally the weakest quarter of the year with an average sequential revenue decline of -2.1%, a high of +9.2%, a low of -19.4%, and 25 declines in the last 37 years—including 11 of the last 12, according to industry statistics.

The 2Q outlook is also soft. The specific weighted average guidance for revenue so far calls for a sequential gain of +3.8% this quarter (or +2.6% excluding NVDA), ranging from +0.7% to +6.8%. The 2Q is seasonally a recovery quarter with an average sequential revenue increase of +4.2%, a high of +20.0%, a low of -19.9%, and eight declines in the last 38 years—including only two of the last 12, according to industry statistics.

More Banking, Less Government: Last month Polar Semiconductor scored $120M in US CHIPS funds for its fab in Minnesota, Microchip sold $1.1B of converts and investor Mubadala sold $950M of its GlobalFoundries holdings of which GFS repurchased $200M. Intel recently announced a deal selling 49% of its Fab 34 in Ireland to investor Apollo for a cool $11B. Pending deals include: Western Digital's plan to split its hard-drive and flash operations into two separate companies 2H24; Silicon Motion suing MaxLinear for backing out of its takeover last year; and Infinera rumored to be shopping itself since March 2023 (it recently fixed its revenue recognition issue from 3Q23).

Semiconductor Equities Outperform, But Lack Breadth: Semiconductor sector share prices outperformed broader equity market gains last month and continue to outperform on a year-to-date basis, although the average across my Universe continues to underperform. During May the Philadelphia Semiconductor Index Option (SOX) advanced by +9.6% while 41 out of 55 stocks in my Universe grew by only +5.3%. Year-to-date the SOX is significantly outperforming broader equity markets with a gain of +22.7%, although only 27 out of 55 stocks in my Universe have advanced by an underperforming average of +6.2%. Broader equity markets have gained with the NASDAQ, S&P500 and DOW up by +11.5%, +10.6%, and +2.6%, respectively.

May

Winners *(41/55)*		Losers	
SQNS	59.2%	PXLW	-40.2%
SITM	36.7%	GSIT	-33.8%
AOSL	34.0%	SKYT	-26.3%
CRUS	29.5%	ALAB	-23.9%
HIMX	28.7%	MRAM	-19.7%
average stock +5.3%		*SOX +9.6%*	

QTD *(2Q)*

Winners *(28/55)*		Losers	
SQNS	102.6%	PXLW	-58.5%
SMTC	41.5%	INTC	-30.2%
AOSL	33.0%	XPER	-26.9%
SITM	30.7%	SKYT	-25.7%
PI	27.5%	MRAM	-24.7%
average stock +1.9%		*SOX +4.4%*	

YTD

Winners *(27/55)*		Losers	
NVDA	121.4%	SQNS	-72.4%
PI	81.8%	WOLF	-40.9%
ALAB	79.3%	MBLY	-40.8%
SMTC	77.5%	INTC	-38.6%
ARM	60.4%	MRAM	-34.1%
average stock +6.2%		*SOX +22.7%*	

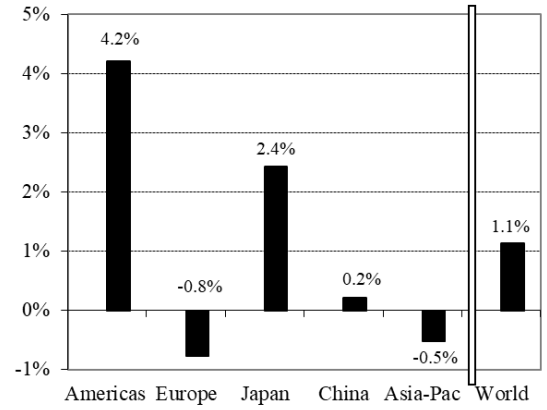
Indices

	May	*QTD*	*YTD*
SOX	9.6%	4.4%	22.7%
SMH	12.3%	6.9%	37.5%
NASDAQ	6.9%	2.2%	11.5%
S&P500	4.8%	0.4%	10.6%
DOW	2.3%	-2.8%	2.6%

Stocks Still Scary: While AI is a huge growth opportunity that single-handedly boosted this year's chip industry forecast, the rest of the semiconductor industry's products and markets are experiencing malaise and/or transitions. In the meantime, the SOX index remains way over-extended versus the S&P500 (note the relative premium of the SOX in the chart on Page 4 of this report), and most fundamental valuations across the sector are not attractive. Net-net, I remain very careful and extremely selective approaching potential chip sector opportunities at this time.

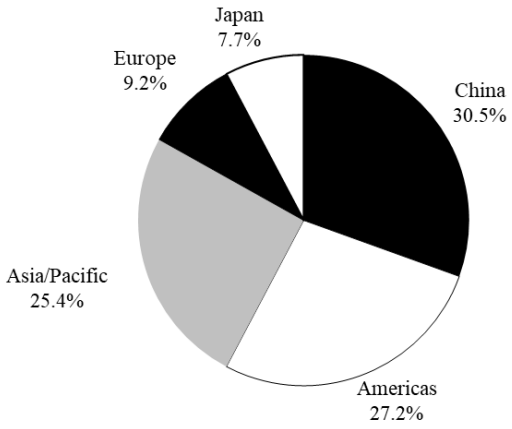
—Dan K. Scovel
Semiconductor Analyst

April 2024 Semiconductor Growth by Region
(compared with prior month)



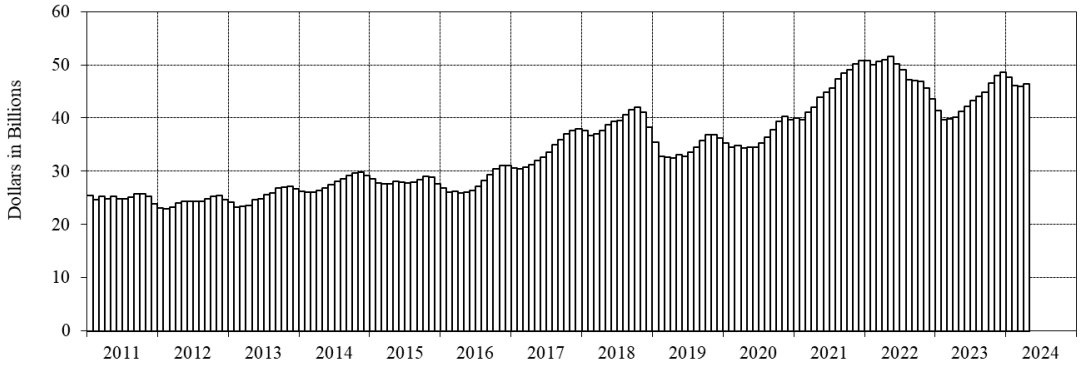
Source: WSTS and Tokeneke Research LLC

April 2024 Semiconductor Revenue by Region



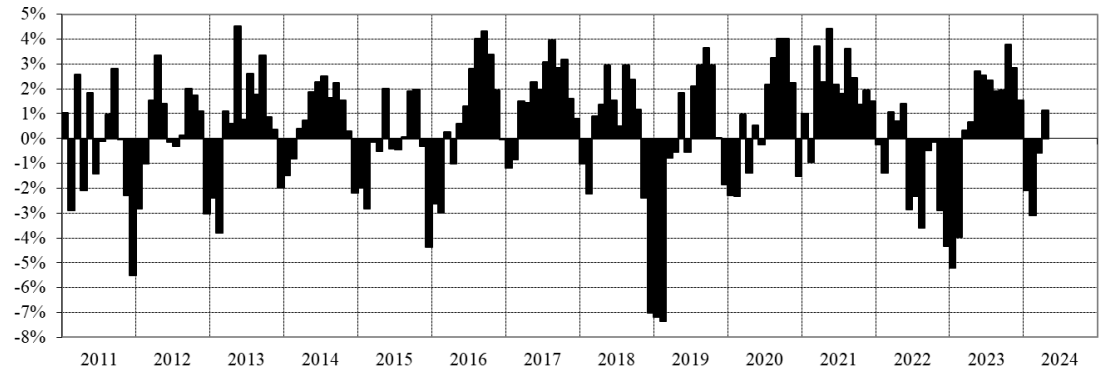
Source: WSTS and Tokeneke Research LLC

Worldwide Semiconductor Revenues
3-month Rolling Average

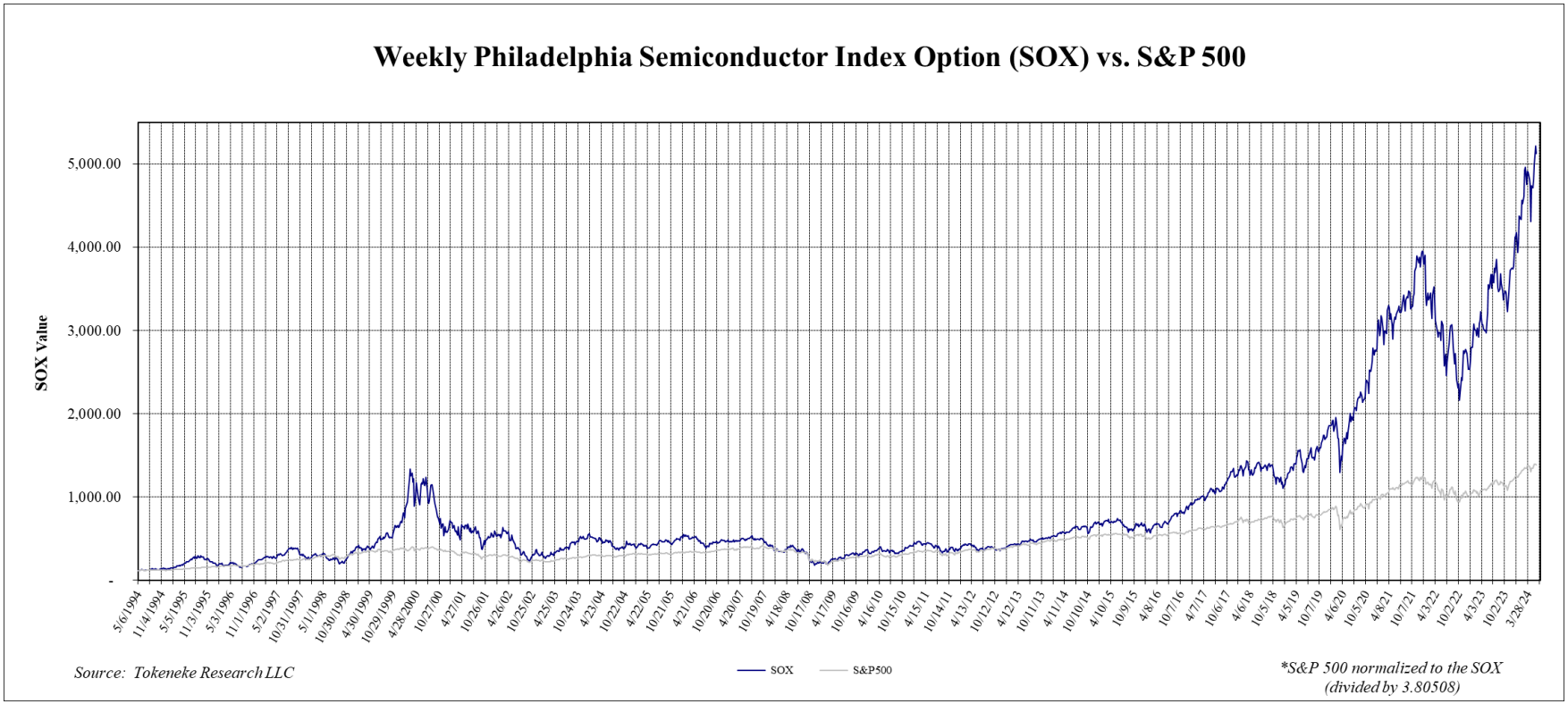


Source: WSTS and Tokeneke Research LLC

Worldwide Semiconductor Revenue Growth
Sequential 3-month Rolling Average



Source: WSTS and Tokeneke Research LLC



Tokeneke Research LLC

Semiconductor Industry Analysis and Insight

Company Overview

The Tokeneke Universe:

55 companies/tickers as of 3/10/24

Company	Ticker	Company	Ticker	Company	Ticker
Adeia	ADEA	Microchip Technology	MCHP	Rambus	RMBS
Analog Devices	ADI	Monolithic Power Systems (MPS)	MPWR	Silicon Motion	SIMO
Ambarella	AMBA	Everspin Technologies	MRAM	SiTime	SITM
Advanced Micro Devices (AMD)	AMD	Marvell	MRVL	SkyWater Technology	SKYT
Alpha Omega Semiconductor	AOSL	M/A-COM Technology	MTSI	Silicon Laboratories	SLAB
Arm Holdings	ARM	Micron Technology	MU	Semtech	SMTC
Broadcom	AVGO	MagnaChip	MX	Sequans Communications	SQNS
CEVA	CEVA	MaxLinear	MXL	STMicroelectronics	STM
Cirrus Logic	CRUS	Netlist	NLST	Skyworks Solutions	SWKS
Diodes	DIOD	NVIDIA	NVDA	Synaptics	SYNA
GlobalFoundries	GFS	NXP Semiconductors	NXPI	Tower Semiconductor (TowerJazz)	TSEM
GSI Technology	GSIT	ON Semiconductor	ON	Taiwan Semiconductor Mfg. Corp. (TSMC)	TSM
Himax Technologies	HIMX	Impinj	PI	Texas Instruments (TI)	TXN
InterDigital	IDCC	Power Integrations	POWI	United Microelectronics Corp. (UMC)	UMC
Infinera	INFN	Pixelworks	PXLW	Vishay Intertechnology	VSH
Intel	INTC	QUALCOMM	QCOM	Western Digital	WDC
Lattice Semiconductor	LSCC	Qorvo	QRVO	Wolfspeed	WOLF
Mobileye Global	MBLY	QuickLogic	QUIK	Xperi	XPER

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.

My Background

I have an electrical engineering degree, nearly 12 years of semiconductor industry experience, and was on Wall Street for nearly eight years where I was selected as Best On The Street semiconductor analyst by The Wall Street Journal in 2002.

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 coverage as a sell-side analyst included the following: 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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