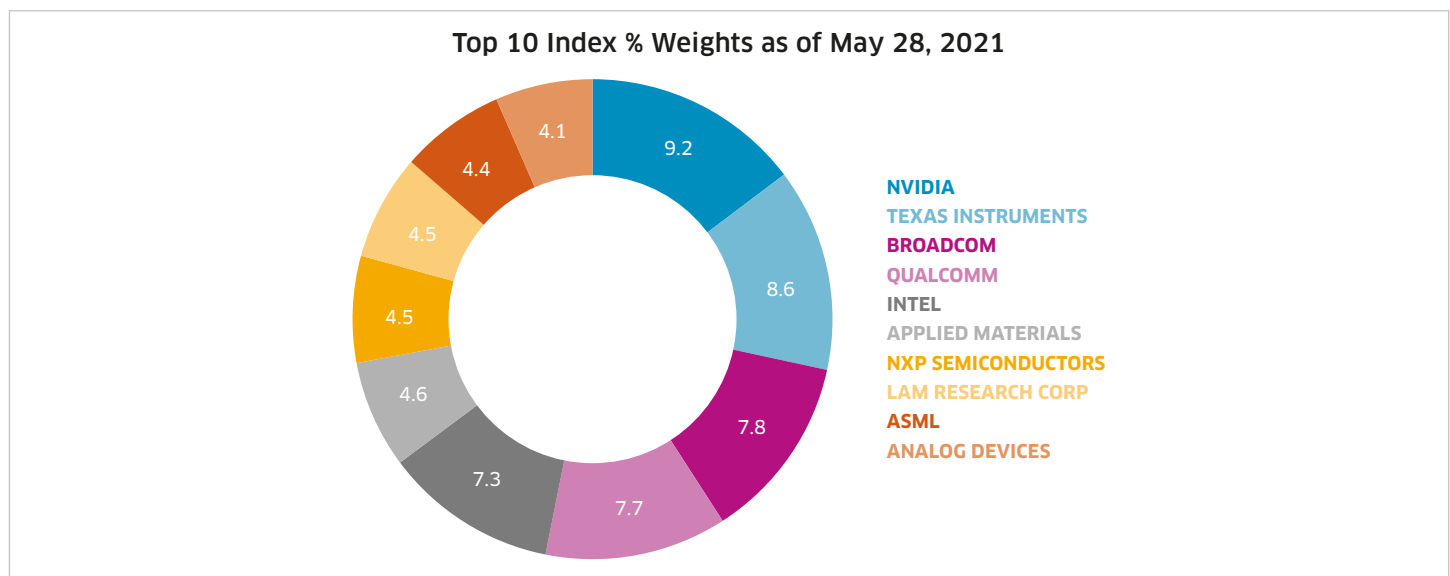


Semiconductors in the Turbocharged, COVID-19 Era of Thematic Tech

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The PHLX Semiconductor Sector Index (SOX) was launched on December 1, 1993, and has enjoyed a storied history, becoming one of the best-known and most widely-tracked subsector indexes. During the 2010s, SOX returned 513% on a total return basis, besting even the Nasdaq-100 Index (NDX) which soared 426%. In 2020, it appreciated by an incremental 54%, slightly ahead of NDX's total return of 49%. Its constituent basket consists of the top 30 securities by market capitalization in the semiconductor industry, as defined by ICB's subsector classification (inclusive of Production Technology Equipment), and its relatively straightforward methodology employs modified market cap-weighting (8% capping for the top 5 constituents, with the rest capped at 4%) on a quarterly rebalancing schedule. Constituents must have a listing in the United States on either the Nasdaq, NYSE, or CBOE exchanges, and are required to meet minimum thresholds for market cap (\$100MM) and liquidity (1.5MM shares traded in each of the last 6 months). Let's review how SOX has performed in the recent past and what its components look like today, before analyzing its importance to the broader universe of thematic technology.

Current Composition



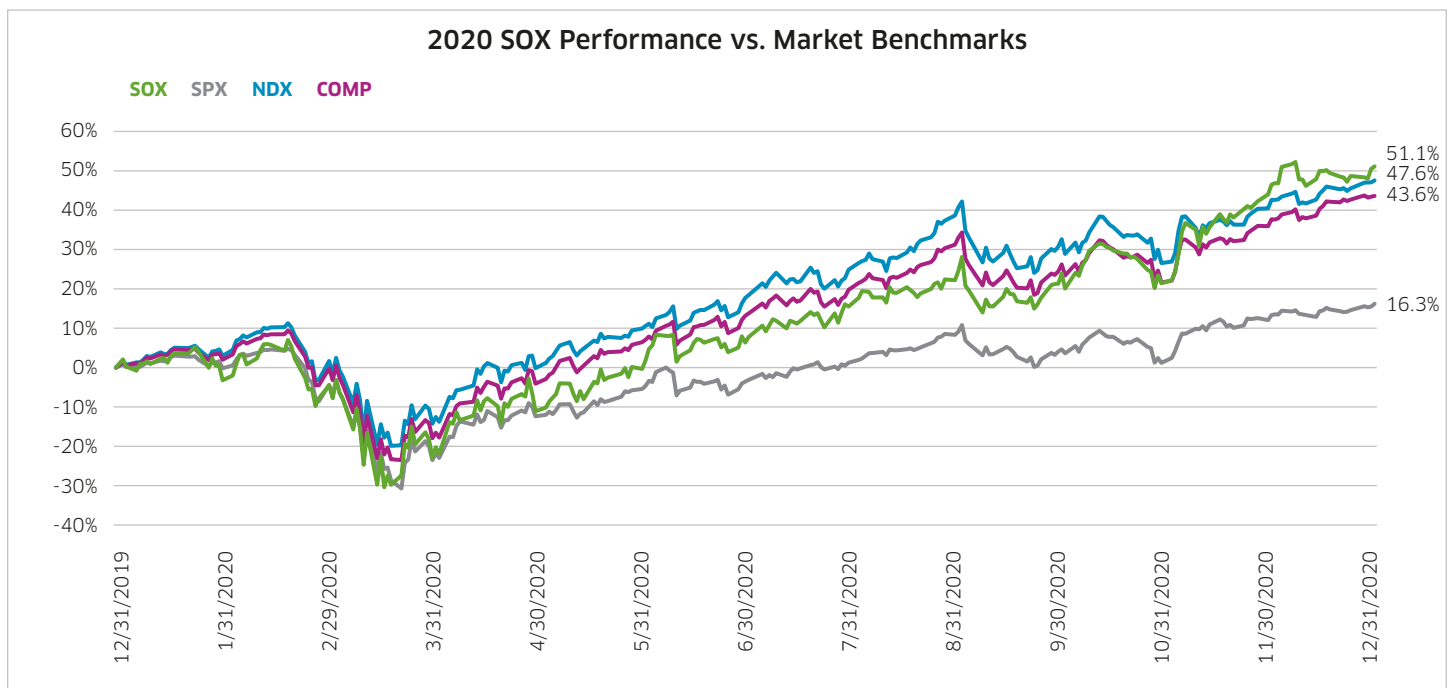
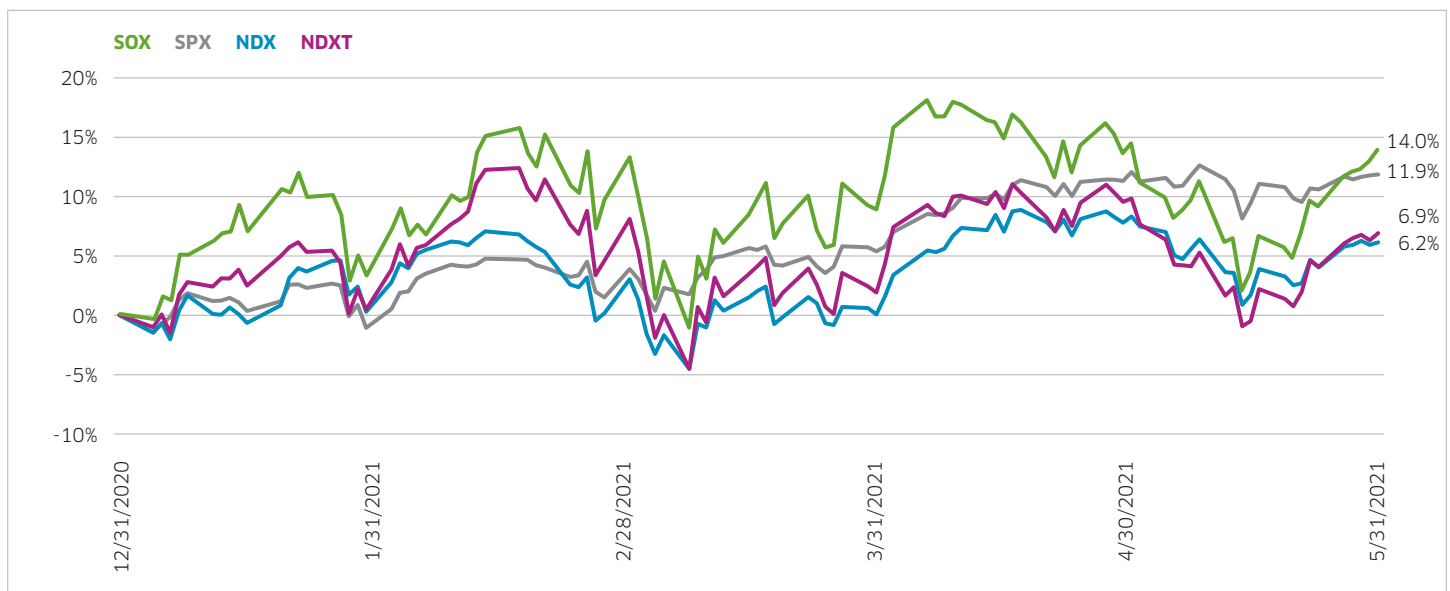
Of the 30 constituents in SOX, the top 10 represented 63% of the index weight as of May 28, 2021. The top 5 names represented approximately 41%, while the top 15 represented 81%. The largest of these was NVIDIA (NVDA), whose outsized weighting is a function of its 26% return since the last quarterly rebalance in March. The average YTD return for the top 15 was 18%.

In terms of market capitalization for the overall group, the average was \$94.5Bn, while the weighted average was \$158.1Bn. The median was \$41.3Bn, and the range from largest to smallest was \$547.0Bn.

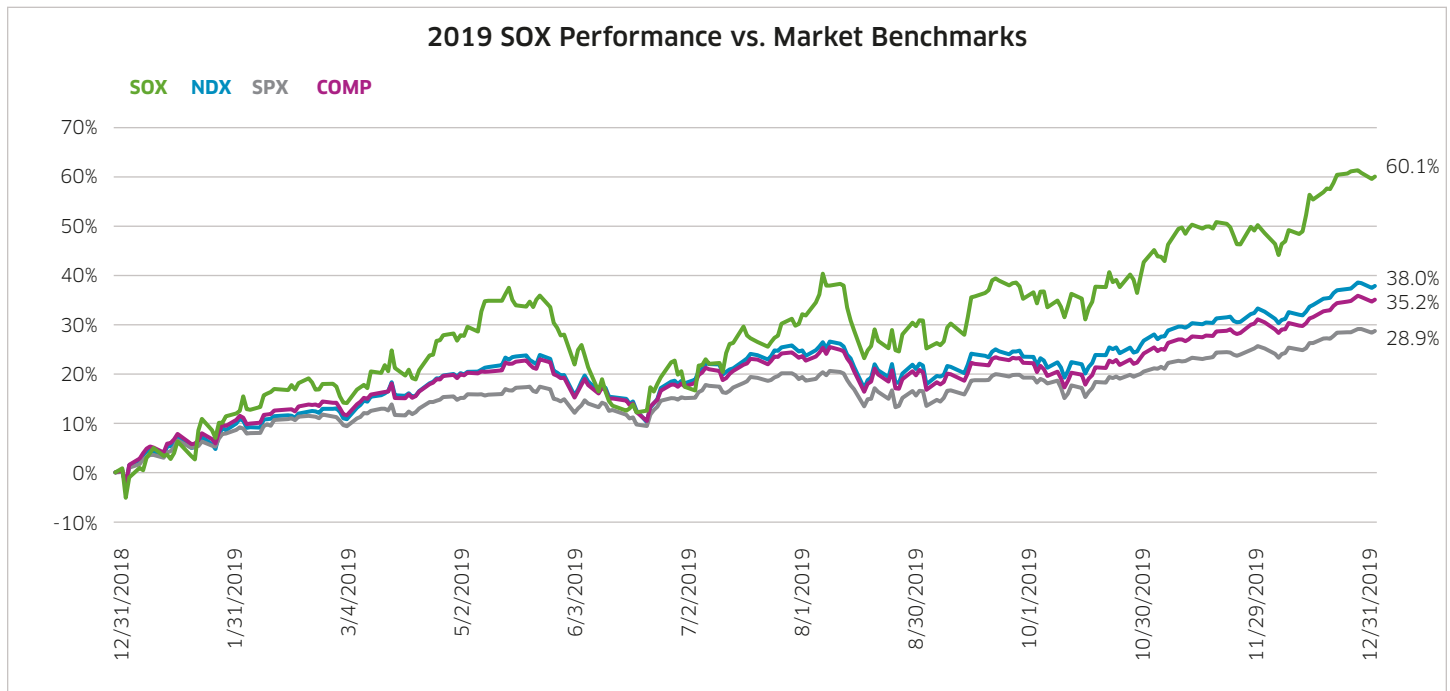
2020 was a banner year of performance for SOX, outpacing the Nasdaq-100 by approximately 3.5% and more than tripling the return of the S&P500.

Recent Performance

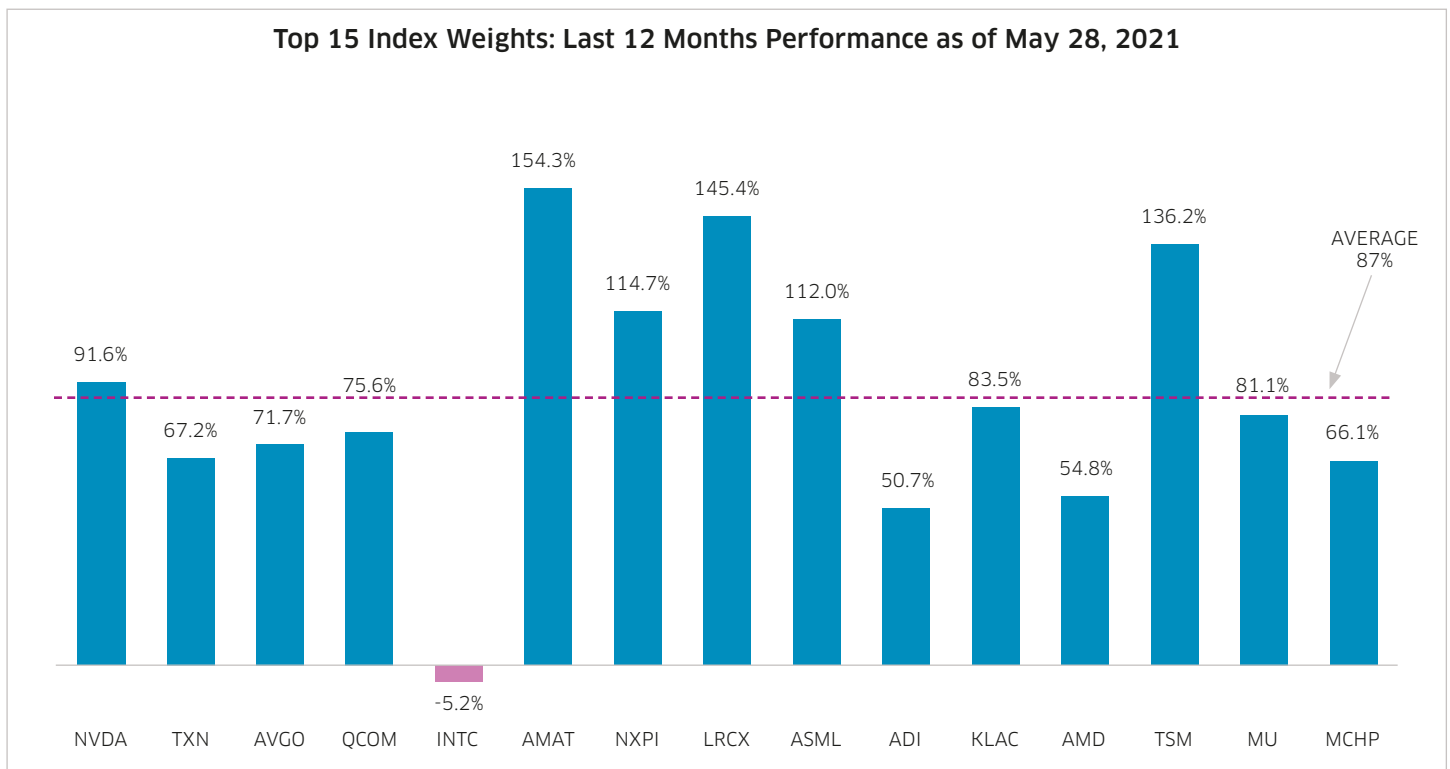
SOX has outperformed both the Nasdaq-100 (NDX) and the S&P500 (SPX) in the first five months of 2021, with a gain of 14.0% (price-return basis). Even the Nasdaq-100 Technology Sector Index (NDXT) has not kept pace with SOX, which is still in the midst of the longest-running and sharpest streak of outperformance in its history.



As previously mentioned, 2020 was a banner year of performance for SOX, outpacing the Nasdaq-100 by approximately 3.5% and more than tripling the return of the S&P500. Full-year performance in 2019 was also very strong, more than doubling the S&P500 and easily outpacing both the Nasdaq-100 and the broader Nasdaq Composite (COMP).

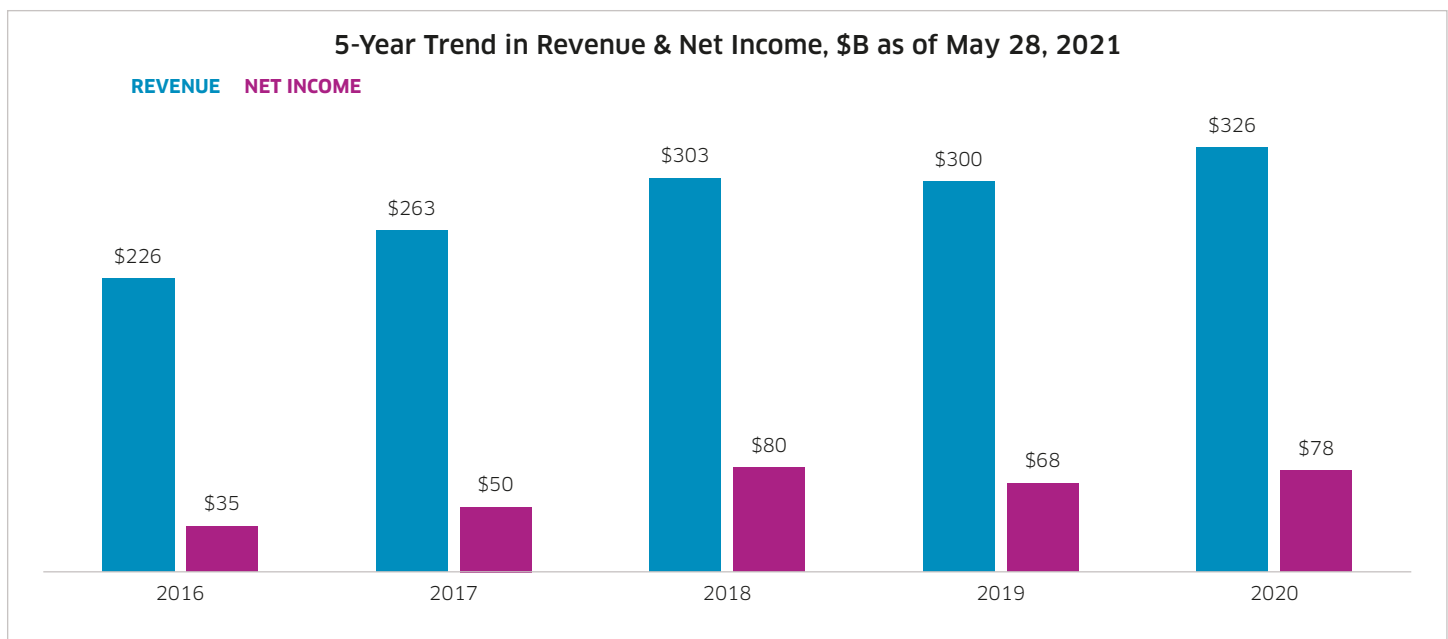


Individual and Industry Drivers of Performance



On an individual company level, five of the top 15 index constituents have seen their share prices rise more than 100% over the past 12 months, averaging 86.6% as a group. Only Intel (INTC) recorded a negative return – quite a feat considering the historic breadth and depth of the economic dislocations caused by Covid-19.

What drove SOX's stellar performance in 2020, 2019, and in years prior? These semiconductor firms have been riding a wave of increasing demand for their products, which power an ever wider array of devices thanks to the rise of Cloud Computing and the Internet of Things (IoT). As more devices connect to the cloud, there will continue to be a need for ever smaller and more powerful computer chips and processors. Continuous advances in mobile phones, gaming and media entertainment, cryptocurrency, and new machinery such as drones, robots, and autonomous vehicles will drive further innovation in this competitive field. With that comes growing sales, but also the necessity of ongoing investment in raw manufacturing capacity as well as research and development. Over the past five years, global revenues among SOX firms have grown by a rate of nearly 10% compounded annually – despite a slight dip in 2019. Global net income, meanwhile, has grown by nearly 22% compounded annually – even with a notable drop in 2019 that was mostly recovered during 2020.



The supportive trends in place prior to Covid-19 have only accelerated with the pandemic spurring widespread work-from-home, learn-at-home, and play-at-home. Per Gartner, worldwide PC shipments reached 275 million units in 2020 and saw the highest growth in ten years.¹ Tablet sales grew nearly 20% year-over-year, with more than 52 million shipments in the fourth quarter alone – a new record.² Sales of gaming consoles are on track to hit fresh records in 2021 after exceeding 50 million shipments for the first time in 2020.³ Smartphones saw modest year-over-year declines, driven to some extent by supply chain disruptions throughout 2020; with the arrival of 5G plus new lower-tier options that should prompt upgrades from traditional mobile phones, Gartner expects smartphone demand to rebound by more than 11% in 2021 to a total of 1.5 billion units. Finally, the global auto market is also expecting a rebound in 2021 after some disruption in 2020, with a forecast of 83.4 million light vehicle sales per IHS Markit.⁴ Some cars – especially electric-powered, but even high-end combustion engine vehicles with sophisticated media and driver assistance systems – can require thousands of semiconductors.⁵ It remains to be seen to what extent automakers, who have traditionally made up a very small portion of overall

1 <https://www.gartner.com/en/newsroom/press-releases/2021-01-11-gartner-says-worldwide-pc-shipments-grew-10-point-7-percent-in-the-fourth-quarter-of-2020-and-4-point-8-percent-for-the-year>

2 <https://www.idc.com/getdoc.jsp?containerId=prUS47423721>

3 <https://www.visualcapitalist.com/multi-billion-dollar-console-gaming-market/>

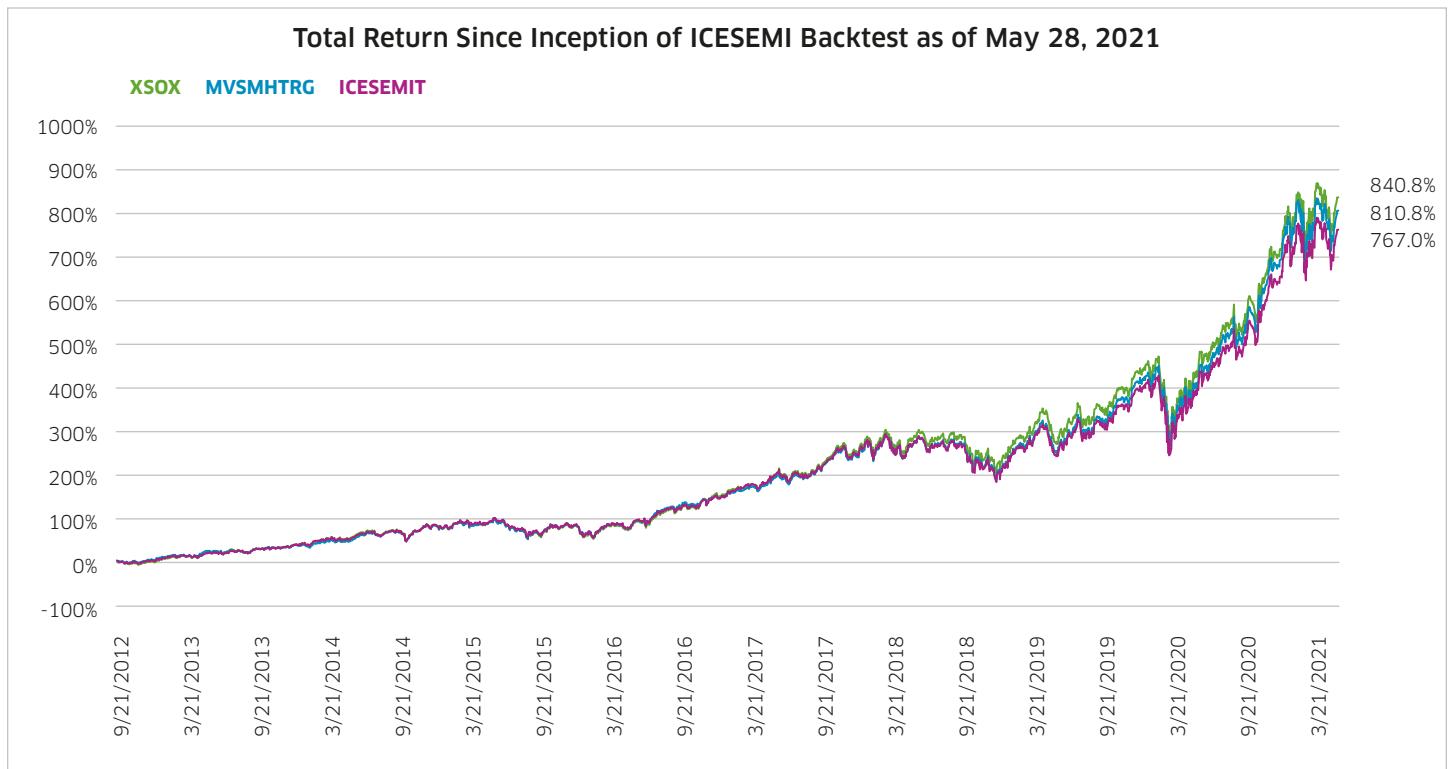
4 <https://www.businesswire.com/news/home/20201217005798/en/Global-Auto-Sales-Expected-to-Gain-Momentum-Next-Year-83.4-Million-Light-Vehicles-to-Be-Sold-In-2021-According-to-IHS-Markit>

5 <https://www.caranddriver.com/news/a35228204/microchip-shortage-car-production-disruption/>

semiconductor demand, can work with suppliers to resolve their ongoing production delays. The mismatch between semiconductor supply and demand has grown so acute as to prompt consideration by the US government to step in with assistance, with an eye towards national security ramifications.

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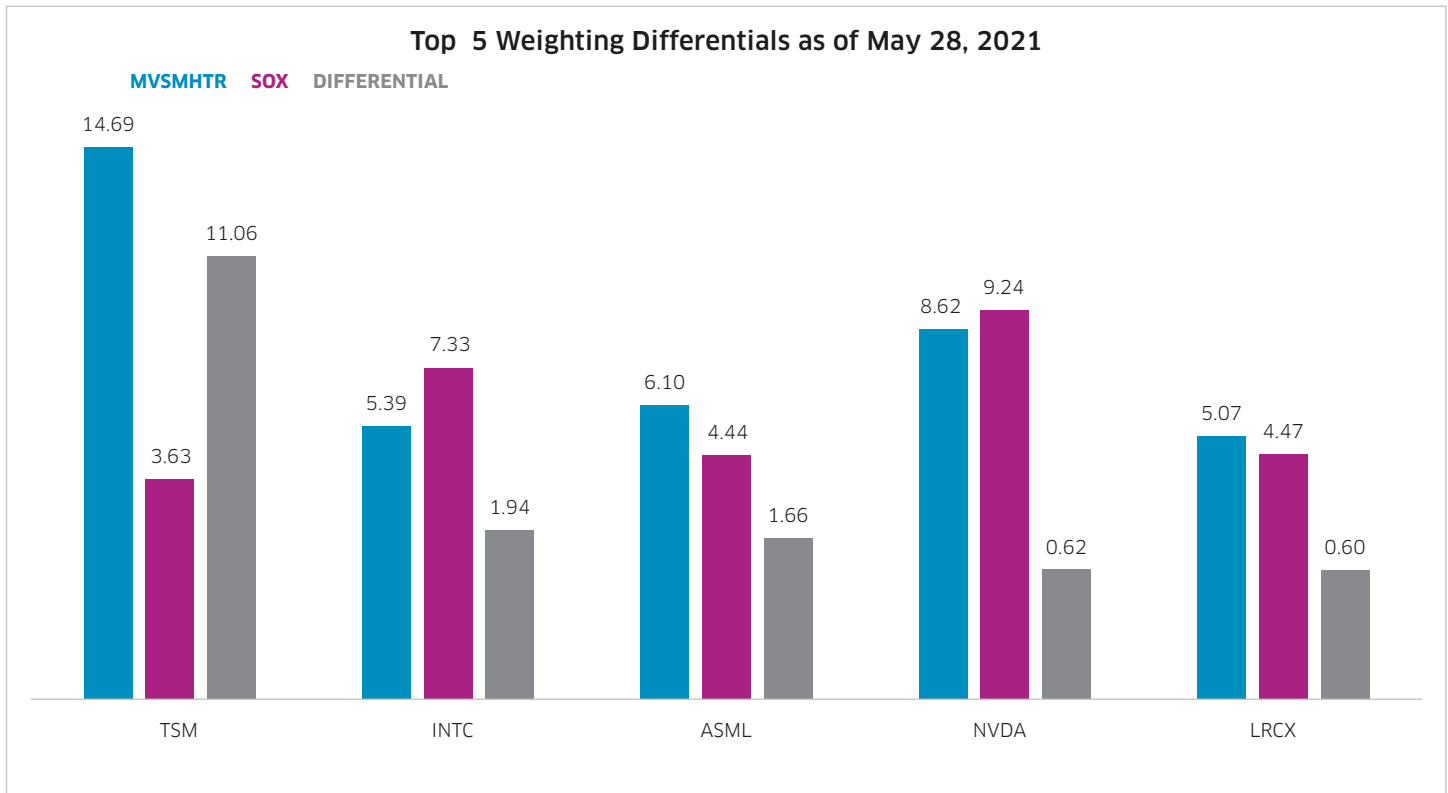
Comparison to Competitor Benchmarks



Comparing the long-run returns of SOX to two competing semiconductor benchmarks – the ICE Semiconductor Index (ICESEMI) and the MVIS US Listed Semiconductor 25 Index (MVSMTG), tracked by the Van Eck Semiconductor ETF – it immediately becomes obvious that there is limited differentiation in index construction amongst the three. Yet, Nasdaq can claim a unique position as offering the longest-running live index by far, with a launch date in 1993 for SOX vs. 2011 for MVIS and 2021 for ICE (whose index backtest goes back to 2012, i.e. an almost nine-year period of simulated performance). SOX is also the best-performing index over that same timeframe.

Beyond index history, there are a few notable distinctions to draw, especially between SOX and MVSMTG. While SOX utilizes ICB subsector classifications to target the 30 largest companies in the industry, MVSMTG relies on an internally-managed screening process to flag the 25 largest constituents with “at least 50% revenues from semiconductors and semiconductor equipment.” The other major difference is in the capping scheme, which has a maximum individual weight of 20% (vs. only 8% for SOX); a range of 5% to 20% weights for “large” companies; a range of 0% to 4.5% for “small” companies; and to bring it all together, a targeted split of 50% each of the portfolio allocated to the “large” and “small” groupings. The result is a portfolio with only 20 constituents in common with SOX. The 5 constituents unique to MVSMTG are Xilinx, Cadence Design Systems, ST Microelectronics, Maxim Integrated Products, and Universal Display Corp, which collectively made up 9.1% of the index weight as of May 28, 2021. On the SOX side, there are 10 unique constituents comprising 8.1% of its index weight, including Monolithic Power Systems, Entegris, IPG Photonics, Cree, MKS Instruments, Brooks Automation, Lattice Semiconductor, IIVI, Silicon Labs, and CMC Materials.

The biggest surprise, however, stems from the shared constituents and the material differences in some of their weightings. Taiwan Semiconductor Manufacturing's ADR (TSM) was the 13th largest constituent of SOX as of May 28, 2021 with a weight of 3.63%, whereas it was the largest component of MVMHTR at 14.69%. The gap is driven not only by the difference in the capping schemes, but also by MVMHTR weighting according to aggregate company market capitalization, as opposed to SOX's utilization of individual listing capitalization. The result is a measurable difference in weights across some other important companies including Intel and ASML, the latter also driven in part by its ADR. And while TSM has been on a strong run of performance, contributing a disproportional amount of MVMHTR's recent returns, its outsized weighting relative to SOX is not without its risks.^{6 7 8}



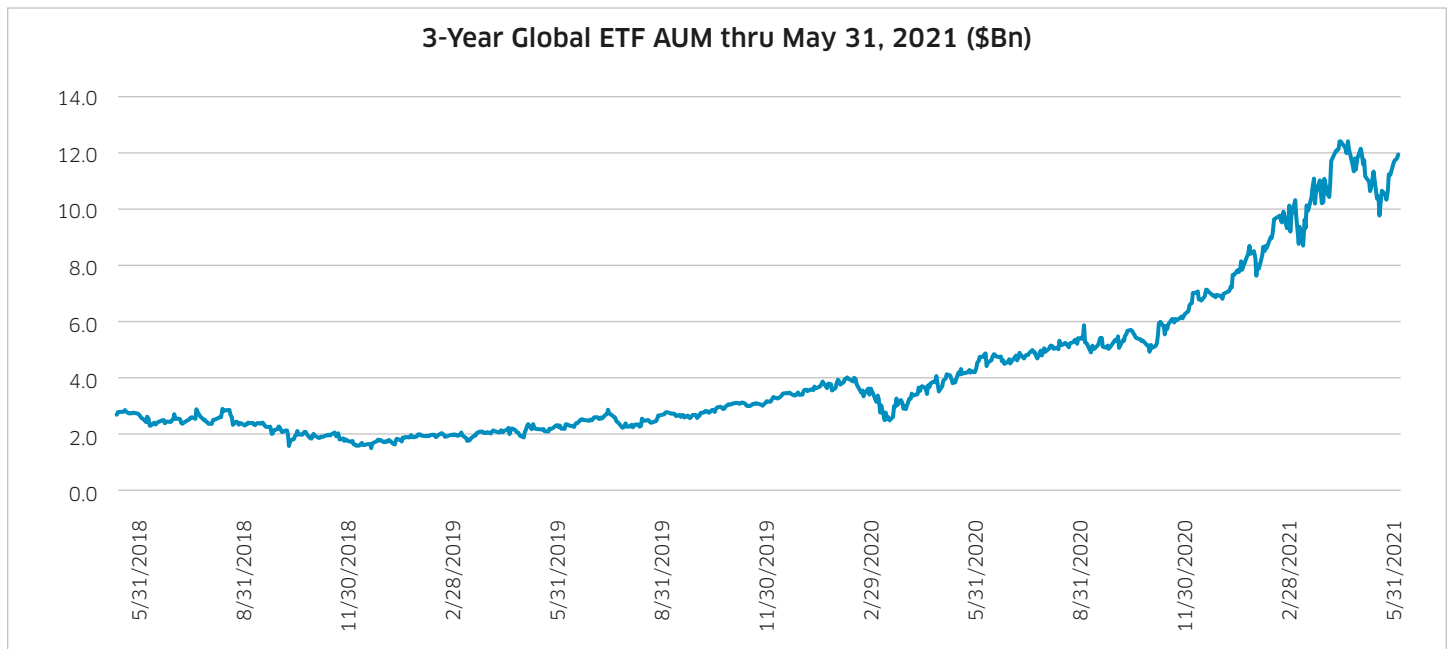
SOX ETP Assets

Finally, we look at how assets under management (AUM) have grown over the last 3 years within the exchange-traded product universe tracking SOX, including the Direxion Daily Semiconductor 3x Bull / 3x Bear Shares ETFs in the US and two products listed in Asia. Three years ago, aggregate AUM across all SOX-tracking products totaled \$2.7Bn. The decline witnessed during the broader market panic in March 2020 turned out to be short-lived, presaging an even steeper rise in AUM post-crisis versus preexisting trends. Aggregate AUM grew to briefly exceed \$12B early in April 2021, coinciding with the launch of the newest tracking product in South Korea from Mirae Asset, whose AUM already exceeds \$200MM.

6 <https://www.latimes.com/world-nation/story/2020-12-17/taiwan-chips-tsmc-china-us>

7 <https://www.ft.com/content/b452221a-5a82-4f5d-9687-093b9707e261>

8 <https://www.bloomberg.com/news/features/2021-01-25/the-world-is-dangerously-dependent-on-taiwan-for-semiconductors>



Summary

SOX continues to demonstrate its importance as one of the most widely-followed subsector indexes, representing companies that facilitate and embody technological advancement. Similar to the Nasdaq-100, it has outperformed broader market benchmarks such as the S&P500 and the Nasdaq Composite in recent years, despite being less diversified on a sector basis. It tracks constituent firms that are both household names (e.g. Intel) as well as the lesser-known, but equally vital players in the Tech ecosystem. It is heavily tilted towards US firms, but not restricted by geography. Taiwan Semiconductor and NXP Semiconductors, among others, are US-listed, foreign companies with substantial weights in the index. There is ultimately very strong overlap with the Nasdaq-100; 16 of the index's 30 constituents were also in the Nasdaq-100 as of May 28, 2021, representing 83% of SOX's index weights. Given the Nasdaq-100's global reputation for innovation-leading, high-growth companies, it should thus come as no surprise that SOX ranks highly in performance when compared to many other leading index benchmarks.

With the rise in popularity of various thematic tech indexes and tracking funds, it is worth considering just how central semiconductors are to the many products and services that comprise the modern landscape of thematic technology. With a transparent, practical methodology and its industry-leading live index history of nearly 28 years, the PHLX Semiconductor Sector Index (SOX) offers investors the ability to track this compelling industry with an effective, stable, and highly accessible benchmark.

ETFs currently tracking SOX include the Direxion Daily Semiconductor Bull 3x Shares (Ticker: SOXL), the Direxion Daily Semiconductor Bear 3x Shares (Ticker: SOXS), the Cathay U.S. PHLX Semiconductor Sector ETF (Ticker: 00830) listed in Taiwan, and the MIRAE Asset Tiger US PHLX Semiconductor Nasdaq ETF (Ticker: 381180) listed in South Korea.

Sources: FactSet, Bloomberg, Nasdaq Global Indexes.

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