
SEMICONDUCTORS: THE KEY TO UNLOCKING TODAY'S GLOBAL ECONOMY

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At WisdomTree, we spend a lot of time writing about resources. There are certain commodity resources that will help the world transition to 'greener' sources of energy. There are certain food resources necessary to feed a growing global population. There are certain monetary resources that allow different economies to pay to secure different standards of living for their populations.

But one thing that events of 2022 made clear was that access to one type of thing—semiconductors—might be the key that unlocks the capability of further participation in the world's economy.

Follow the money

'Follow the money' is an expression frequently used as a tool to help an observer to better understand what is important in a given economic system. A quick look back at 2022 shows us¹:

- In September 2022, Intel pledged to invest at least \$20 billion in Ohio in two new factories to make semiconductors.
- In October 2022, Micron indicated expectations to spend \$20 billion by the end of the decade—and eventually perhaps \$100 billion over time—on a new manufacturing site in upstate New York.
- In December 2022, Taiwan Semiconductor Manufacturing Co. (TSMC), indicated a plan to increase investment in Arizona to a figure around \$40 billion and build a second new factory to create advanced chips.
- US companies, generally, have pledged nearly \$200 billion for chip manufacturing projects since early 2020.
- China is working on a more than 1 trillion yuan (roughly \$143 billion) support package for its semiconductor industry, seeking to counter the impact of US restrictions².

On 30 September 2022, we had Chris Miller, author of the recent bestselling book *Chip War* on the Behind the Markets podcast. Chris' book gives an excellent historical foundation to help in understanding where we are today—that access to cutting edge semiconductors is deemed to be the primary determinant in participating in the next phases of global economic growth during the 2020's. In his book, you see how this dynamic impacted³:

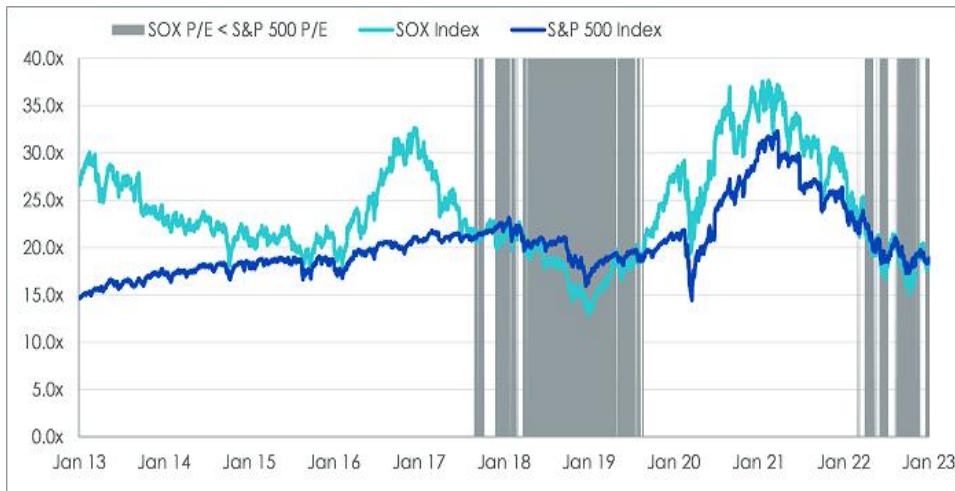
1. The Cold war: namely how the US was able to allocate resources in ways that promoted the miniaturisation of semiconductor technology, while the Soviet Union was unable to keep up.
2. The current dynamics we are seeing with China vs. the US. There are certain links in the 'semiconductor value chain' that are currently in US control, which means that the US can denote certain types of technologies that it doesn't want to end up in China. While it doesn't mean that China would never gain these technologies on its own, the degree of expertise required to attain them is something expected to take both massive financial resources and years of time.
3. Japan's rise in the 1980's, and subsequent stagnation. Japan's companies went 'all-in' on memory chips. In the 1970's and 1980's, this move was deemed prescient, and Intel CEO Andy Grove's move toward logic chips—what we think of as central processing units (CPUs) today—was viewed as an existential bet. When the market shifted to valuing CPUs more highly and memory chips becoming commoditised, Japan was flat-footed.
4. If one is looking at recent military conflicts where weapons are actively deployed, one can see a notable difference—for instance between the NATO-supplied weapons Ukraine is using vs. Russia's standard arsenal. There is a reason why Ukraine has had the success that it has even if one looks at the size of Russia's perceived military might and figures the scale is anything but balanced.

Illustrating the cyclicity of semiconductors

Even if people read the above and agree about the world's focus on semiconductors, the recent equity market performance of many of the stocks has been quite poor. While we wouldn't say we could 'pick the bottom', be it in the performance of semiconductor companies or really any others, it is always notable to bring back the longer context. Figure 1 looks at the PHLX Semiconductor Sector Index (SOX Index) to give an impression of the valuation of semiconductor stocks.

- The run up in valuation of semiconductor stocks between roughly January 2019 to roughly January 2021 was significant—we see the trailing price-to-earnings (P/E) ratio go from just below 15.0x to around 35.0x (and is possibly one reason why we've seen such a correction). The market seems to fluctuate around an average somewhere between 20.0x and 25.0x; in each case where it has gotten above those levels, it has ultimately come back.
- The last time the P/E ratio of semiconductor companies was below that of the S&P 500 Index for a period of time, it presaged a subsequent run up in valuation. We cannot say for sure that this will always be the case, but we can note that the business activity of the companies does tend toward a boom-and-bust pattern. Demand outpaces supply. There is capital spending. Capacity increases. Then, eventually, supply outpaces demand. Prices drop. Capital expenditures go down. Inventories eventually drop. And the cycle repeats and repeats.
- The difference now, if there is one, is that interest rates are much higher and we are faced with what may be a general global recession. It doesn't mean we need semiconductors any less in the medium to long term, but it may impact the speed with which we work through this cycle. Short term, we may see a lot of volatility, even if we believe in the long term we could be looking at a strong opportunity.

Figure 1: Semiconductors have a history of trending ups and downs with respect to valuation (1 April 2013 to 6 January 2023)



Source: WisdomTree, Bloomberg. Period from 4 January 2013 to 6 January 2023. SOX Index is the Philadelphia Stock Exchange Semiconductor Index. P/E ratio stands for the trailing 12-month price-to-earnings ratio.

Historical performance is not an indication of future performance and any investments may go down in value.

Thematic universe or semiconductor universe?

In 2021, WisdomTree put together its ‘Thematic Universe’—a classification system through which we are able to look at sensible groupings of thematic investment strategies. This is really our attempt to bring orderly updates to the gigantic menu of options that growth-oriented equity investors face today.

Amongst our more than 40 different thematic sub clusters, shown in Figure 1, we pose one simple question: can you find even one of these topical areas that could find scale and excel without making use of semiconductors?

The diversity of semiconductors is truly astonishing. Certain parts of our daily lives are being facilitated by older, less capable semiconductors while other parts are being powered by chips much closer to the ‘cutting edge.’ If anyone is thinking about smartphones, the more capable models of the iPhone 14 are running 4 nanometre chips, which is close to the most advanced level that the world can currently make⁴.

Figure 2: WisdomTree’s Thematic Universe

DIVERSIFIED THEMATICS							
TECHNOLOGICAL SHIFTS		DEMOGRAPHIC AND SOCIAL SHIFTS		GEOPOLITICAL SHIFTS		ENVIRONMENTAL PRESSURES	
DISRUPTIVE TECHNOLOGIES	HYPER CONNECTIVITY & DIGITALISATION	DEMOGRAPHIC SHIFTS	SOCIAL SHIFTS	GLOBALISATION	MULTI-POLARITY	CLIMATE CHANGE & SUSTAINABILITY	LIMITED RESOURCES
Artificial Intelligence & Big Data	Cloud Computing	Aging Population	Education	Global Logistics	China's Rise	Decarbonisation	Agriculture
Rise of China Tech		Millennials & Gen Z	Equality, Inclusion & Diversity		Polarisation	Protect Biodiversity	Natural Resources
Blockchain	Cybersecurity		Rise of the Middle Class		Rise of Tension	Sustainable Mobility	
HealthTech	Digital Health		Rise of EM Consumer			Sustainable Energy Production	
Industry 4.0	Digital Infrastructure		Wellness			Sustainable Energy Storage	
Next Gen Communications	Fintech & Digitalisation of Finance					Sustainable Food	
Robotics & Automation	Gaming & Entertainment					Sustainable Cities	
Semiconductors	Internet of Things					Sustainable Resource Management	
Smart Materials & Nano Tech	Metaverse					Extreme Events	
Space	Platforms & Digital Markets						
	Social Media & Media						

Source: WisdomTree. As of September 2022. Darker shaded boxes, for example 'Cybersecurity' or 'Decarbonisation', have WisdomTree products classified within those themes.

Source: WisdomTree. Classification as of WisdomTree’s quarterly market analysis, 30 September 2022. Darker shaded boxes indicate areas where WisdomTree has a thematic strategy that may reasonably be considered as part of that grouping.

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We would make sure to note even if each of the clusters requires semiconductors, not all of the clusters would require access to the world’s most advanced semiconductors. You might have seen the articles about the US restricting Nvidia from selling its A100 chips to China, but when people are unable to source new vehicles because of a lack of semiconductors, it wouldn’t be correct to assume that most chips in cars are on the same level of the A100. There are chips that could cost more than \$1000, and there are chips that can cost closer to \$1, and everything in between.

2023: an entry point for semiconductors (or related thematic strategies)?

In 2022, we spent a lot of time talking about cybersecurity. Even if the share prices of the companies, generally, did not perform well, the story of cybersecurity being a necessity was and remains to be very clear. We would argue that, if we continue to live in a world where electronics are touching us many times daily, the story of semiconductors being a necessity is even clearer. However, even if we can make a case that we always need semiconductors, the share price performance of the companies is certainly not always positive.

As we noted earlier, semiconductors have historically been characterised by a high degree of cyclicity, meaning lots of booms and busts as opposed to a path of steadily increasing returns. 2019 and 2020 were quite positive years, leading to companies increasing capital expenditures...which leads to increasing the supplies of semiconductors...which eventually leads to supply outpacing demand and prices of different chips falling. All semiconductors are not created equal, the Nvidia A100 chips in datacentres to train the most advanced artificial intelligence models has one source of demand, whereas the inexpensive chips used in high volumes in the automotive industry have a different source of demand. There were different arguments advanced about how in sync or out of sync the different types of semiconductor demand might or might not be⁵,

but the general trend of share price performance was more negative than positive in 2022.

Then, suddenly, in November 2022 we (and many others) saw Warren Buffett's Berkshire Hathaway place an investment of more than \$4 billion into TSMC⁶. Any investment in TSMC can have myriad underlying drivers but, broadly speaking, most modern conveniences that we enjoy in the Western world would face significant headwinds without the benefit of TSMC's products.

At WisdomTree, we can't say we can call the bottom on semiconductors, but we can say that few things capture as much of the world's focus...and money. We tend to like semiconductors tied to specific, advanced functions, like semiconductors specifically designed for autonomous driving applications or semiconductors specifically designed to aid in training advanced artificial intelligence models. While people can decide on individual companies, we think that artificial intelligence cannot exist without semiconductors, so it's possible to gain diversified exposure to semiconductors participating in this specific area for those interested.

Sources

¹ Source: Unless otherwise stated within these bullets, Clark, Don & Ana Swanson. "U.S. Pours Money Into Chips, but Even Soaring Spending Has Limits." The New York Times. 1 January 2023.

² Source: Zhu, Julie. "Exclusive: China readying \$143 billion package for its chip firms in face of U.S. curbs." Reuters. 14 December 2022.

³ Source: Miller, Christopher. Chip War: The Fight for the World's Most Critical Technology. Simon & Schuster, Inc. 2022.

⁴ Source: Ting-Fang, Cheng. "TSMC reaffirms 'commitment to Taiwan' despite US chip push." Financial Times. 3 January 2023.

⁵ Source: Sundstrom et al. "Semiconductors: A Less Cyclical Future." PIMCO Blog. 10 June 2022.

⁶ Source: Platt, Eric. "Warren Buffett's Berkshire Hathaway buys \$4bn stake in chipmaker TSMC." Financial Times. 15 November 2022.

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