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Semiconductor wars – identifying the likely winners

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There is an old adage on Wall Street*, *"Semiconductors make the world go round."*

The entire $5 trillion IT and electronics market is underpinned by the more than $500 billion semiconductor industry. What's more is that it is expected to reach $1 trillion by the end of the decade. This means that an industry which took more than 40 years to reach its current size, will basically double within the next seven years.

What are semiconductors, and why do they matter?

People in general are blissfully unaware of the intricate and impossibly complicated technology beneath the covers of their cell phones and smart watches. From these shadows, semiconductors operate – literally making the modern world work – to the extent that the global tech hotspot known as Silicon Valley has been named after the Silica used to make them.

The term *semiconductor* loosely refers to any integrated circuit, or microchip as they are more commonly known. The name refers to the base material (typically ultra-pure silicon) that is neither a conductor, nor an insulator of electrical current. Instead, its conductive properties can be altered to allow the flow of electrons. These electrons can be thought of as information travelling between *transistors* – microscopic "switches" communicating in binary code that are either on or off, 1 or 0 depending on the last performed action. This is an extremely simplified explanation of a very complex process. Chemistry lesson done.

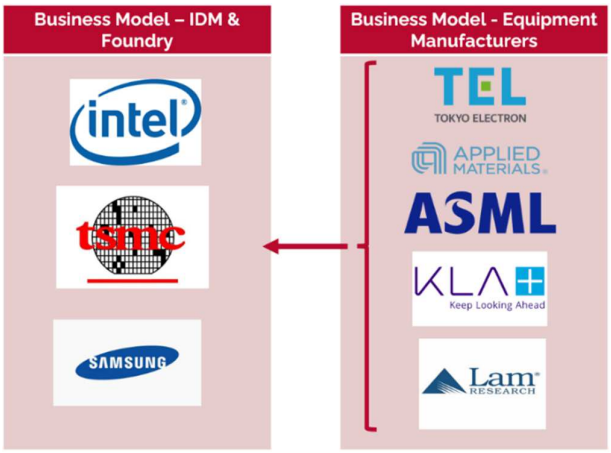
Why are semiconductors so important and topical? That's the more pertinent question. They are found in every conceivable electronic product: from laptops, airplanes and automobiles to medical equipment and military cruise missiles. They form the backbone of modern supercomputers, artificial intelligence engines, and big data-driven applications. This gives them tremendous strategic importance for any company – or more importantly, country – with ambitions of being at the bleeding edge of technological development. Predictably, this has also turned semiconductors, and the companies involved with their development and production, into something of a political bargaining chip. The clearest example of this was the US government effectively forcing its Dutch counterpart to block lithography giant ASML from supplying any of its latest generation equipment to China. ASML is the only company currently able to produce leading edge EUV lithography machines, and cutting China's access to them effectively means they can only operate at the lagging edge. These geopolitical tensions have introduced a number of new variables into an already complicated equation.

Consider an industry that is notorious for its cyclicality. Now throw sanctions against Beijing, the ever-present undertones of unification with Taiwan (by force, if necessary), concerns about supply chain security leading to deglobalisation, and multi-billion-dollar governmental subsidies into the mix. The near-term prospects for the industry become complicated, although its structural prospects can't be disputed.

The main players

There are three different segments at the bottom of the supply chain.

- Integrated device manufacturers (IDM's) such as Samsung and Intel design manufacture their own chips.
- Fabless players like AMD and Qualcomm only design chips.
- Foundries manufacture chips for fabless players – and this is where we find Taiwan Semiconductor Manufacturing Company (TSMC).



Over the last 20 years, the number of players operating at the very leading edge in each segment of the industry have dwindled down to a point where they can be counted on one hand. This is true for IDMs and foundries.

There are now a mere three companies – TSMC, Samsung and Intel – that are able to produce chips at the leading edge, compared to roughly 25 in 2000.

Further up the supply chain are the capital equipment manufacturers (semicaps), that make the individual components that IDM's and foundry players need to make chips. Similarly, the market share of the top five semicap companies have increased from just over 50% to 70% over the past two decades. This is mostly due to the rapid pace of technological advancement and capital intensity required to stay competitive.

To get a better idea of how steep this development curve is, consider the following. Today's advanced microchips – such as those in our smartphones – are roughly the size of a fingernail, but they contain billions of microscopic transistors. This is possible because companies are creating transistors so small, they need to be measured in nanometres, which is one billionth of a metre.

Perspective:
The average beard grows roughly eight nanometres **every second** – more than the size of a single leading-edge five nanometre transistor.

Fail to progress to the next technology iteration, and you can expect to be bumped off the bandwagon. Intel's recent slip-ups in manufacturing capability is a great example of this. While they remain very much relevant in the bigger scheme of things, failure to progress to the latest iteration has forced them to outsource production of their most advanced designs to TSMC – something that would have been almost inconceivable a number of years ago.

Identifying the potential winners

The semiconductor industry seems to be at an inflection point, with a number of secular drivers becoming more evident. These include the advent of the big data era, artificial intelligence, autonomous driving, 5G, the Internet of Things etc. which all require more, smarter, and faster semiconductors. The industry therefore must keep evolving and creating more complex structures in an attempt to decrease size and power consumption, while increasing performance, in an effort to keep up with Moore's Law. This is one of several drivers positioning the capital equipment providers more favourably compared to other segments over the coming years.

Reshoring of global supply chains is another factor that is bound to introduce inefficiencies into the system. Pulling on the short straw of these changes we will likely find TSMC, Intel, and Samsung, as they might have to operate more factories at sub-optimal utilisation levels. The most likely benefactors will be companies tasked with kitting out these factories, i.e., the semicaps, as they will be churning out more equipment per unit produced.

Why we prefer Applied Materials

One of the largest of these equipment manufacturers which looks poised to capitalise on this trend over the long term is Applied Materials.

As a semicap player, they sit further up the supply chain, which means they are generally more cyclical than IDM's and foundry players. This has led to their share price selling off to a greater extent during this cyclical downturn in semiconductors, even though there has been no impairment to their long-term prospects.

They have the broadest range of products and services within the industry, which provides them with valuable insight into the most pressing challenges faced by clients. An R&D budget of billions of dollars and a portfolio of more than 15 000 patents enable them to be a key player in solving some of the industry's most difficult challenges. Lastly, their fortress balance sheet and high levels of free cash flow generation has enabled them to deliver good returns, while reducing the number of shares outstanding by 25% over the last five years.

Despite short-term headwinds, Applied Materials is well positioned to weather this storm and continue delivering strong returns to shareholders.

**Disclaimer: Wall Street does not really have an old saying about semiconductors and how they make the world go round, but perhaps they should have….*

Glacier Research thanks JD Hayward for his contribution to this week's *Funds on Friday*

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JD is an equity analyst at Flagship Asset Management, a specialist global investment management boutique based in Cape Town, South Africa. Prior to joining Flagship in 2021, he worked in the engineering and fintech industries while pursuing further studies in investments. JD holds a B.Eng (Civil) degree from Stellenbosch University and has passed all three levels of the CFA® exams.