# Semiconductors will continue to enable the AI revolution

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## Key Takeaways

- Nvidia's market cap has skyrocketed amid the AI boom, underscoring the crucial role of semiconductors in this space.
- Semiconductors are the "picks and shovels" of the AI revolution, supporting large data centers and edge devices alike.
- Companies like Amazon, Meta, and Alphabet are rapidly increasing AI-related infrastructure investments.
- Long-term AI success depends on the diversity of semiconductor types across different platforms.

Nvidia's performance since the introduction of ChatGPT has been historic. We have not seen another example of a company that, in such a short time, went from a market capitalisation in the hundreds of billions of US dollars to eclipsing three trillion US dollars.

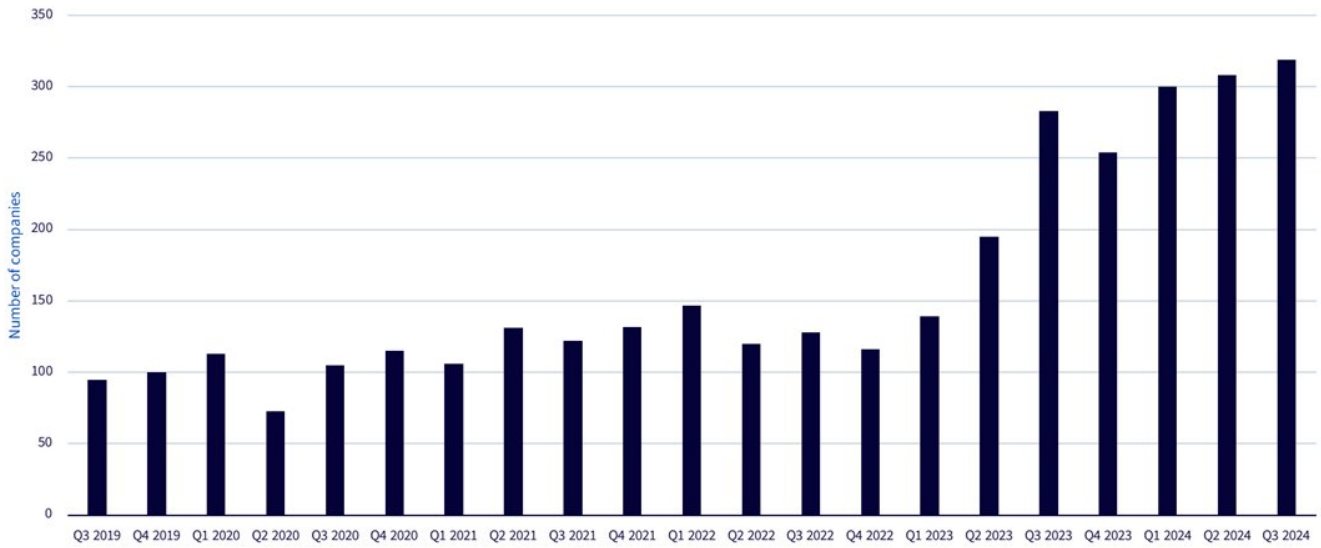
Even if, at times, it seems like the AI revolution has been compressed into the past couple of years – the so-called 'post-ChatGPT world' – we must remember that models and theories of what might work within AI and machine learning have been progressing for decades. It is just recently that we have the data storage, data transmission speed and processing power to operate at a scale where we are starting to see exciting things.

One of the impacts of this is in Figure 1:

- ChatGPT was released in November 2022. In the fourth quarter of 2022, around 100 companies mentioned AI in prepared remarks for earnings calls for the constituents of the Russell 1000 Index.
- By the time the calendar turned to 2024, we saw around a three-times increase in companies mentioning AI every quarter.

- The introduction of ChatGPT did not suddenly mean that these businesses were immediately adopting and using AI – it simply awakened them to the potential. Data remains the fundamental fuel that all these models run on, so most companies will have to undertake huge data organisation to extract value from AI.

## Figure 1: The number of Russell 1000 index constituents mentioning AI in prepared remarks for earnings calls




Source: Bloomberg, as of 30 August 2024. **You cannot invest directly in an index. Historical performance is not an indication of future results and any investments may go down in value.**

## Semiconductors: The picks and shovels

The expression 'picks and shovels' hearken to the California Gold Rush period in the 19th century. Prospectors were attracted to California on the chance that they might find gold. Many people attempted to do this, but most did not strike it rich. However, they needed to buy certain equipment, like picks and shovels, to have a chance of finding gold.

How do you like the chances of the businesses that seek to sell the prospectors the picks and shovels instead of the prospects of businesses based on the possibility of finding gold?

AI is at a similar point. It may be that these large language models will provide incredible value in the future, but now, even if we have a chance to train them and run them, vast numbers of graphics processing units (GPUs) are needed. Look at what some of the CEOs of the largest companies are saying about their need to build this capacity:

*"At this point, I'd rather risk building capacity before it is needed than too late."* – Mark Zuckerberg, CEO of Meta Platforms[1].

*"While we're investing a significant amount in the AI space and in infrastructure, we would like to have more capacity than we already have today."* – Andy Jassy, CEO of Amazon[2].

*"When you go through a curve like this, the risk of underinvesting is dramatically greater than the risk of overinvesting."* – Sundar Pichai, CEO of Alphabet[3].

To build this infrastructure and make the investments that these CEOs (and others) are talking about in the second half of 2024, much spending is going towards data centres, encompassing a host of semiconductor companies – not just Nvidia. It may be that, when we look back with the benefit of history, Nvidia has taken the largest share of the overall economic 'picks and shovels' pie. Still, for AI to broaden across the entire economy, we believe many different types of chips from many companies will be needed.

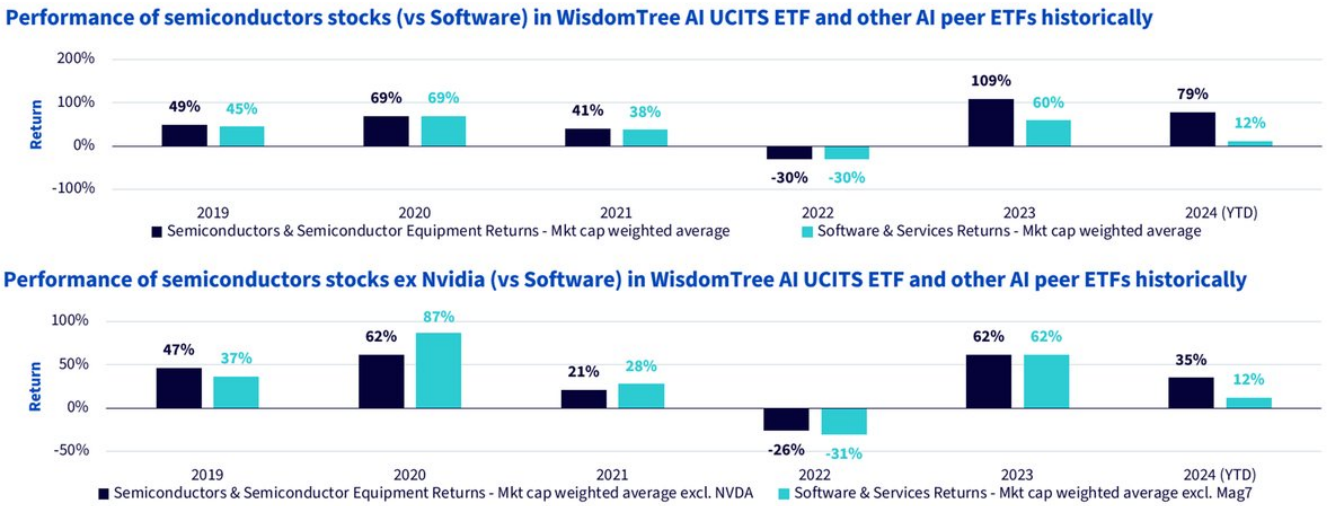
In Figure 2, we wanted to compare the performance of software to the performance of semiconductors. Many investors believe that AI will be a huge contributor to the growth of the global economy in the coming decades. However, as we think about what we have seen in 2024:

- Semiconductor firms have delivered relatively strong performance, including and excluding Nvidia.
- Software firms have, in a relative performance sense, been much weaker.

It's interesting to consider how the market ends up discounting a few different elements of this picture, as shown in Figure 2:

- One of the easiest things to see in the second half of 2024 is the spending of the hyperscalers (companies like Amazon, Alphabet, Microsoft, Meta Platforms, and Oracle). Much of that spending feeds into the revenues and earnings of the semiconductor firms.
- One of the hardest things to see – at least in the second half of 2024 – is exactly how the software we see in place today will drive a return significant enough to make sense on a base investment of over $1 trillion over a sensible time frame.

## Figure 2: Performance of semiconductors vs. software over different calendar years




Source: WisdomTree, Bloomberg. Stocks were screened as the end of each year from 2019 to 2023, and 30 August 2024. The stocks were sourced from WisdomTree Artificial Intelligence UCITS ETF, Global X Robotics & Artificial Intelligence UCITS ETF, L&G Artificial Intelligence UCITS ETF, Xtrackers Artificial Intelligence & Big Data UCITS ETF, Amundi MSCI Robotics & AI ESG Screened UCITS ETF, Fineco AM MarketVector Artificial Intelligence ESG UCITS ETF and ARK Artificial Intelligence & Robotics UCITS ETF. The stocks were categorised based on GICS Industry Group. GICS is the Global Industry Classification Standard. GICS Industry Group represent second level classification in the Global Industry Classification Standard (GICS) hierarchy. **Historical performance is not an indication of future results and any investments may go down in value.**

## From the iPhone to Uber

The iPhone – and it's important to have the historical context that Steve Jobs took the stage to introduce this device and kick off the smartphone revolution in 2007 – became an incredible platform supporting innumerable future innovations. If we are honest, most of us did not immediately think about these innovations in 2007, 2008 or 2009. Instead, we were considering whether we needed a keyboard or whether it made sense to jump from the Blackberry ecosystem into the iPhone ecosystem.

Uber is a good example of an application that could not exist without the smartphone but has since ignited the concept of resources – like cars and drivers – being available on demand at an adjusting market price. Many cities worldwide had to be dragged into it, sometimes kicking and screaming, but now the idea of immediately responsive taxis and deliveries is here to stay.

It took time to go from the iPhone – the platform – to the world-changing application, of which Uber is certainly an example. Even with that said, Uber's first profitable year was 2023, so it still took time.

If we think of the massive data centres that the hyperscalers are building as the platform, we may have to be honest and state that it is not certain what applications will be the big winners or whether those applications will be immediately profitable or take years to get there, as did Uber.

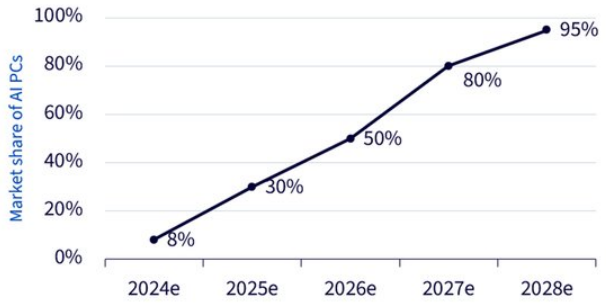
In Figure 3, we see one of the benefits of forcing ourselves to think of the AI ecosystem in a diversified way. On the right, we see an example of McKinsey's forecast on data centre spending. This is clearly being factored into analyst projections on Nvidia's share price and financial fundamentals.

However, there is also what we see on the left, the concept that all our devices, in the coming years, are likely to include the capability to run at least some AI functions. This means that we will need more advanced chips from an array of different companies – and the Nvidia GPUs gaining all the attention in the data centres are completely different from the chips that run devices like smartphones, tablets and laptops. We spend a lot of time thinking about Qualcomm, with the company's SnapDragon processors featuring in many new devices, like Microsoft's Copilot+ PCs, but we also see how Apple has not yet been able to design Qualcomm out of the iPhone. For people thinking about new devices, there is a high probability that at least one Qualcomm chip could be there.

## Figure 3: Edge AI vs. cloud AI

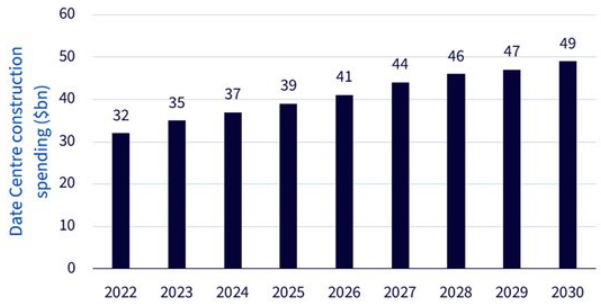
**AI device (edge AI)**

+ Morgan Stanley has projected that AI PCs will dominate the market, reaching a 95% share by 2028. As AI smartphones and computers begin to replace traditional non-AI devices, the demand for a new generation of high-performance chips is expected to surge significantly.




**Data centre (cloud AI)**

+ McKinsey has forecasted that global spending on data centre construction will reach $49 billion by 2030. This substantial investment is driven by the increasing need for robust infrastructure to support the growing AI ecosystem. Tech giants are currently engaged in an arms race in the development of large language models (LLMs), further fuelling the demand for advanced data centres.




Source: WisdomTree, Morgan Stanley, McKinsey & Company. **Historical performance is not an indication of future results and any investments may go down in value.**

## Conclusion: A broad set of AI winners over a sustained period

Our thesis at WisdomTree remains that there could be a broad set of AI-winners over time. Nvidia's returns over the past two years have probably spoiled us. Our base case is that the Nvidia case of such an incredible increase in market value will not be easily repeated, particularly over such a short period.

It will be interesting to see if the broadening out that we believe should happen ends up bearing fruit by way of market returns.

[1] Meta, Q2 2024 Earnings Call, 31 July 2024
[2] Amazon, Q2 2024 Earnings Call, 1 August 2024
[3] Alphabet, Q2 2024 Earnings Call, 23 July 2024

## Important Risks Related to this Article

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