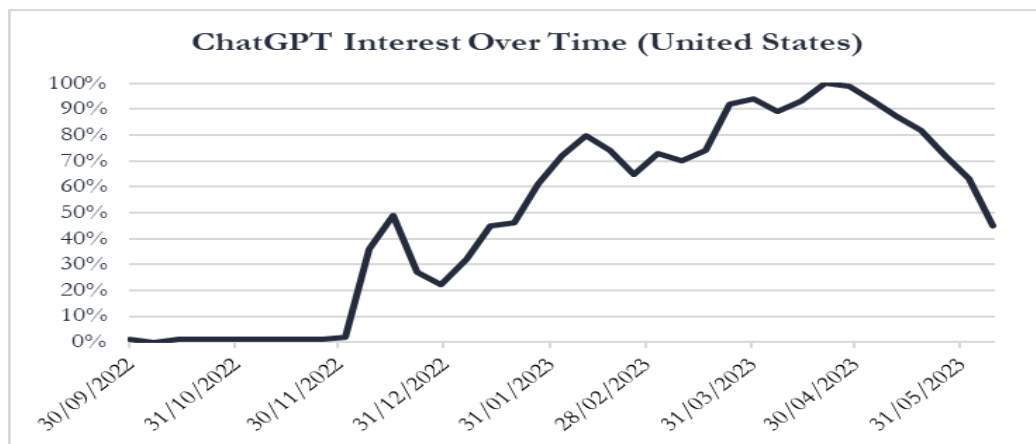


Investment Insight

Artificial Intelligence: The next computing paradigm

We recently wrote about ChatGPT, the first 'killer' app showcasing the power of generative artificial intelligence. ChatGPT had been hailed a revolution and while it certainly looks to add value in certain areas, such as education, we felt that it had its limitations and would be unable to replace everything at once ([fund managers included!](#)). A glance at Google trends data suggests that the ChatGPT excitement is waning somewhat – although we must note that users can visit its site and app directly.



Source: Google Trends data, J. Stern & Co.

However short-lived interest in the ChatGPT app turns out to be to be, it has propelled AI into the mainstream. There will undoubtedly be further applications that will revolutionise how we go about our daily work and leisure. We think that AI will be the next computing paradigm. ChatGPT is the first iteration and there will be much more to come.

The AI opportunity: Phases, scale and uncertainty

As investors, we have an opportunity to benefit from this paradigm shift. Looking at other examples we see a clear parallel with mobile computing in the 2000s. There were three phases, driven by companies that developed the technologies and delivered exceptional returns to investors:

- Early success came from the semiconductor companies that enabled mobile phones. Semiconductors are the foundational building blocks of technology and enablers of these paradigm shifts. They included Qualcomm (makers of the 3G / 4G technology) and ARM (the UK semiconductor company whose technology powers 95% of the world's smartphones).
- Next came the infrastructure and devices that house the semiconductors. This began with Research in Motion (the parent company of Blackberry) and included Apple and Samsung, which continue to dominate the handset industry with their range of iPhone and Galaxy smartphones.

- Finally came the wave of companies providing software and services. Google and Meta are two examples of companies that adapted and developed apps for the mobile. Today there are many more mobile app companies that started with the advent of the iPhone and could not have been created without GPS and internet access.

Applying the same framework to the AI landscape, we believe that it is too early and too uncertain to know what exactly the infrastructure and application layers will look like. It took many years after the initial smartphones for the software and services to properly emerge.

What matters to us is not the certainty of what AI will look like in 20 years and who the winners will be. Nobody knows. What is important is that we understand the scale of the opportunity of AI and use that insight to find great companies even if it is very early for AI and we do not know quite what the use case will be and how the devices and applications will look.

This ability to understand the opportunity, accept the uncertainty and analyse what it means for the companies we invest in is at the core of our investment approach. It is what has led us to invest in leaders in digital transformation, e-commerce, digital advertising, software applications, AI and the metaverse.

It's not a bubble: AI use cases in every industry

The surge in interest and the noise around AI coincided with a semiconductor company breaking the trillion-dollar valuation for the first time. The company is Nvidia, and we own it because its GPUs (graphic processing units) are the best semiconductor technology for AI. At the end of May, Nvidia's stock rallied sharply after its first quarter results. It reported revenues of USD 7.2 billion in the quarter, 10% ahead of expectations, and guided for USD 11 billion of revenues for the next quarter a 64% increase year over year. Nvidia's guidance was almost USD 4 billion above previous market expectations and drove the stock price significantly higher.

Everyone wants to call a bubble and some charts compare Nvidia's share price to the dotcom bubble. The charts may be at highs but that is where similarities end. The last time we had to defend our digital stocks was in August 2015, when the digital platform stocks recovered to their previous highs.

Back then we said that the resurgence of the sector was still in its early stages of growth. The chart below says it all. Today the NASDAQ index recently fell 35% from peak to trough in late 2021 to late 2022. It has recovered by 33% since and we do not think that it will take 15 years to reach new highs.

J. STERN & CO.

The Value of Long-Term Investing



Source: Bloomberg, J. Stern & Co. 08.06.2023

One of the key differences to the dotcom bubble is that AI will change many parts of the economy, not just technology companies. Like with our previous example, PCs and mobile phones have had significant impacts and AI will have a much wider impact.

Take our holding in Meta and the impact AI is having on the advertising industry. Meta had struggled both in terms of its business and its share price. Far from being finished off by a structural collapse in digital advertising, Meta has continued to invest and to innovate. It has been able to use AI as a recommendation engine and to improve ad conversion. It noted in its recent earnings that AI now accounts for 40% of content recommended on Instagram and that it has increased time spent on Instagram by 24%. Meta is working on AI to create personalised adverts and with these very significant positives, helps explain why Meta's shares have been as strong as they have this year.

There are other industries where AI will likely play an important role. In healthcare, AI can drive smart implants, personalised medicine, new drug development and medical imaging. In the financial sector, we have already seen Bloomberg and JP Morgan announce plans to develop AI tools, with a potential impact on portfolio management and trading, and insurance companies like Aon and others are implementing AI for risk analysis and claims processing. Within the energy sector, AI can improve geological modelling, usage analytics, and pipeline tools. Within retail and freight, it will have an impact on supply chain management, inventory management, as well as autonomous fleet networks. In customer service, the chatbots and automated phones we use today, will be transformed to have superior interactions and analytics.

There are use cases in every industry. Artificial intelligence can play an important role as it already is in the digital advertising industry. It will be critical and impactful that companies develop an AI strategy and understand what opportunities AI can offer but also how it can disrupt their businesses. Those that incorporate AI will succeed and those that ignore it will do so at their peril.

Nvidia: The winner of stage one

We believe that Nvidia will emerge as a key player in the AI space because it is a clear leader in semiconductors and is set to remain so for a very long time.

We first invested in Nvidia with the understanding that its GPUs are the best semiconductor technology for AI. The GPU can process tasks in parallel, which is crucial for the large data sets that come with AI, compared with the CPU (central processing unit) which processes tasks sequentially. The primary difference between a CPU and GPU is that a CPU handles all the main functions of a computer, whereas the GPU is a specialised component that excels at running many smaller tasks at once. The GPU can speed the workloads beyond what the CPU can and so it has an inherent performance advantage.

Demand is surging for Nvidia's products, and it is incumbent on it to secure enough supply from its contract manufacturers to fulfil the demand. Nvidia is overwhelmed by orders from some of the largest companies in the world including Alphabet, Amazon, Microsoft, and Meta.

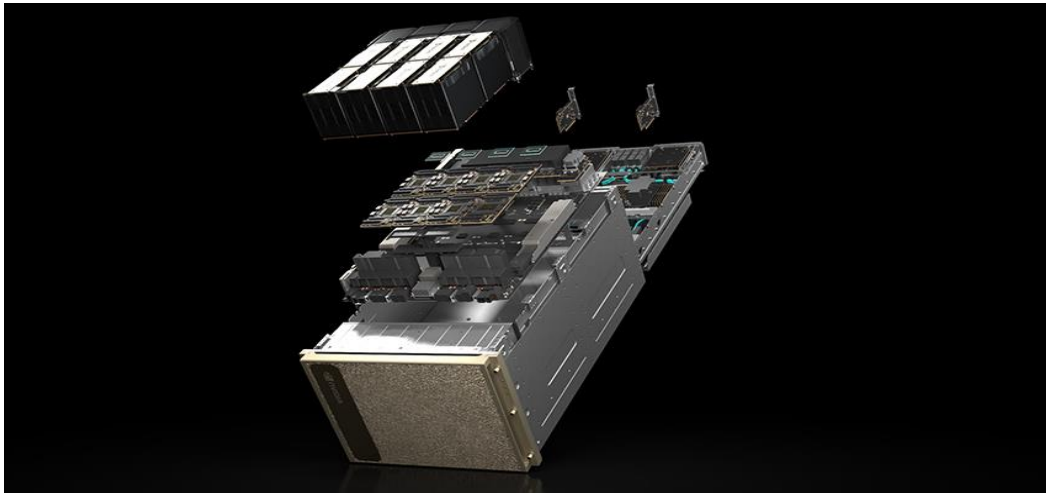
Decisions to spend extra billions are not taken lightly, in particular at a time of cost cuts, headcount reductions and real estate roll-backs. These big tech companies are pulling back corporate spending but are willing to spend more with Nvidia. The reason is because of the essential nature of Nvidia's products and the extent of their technological advantage. Nvidia's customers are the best-resourced companies in the world, so their orders are not for lack of trying. They have all tried to make their custom ASICs (application-specific integrated circuits) to complete some of the processes but they have all reverted to using Nvidia to fulfil their requirements.

The demand from the big tech companies is only at the leading edge. There is also a long pipeline of demand coming from virtually all other industries that are in a race to create their own AI products and solutions.

In a simplified way, AI applications work in two stages. The first is training, where the models learn, improve and reinforce themselves. Training does not stop. It is continuous, which creates ongoing demand for Nvidia's products. For example, Nvidia is the leader for large language models like OpenAI's ChatGPT or GPT4.

After training, the second stage is the inference which is where the trained model is asked to interpret something. In terms of the development of AI, we think that we are still at the early training stage and that inference represents a significant opportunity that is very underappreciated and a further market that Nvidia can capture. Inference can be deployed at the datacentre or at the device level itself, e.g., the self-driving car. If every car needs a GPU, it will create many more orders for Nvidia.

Nvidia's products are not those of a typical semiconductor company. According to industry estimates, the average selling price of a semiconductor in 2021 was 48 cents. This contrasts with the Nvidia H100 selling for USD 40,000 and its DGX H100 selling for USD 400,000. Nvidia is selling an entire solution that has been built up from decades of research and experience rather than a commodity semiconductor part.





















Source: Nvidia DGX H100

Nvidia has been working on its accelerator technology for over two decades. Whilst it created the GPU for its first use case in video game graphics in 1999, the GPU is at its heart an accelerator and can be used to speed up tasks. Nvidia knew what its GPU and accelerator technology could do but did not have certainty about what all the use cases could be. It did what great companies do: It kept developing and investing, anticipated digital innovation, successfully identified AI as a suitable end market and built its solutions accordingly.

A signal of its vision was the acquisition of Mellanox in 2019, which provided Nvidia with the important InfiniBand technology. It is a technology standard that allows for very fast throughput of data at very low latency and is particularly vital in the AI large language models, where there are billions of calculations being made and low latency is essential.

Another signal of its intent was Nvidia's focus on CUDA, an application programming interface (API) that allows software developers to translate their codes from programming languages into the GPU's instruction set and computational elements. Nvidia has developed over 400 domain-specific software libraries that provide pre-trained models and programming frameworks. This dramatically reduces the time and effort for users who can focus on building their applications and end uses rather than trying to have compatible language and frameworks. It also means that Nvidia has over four million registered developers and CUDA has been downloaded more than 40 million times. These developers are used to CUDA for their most advanced programming, creating additional competitive advantage and barriers to entry for Nvidia.

We think of the AI stack split into six parts as in the chart below. Nvidia leads in three of them. The opportunities for each part of the stack are likely to be very different in scope and scale. It is clear that Nvidia plays a very strong part in the overall development of AI. Going back to the comparison with mass computing with PCs and smartphones, the Wintel (Microsoft Windows and Intel) duopoly took a significant amount of the PC stack and Apple a vast amount of the smartphone economics, so there is precedent for Nvidia to take a large slice of the AI market.

| | Companies | Leader |
|--------------------------------|---|--|
| IaaS |    | AWS are leaders in cloud, but Azure is more AI focused |
| System & Networking |   | Nvidia has the most optimised AI networking stack |
| Hardware (GPUs & Accelerators) |    | Nvidia has the leading hardware with others behind and customized solutions |
| Software (Libraries, Kernels) |    | Nvidia leads with CUDA and domain specific libraries but GOOG and Open AI are making progress |
| AI Models |    | Open AI has led the early attention but others are catching up |
| Applications |     | Are many initial applications, copywriting, coding, developer tools, chatbots so very fragmented |

Source: The six parts of the AI stack J. Stern & Co.

Nvidia’s products and ecosystem give it an exceptional competitive advantage. There are other companies like Graphcore, Habana and Cerebras that are working on developing their specific processing units but Nvidia’s compatible networking system and the software libraries surrounding its hardware offer far more powerful, effective and proven solutions.

We believe that Nvidia’s AI opportunity is a compelling combination of a unique competitive position and an enormous total addressable market (TAM) which is still in its infancy. History does not repeat but it rhymes. There will inevitably be many twists and turns on the road as AI evolves, but as with the gold rush of the 1840s, those who provided the picks and shovels benefited more rather than those that hunted for the gold. GPUs and DPUs are the picks and shovels of today and we think history will ring true again.

*Giles Tulloch
June 2023*

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