

SO, YOU'RE INTERESTED IN ARTIFICIAL INTELLIGENCE...?

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While [artificial intelligence \(AI\)](#) was always a “big topic”—and we could pick from various consultant research pieces to denote future predictions as to the impact on economic growth and productivity—talking about the [gross domestic product \(GDP\)](#) lacks that “sizzle” that gets people talking, messaging and sharing.

ChatGPT, on the other hand, with just that right balance between innovation, power and novelty, achieved virality. The immediate result is that more people are regularly discussing AI like it was any other normal topic at a veritable cocktail party.

Investors are re-engaging to better conceptualize the range of actions that they might consider if, in fact, they believe an AI exposure is appropriate within their specific portfolios.

Consideration 1: The GIANTS

In light of the recent concerns spurred on by perceptions of risk in the financial sector, some have noted that large companies associated with technology may be a relative “safe haven.” That doesn’t mean they will have positive returns—just that investors may be in search of significant cash balances and cash generation, and few companies do this better than Apple, Microsoft or Alphabet. And with all of the grief CEO Mark Zuckerberg has taken for his venture into the metaverse, few can even argue that, as a cash-generating business, Meta is still remarkable.

ChatGPT has brought large language models (LLMs) into focus, and certain longstanding rivalries between Microsoft and Alphabet have been brought to the forefront. Microsoft CEO Satya Nadella achieved a PR coup by getting certain publications to write about the possibility of a coming war in search.

Even if Microsoft’s PR announcements were not perfect, by any stretch, the world was quick to focus on perceived errors made by Google’s instantiation of its LLM, Bard. We’d be careful to remind readers that researchers at Google were responsible for developing the concept of the transformer (the “T” in GPT),¹ and even if OpenAI² has leaped ahead with the virality of its applications, Google does have some of the strongest AI research capabilities in the world. With its massive usage and the fact that Alphabet is also responsible for YouTube, sometimes Alphabet has to err toward caution as opposed to being able just to launch interesting AI technologies to its billions of users.

Figure 1: Performance of Microsoft (MSFT) and Alphabet (GOOG) Post ChatGPT Release (Shown along with [Nasdaq 100 \(NDX\)](#))



Sources: WisdomTree, FactSet, period from 12/1/22 to 4/6/23. Past performance is not indicative of future results. You cannot invest directly in an index.

We simply pose one question: Over time, are they more likely to see their share prices moving on the basis of their perceived connection to AI, or are these large, diversified businesses susceptible to reflecting a bit on AI, a bit on the potential of different regulatory actions, a bit on their core legacy business interests...the list can go on?

Consideration 2: Processing Power

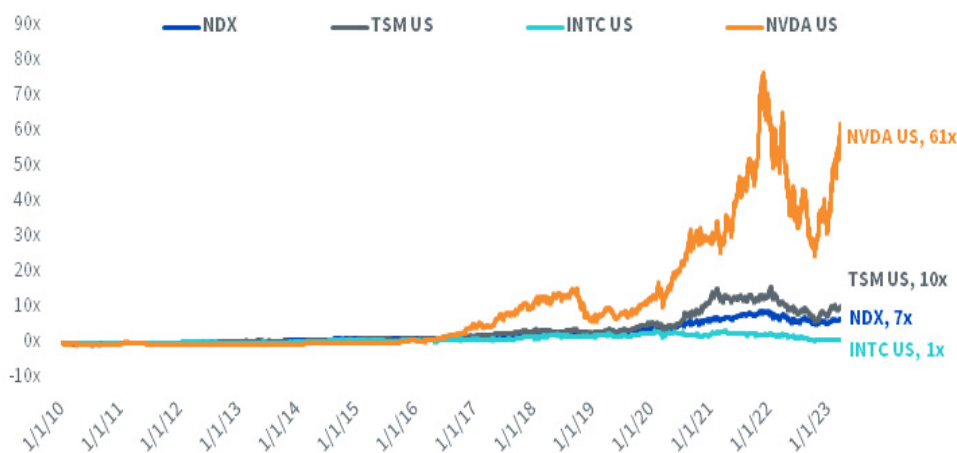
Nvidia has done an incredible job associating its offering with sheer processing power to facilitate the training and running of different large AI models. One sees this in the returns, in that one of the more important perceived areas of growth in semiconductors lies in providing the semiconductors that run data centers. Even if the inertia and current market share statistics indicate that Intel is a large player, the forward-looking prospects seem to favor other players.

AI does not require small amounts of incredibly accurate calculations—it requires very large amounts of calculations that converge toward accuracy due to their scale. The graphics processing unit (GPU) is equipped to do this better than the standard central processing unit (CPU) logic chip. Nvidia's offering, therefore, went from being primarily for gamers—still a big market in itself—to gamers, data centers, companies exploring autonomous driving, basically, a truly endless list. Articles even cite a "Huang's Law," named after Nvidia founder and CEO Jensen Huang, which posits that the processing power of a GPU may more than double every two years.³

If we think of AI as an ecosystem, however, it's important to recognize that semiconductors are also an ecosystem, in that Nvidia, by itself, could not necessarily bring physical semiconductors to the market. The way to think of it is that Nvidia is designing the chip, companies like Cadence⁴ and Synopsis are seeking to verify the feasibility of the designs and then a company like Taiwan

Semiconductor Manufacturing Co. (TSMC) is fabricating the chip. Each of these companies and different layers of the value chain—in this case, a very simplified view—may be trading in accordance with many different perceived risks, with share prices rising and falling in part due to expectations regarding the growth of AI and in part due to other factors.

Figure 2: Performance of Nvidia (NVDA), Taiwan Semiconductor Manufacturing Co. (TSMC) and Intel (INTC) since 2010, Shown along with Nasdaq 100 Index (NDX)



Sources: WisdomTree, FactSet, period from 1/1/10 to 3/24/23. 61x refers to the value of the shares being 61 times greater than at the start of the period. 10x, 7x and 1x can be thought of analogously. Past performance is not indicative of future results. You cannot invest directly in an index.

Bottom Line on Processing Power: [Semiconductors](#) are very [cyclical](#), in that demand tends to come in waves, and [capital expenditures](#) and investments seek to increase that capacity, leading to periods of undersupply and oversupply over time, with commensurate moves in the prices of the actual chips. And we have some of the bigger companies, like Alphabet, Tesla and Apple, seeking to design more and more of their own chips. This may favor a company like TSMC—the big players still need their chips to be fabricated—but may not favor other chip companies that seek to design chips.

Consideration 3: Diversified Value-Chain Approach

One of the principles we have espoused for some time is that AI has the potential to impact every industry, so it would not be appropriate to state that AI is solely this type of company and not that type of company. There are users of AI (think of TikTok, Netflix and YouTube), there are AI software providers (think of Nice, UiPath and even OpenAI), there are hardware players that allow AI to function (Nvidia, TSMC and Infineon) and there are some giant companies that when they make a small investment relative to their balance sheets, it could advance the space immeasurably (Microsoft, Amazon, Alphabet, Apple).

Picking individual winners is hard. Mixing the giants, the hardware providers and the software providers together can allow an overall strategy to be sensitive to different elements of the AI value chain getting hot and gaining attention at different points of a given economic cycle. It also helps to mitigate the risk of getting stuck in software when semiconductors are rallying or missing out on strong relative performance in the largest companies during market turmoil.

Finally, the nature of AI advances is not linear, in that we don't know for sure from where or how they will come. One possible path forward from today could be Microsoft integrating the technology underlying GPT-4 across much of its Office 365 suite of programs, which would then mean billions would be using it virtually overnight.

The [WisdomTree Artificial Intelligence and Innovation Fund \(WTAI\)](#) was designed with the concept of a value chain or ecosystem-driven approach in mind. AI currently means many things and has the potential to influence many companies, and the strategy is designed to be focused on the megatrend but at the same time to recognize that the value may be captured by many different types of business models.

¹ Source: Vaswani et al., "Attention is all you need," 31st Conference on Neural Information Processing Systems (NIPS 2017), Long Beach, CA, USA.

² As of March 30, 2023, OpenAI is not eligible for investment by public market investors.

³ Source: Christopher Mims, "Huang's Law Is the New Moore's Law and Explains Why Nvidia Wants ARM," Wall Street Journal, 9/19/20.

⁴ As of March 30, 2023, Cadence had a weight of 2.05% in WTAI.

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You cannot invest directly in an index.

DEFINITIONS

Artificial intelligence : machine analysis and decision-making.

Gross domestic product (GDP) : The sum total of all goods and services produced across an economy.

Nasdaq 100 Index : Includes 100 of the largest domestic and international non-financial companies listed on The Nasdaq Stock Market based on market capitalization. The Index reflects companies across major industry groups including computer hardware and software, telecommunications, retail/wholesale trade and biotechnology. It does not contain securities of financial companies, including investment companies.

Semiconductor : A semiconductor is a material product usually comprised of silicon, which conducts electricity more than an insulator, such as glass, but less than a pure conductor, such as copper or aluminum. Their conductivity and other properties can be altered with the introduction of impurities, called doping, to meet the specific needs of the electronic component in which it resides.

Cyclical sectors : Consumer Discretionary, Energy, Industrials, Materials, Financials and Information Technology sectors.

Capital expenditures : Spending by a company typically made to enhance longer-term productive capacity.