The Tide is Changing as Artificial Intelligence and Big Data Become Mainstream:

A deep dive into the Nasdaq Yewno Global Artificial Intelligence and Big Data Index

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Introduction

The Nasdaq Yewno Global Artificial Intelligence and Big Data Index™ (NYGBIG™) is designed to track the performance of companies that are involved in the Artificial Intelligence (AI) and Data themes from the Yewno disruptive technology framework. The sub-themes underpinning those themes that are included in the index are: Big Data, Cloud Computing, Cybersecurity, Deep Learning, Image Recognition, Natural Language Processing, and Speech Recognition & Chatbots.

American scientist and cognitive scientist, John McCarthy who coined the term in 1956, defined AI as the 'science and engineering of making intelligent machines.' In simple terms, it refers to the ability of a computer to do a task ordinarily performed by a human being. The broader investing public is now largely familiar with the sub-fields of AI—machine learning and deep learning. It's easiest to think of machine learning as a sub-field of AI, and deep learning as a sub-field of machine learning, which is a neural network with three or more layers. Both machine learning and deep learning rely on large volumes of data. In that sense, AI and Big Data have a symbiotic relationship.

Big Data refers to structured, semi-structured and unstructured data that are too complex to be dealt with by traditional application software. It makes data processing possible beyond the human scale. It allows for data mining and analytics. At a fundamental level, it aids AI's decision making.

Businesses are just scratching the surface when it comes to adoption of AI & Big Data. As use cases of AI are aplenty, we are likely to see accelerated adoption of AI over the coming years. We anticipate that most companies will first capture the low-hanging fruit, then steadily move towards more complex applications of AI. As recently as the pandemic, we saw the benefits of AI accrue more on the cost front than on the revenue front. To achieve cost savings, companies are likely to follow both core and advanced AI best practices, including MLOps, while moving AI work to the cloud. In terms of geography, emerging economies are now a hotbed for AI applications, with adoption rates highest in India. A new breed of AI high performers is emerging, and as a sub-group, they are likely to use more advanced AI practices while leveraging the cloud more so than on-premise platforms[1].

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[1] https://www.mckinsey.com/business-functions/quantumblack/our-insights/global-survey-the-state-of-ai-in-2021

The Nasdaq Yewno Global Artificial Intelligence and Big Data Index (NYGBIG) Index was down 19.8% year-to-date on a price-return basis, as of April 30, 2022. In 2021, the index was up 23.3% as technology stocks, by and large, showed resiliency in a crisis. Markets have been volatile recently as concerns around the Russian-Ukraine crisis intensified. Investors have been closely watching inflation data as it spiked to a 40 year high. The Fed, in response, has raised its benchmark rate by 50 basis points, its biggest hike in two decades. The Fed is also expected to reduce its bond holdings by $95 billion a month, in a concerted effort to wind down the stimulus. Most recently, there was a broad-based sell-off in tech stocks due to over-stretched valuations and concerns around rising interest rates.

While market sentiment has turned negative towards technology stocks, we believe that over the long-term, there is reason for investors to be optimistic. As our recent research[2] on Fed tightening suggests, U.S. large-cap/growth stocks such as the Nasdaq-100® (NDX®) have outperformed during yield pick-up periods. Further, NDX was found to have higher (i.e., more positive) interest rate sensitivity vs. both the S&P 500 and Dow Jones Industrial Average indexes, with a sensitivity of 2.0. This has led us to conclude that growth/tech stocks should benefit from a rise in interest rates.

Inflationary headwinds will eventually pass, and investors with longer time horizons are likely to benefit from targeted exposure to this accelerating trend. Also, those technology companies with pricing power and consistent profitability are likely to be better suited to weather the challenges in the current macroeconomic environment.

Methodology

The NYGBIG Index was launched on November 12, 2018, with a base value of 1,000. The index has sported an equally weighted methodology since launch, but that will change effective the July 2022 reconstitution to be modified float-adjusted company market capitalization-weighted with a 4.5% cap. The index has 97 securities as of April 30, 2022, and is rebalanced and reconstituted semi-annually in January and July. The constituents of the index are selected from the Nasdaq Yewno Global Disruptive Technology Benchmark Index™ (NYTDB™). All securities must have a minimum market cap of $500 million and a minimum six-month average daily dollar trading volume of $2 million. Additionally, 20% of each company's shares outstanding must be available to Foreign Institutional Investors (FII). In addition to the change in weighting at the July 2022 reconstitution, the index will also be adding ESG screens using data from Sustainalytics. Securities will be excluded from the index if any of the ESG field data from Sustainalytics is missing or if they exhibit any of the following:

- ESG Risk Score of at least 40 (severe)
- Non-compliance of the United Nations Global Compact
- Involvement of certain degrees in the following areas:
    - Tobacco products – Significant ownership of or any involvement in production; at least five percent involvement in related products/services or in retail
    - Thermal coal – Significant ownership in extraction or at least five percent involvement in extraction or in power generation
    - Oil sands – Significant ownership in or at least five percent involvement in extraction
    - Controversial weapons – Significant ownership in or any involvement in tailor-made and essential or non-tailor-made or non-essential weapons

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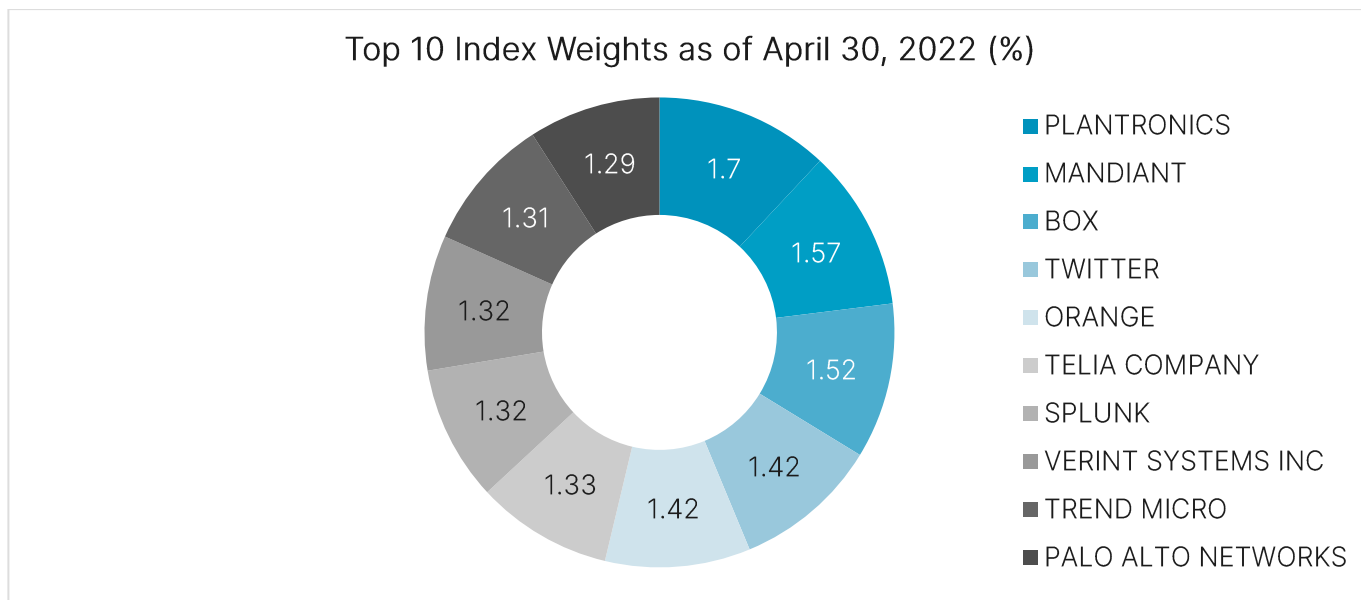[2] https://www.nasdaq.com/articles/what-to-and-not-to-fear-when-the-fed-tightens

- o Civilian firearms – At least five percent involvement in sales of assault weapons to civilian customers or in sales of non-assault weapons to civilian customers, or at least five percent of revenue from the combined sales of assault and non-assault weapons to retail/distribution customers

- o Small arms and military contracting – At least five percent of revenue from the combined sales of assault and non-assault small arms to civilian and retail/distribution customers; small arms to military/law enforcement customers; small arms key components; and weapons, weapon-related products and/or services and non-weapon-related products and/or services for military contracting

- o Nuclear weapons and depleted uranium – Any involvement

- o Adult Entertainment – At least five percent of revenue from the combined revenue from production and distribution

- o Gambling – At least five percent of revenue from the combined revenue from operations, specialized equipment and supporting products/services

Patent activity is indicative of technological progress, and to this end, the NYGBIG Index selects those companies that have recorded recent and relevant patent activity. Each security in the Index is assigned two scores, a Yewno Pure Score and a Yewno Contribution Score. The Pure Score is a measure of the degree of engagement of a company in a particular sub-theme, relative to other themes for which it has recorded patent activity. For example, a Pure Score of 0.5 indicates that 50% of a company's patent activity is related to the sub-theme (e.g., Cloud Computing). The Contribution Score is a measure of a company's share of overall patents related to the same theme (e.g., Cybersecurity) (from the universe of securities in the Nasdaq Global Index™ that includes over 9,000 global equities along with any other US-listed securities not included in the benchmark). For example, a Contribution Score of 0.05 would indicate that 5% of the total share of patents filed for Cybersecurity from the universe of securities were filed by the company.
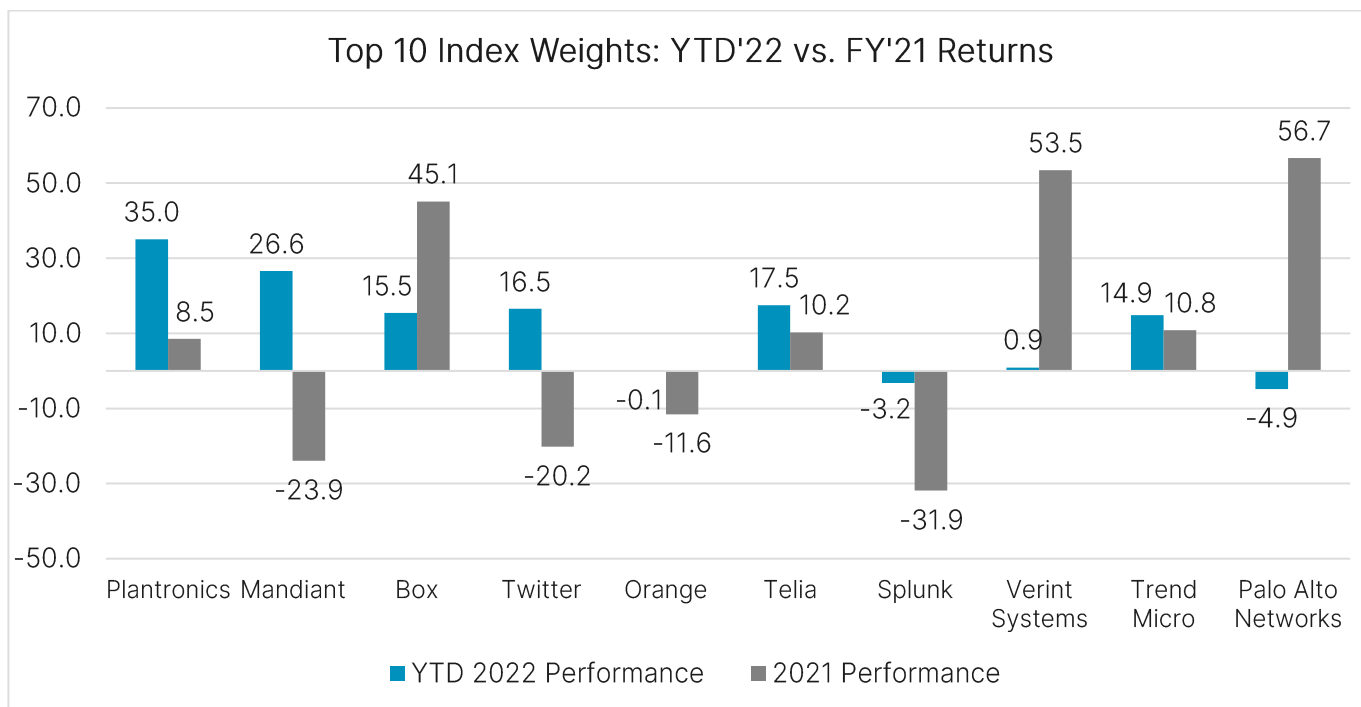
The index selection process is further refined to highlight the companies within the index that are above par in terms of patent activity. Securities that are not already part of the index, but rank within the top 35% of the Pure and Contribution Scores across each market cap size segment and sub-theme, are selected as index additions at each reconstitution; securities already part of the index that are ranked within the top 50% of the Pure and Contribution Scores are eligible to remain. An Intensity Score for each security is also calculated, which measures the number of times a security has passed through the above filtering process (e.g., a score of 4 would indicate that a security passed the filtering process for 4 different sub-themes). If the number of securities in the basket has not exceeded 100, a maximum of 5 securities from the remaining pool can be added, given their Intensity scores are higher than those in the basket. If the number of securities in the basket exceeds 100, those securities with the lowest Intensity scores are removed.

What differentiates NYGBIG from other indexes is that it excludes those companies that haven't filed a patent in the most recent year. By setting this criterion, it is more indicative of those companies that are actively engaged in pushing the boundaries of technological progress. As such, the NYGBIG Index is representative of the significant, ongoing technological progress being made in the AI & Big Data space.

Index Composition and Performance

Top 10 Index Weights as of April 30, 2022 (%)

Legend:
- PLANTRONICS
- MANDIANT
- BOX
- TWITTER
- ORANGE
- TELIA COMPANY
- SPLUNK
- VERINT SYSTEMS INC
- TREND MICRO
- PALO ALTO NETWORKS

Values shown: 1.7, 1.57, 1.52, 1.42, 1.42, 1.33, 1.32, 1.32, 1.31, 1.29

The top 10 constituents comprise about 14% of the index, with some variation in weightings driven by diverging price performance since the last reconstitution. Of the remaining 87 entries, the smallest constituent's weight was only 0.23%.

Top 10 Index Weights: YTD'22 vs. FY'21 Returns

| Company	YTD 2022 Performance	2021 Performance
Plantronics	35.0	8.5
Mandiant	26.6	−23.9
Box	15.5	45.1
Twitter	16.5	−20.2
Orange	−0.1	−11.6
Telia	17.5	10.2
Splunk	−3.2	−31.9
Verint Systems	0.9	53.5
Trend Micro	14.9	10.8
Palo Alto Networks	−4.9	56.7

In FY'21, some of the index's outperforming companies included Palo Alto Networks, Verint Systems and Box, posting returns of 56.7%, 53.5%, and 45.1%, respectively, while some of the underperformers included Splunk and Mandiant, posting negative returns of 31.9% and 23.9%, respectively. All the above examples ranked within the top 10 largest index weights as of April 30, 2022.

Companies typically outperform when there are clear catalysts on the horizon, and especially when revenue and earnings beat analyst expectations. In examining why Palo Alto Networks, a leading cybersecurity company, rose an impressive 56.7% last year, it is important to note that the company posted strong revenue growth and bookings growth. In the second half of 2021, the stock significantly outperformed its peers and posted strong guidance for 2022. Demand for cybersecurity stocks was also high, acting as a tailwind for the stock. Verint Systems, a global leader in customer engagement management and business intelligence solutions, outperformed its peers on the back of strong cloud revenue growth and bookings growth that was ahead of analysts' expectations. Box, which develops cloud-based content management, collaboration and file sharing tools for businesses, was up 45.1% in FY'21. After slowing for eight years, revenue growth picked up in FY'21, with the company guiding 14% revenue growth for FY'23. The company also made a pivotal shift from offering a mere collaboration suite to now offering a more comprehensive content cloud solution, which is likely to provide a fillip to sales.

Stocks typically underperform when they miss analyst expectations for revenue and earnings, and/or when there are near-term headwinds on the horizon. Splunk, Mandiant, and Twitter posted negative returns in FY'21, down 31.9%, 23.9%, and 20.2%, respectively. Splunk, which develops web-based application software, underperformed largely due to its guidance for revenue coming below Street expectations and a change in their management structure. Mandiant, a leader in dynamic cyber defense and response, underperformed despite impressive revenue growth for the year FY'21. It conducted a spin-off of its Fire-eye business to focus more on its cloud-based services and intelligence business. As such, the stock was down as the company posted weak earnings. Twitter was down 20.2% for FY'21 due to a number of headwinds including user growth that came in below expectations, Apple's iOS privacy changes, a one-time $800 million lawsuit settlement, and a change in the management structure with CEO Jack Dorsey stepping down.

In 2022, seven of the top ten constituents have posted positive returns with Plantronics, Mandiant and Box emerging as top performers with returns of 36.3%, 25.8%, and 21.7%, respectively. Plantronics shares rose after it announced that it will be acquired by HP for $40 per share in cash, representing a total enterprise value of $3.3 billion. As with Plantronics, Mandiant's stock rose on the heels of an acquisition announcement. Mandiant is to be acquired by Google for $23 per share in an all-cash transaction value at approximately $5.4 billion. This acquisition is likely to be game-changing for the industry given the unprecedented challenges in cybersecurity faced by governments and companies alike.
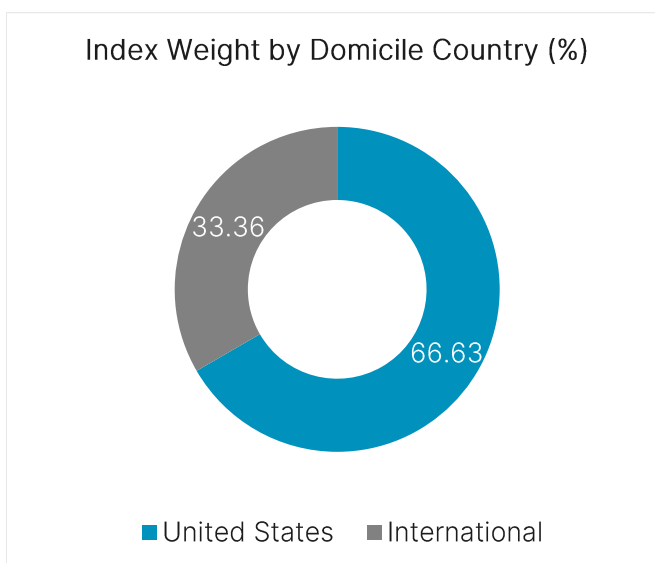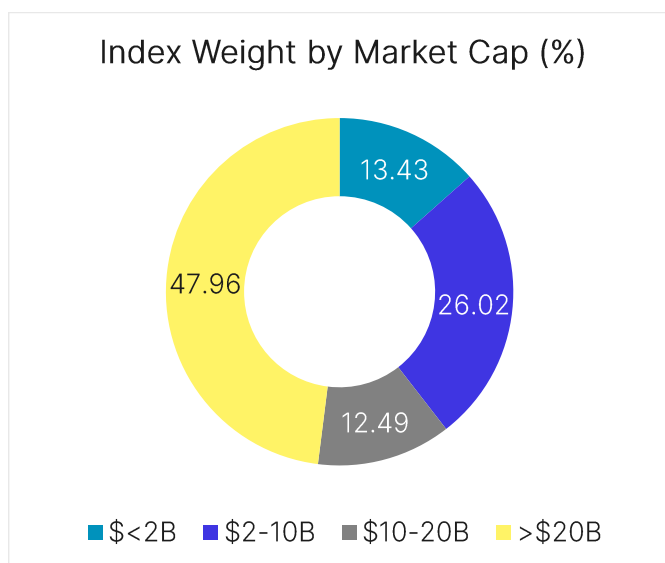
There has been a broad-based sell-off in tech stocks since the beginning of the year, with the Nasdaq Composite ending April with a 13.3% loss in the month alone, its biggest monthly decline since the 2008 financial crisis. The index was dragged down amid disappointing reports from Netflix and Amazon, among others. There have also been concerns that Big Tech was overpriced, at a time when interest rates are in an uptrend, depressing valuations of high-growth companies. Adding fuel to the fire, there have been inflationary pressures weighing the economy down. In response to these concerns, the Fed has continued raising interest rates in its most recent May meeting, which was in line with market expectations. In such an environment of rising interest rates, investors tend to move towards safe-haven sectors such as utilities. We are likely to see some caution on the part of investors towards technology stocks till valuations look more appealing, but over the long term, we expect that investors will benefit from exposure to the secular growth story of AI/Big Data.

YTD Price Performance as of April 30, 2022
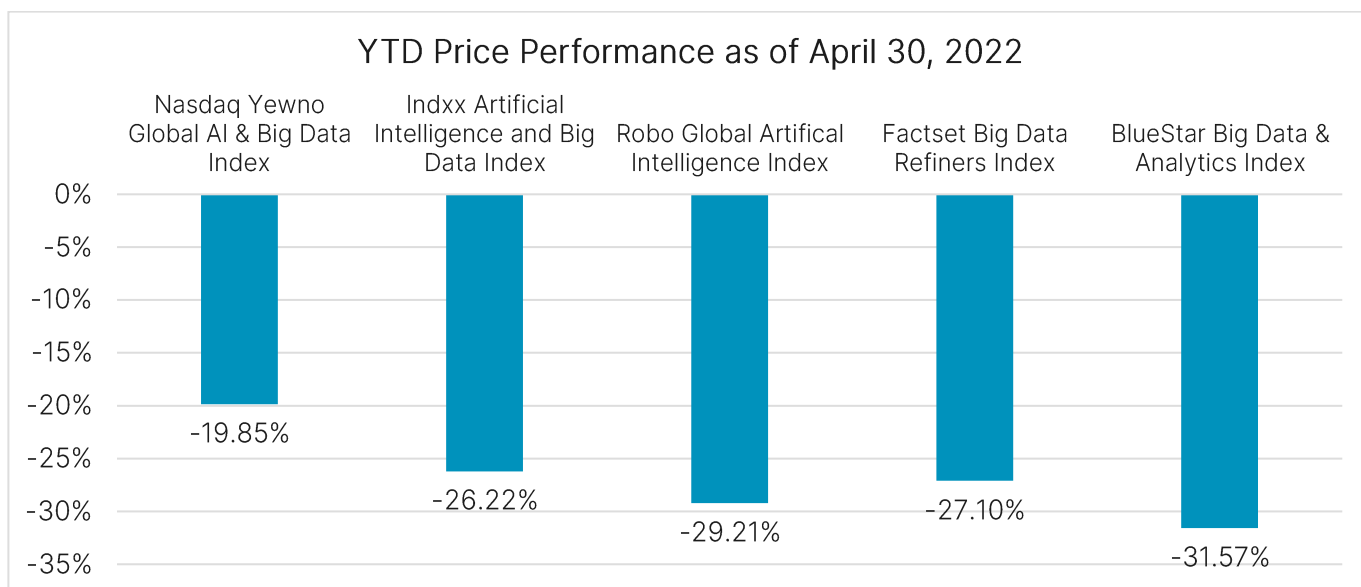
As seen, the NYGBIG Index was down 19.8% YTD, a strong reversal from its prior year performance of 23.3%. On a relative basis, it has outperformed several competitor indexes specializing in AI and/or Big Data, suggesting relative resilience in a volatile market.
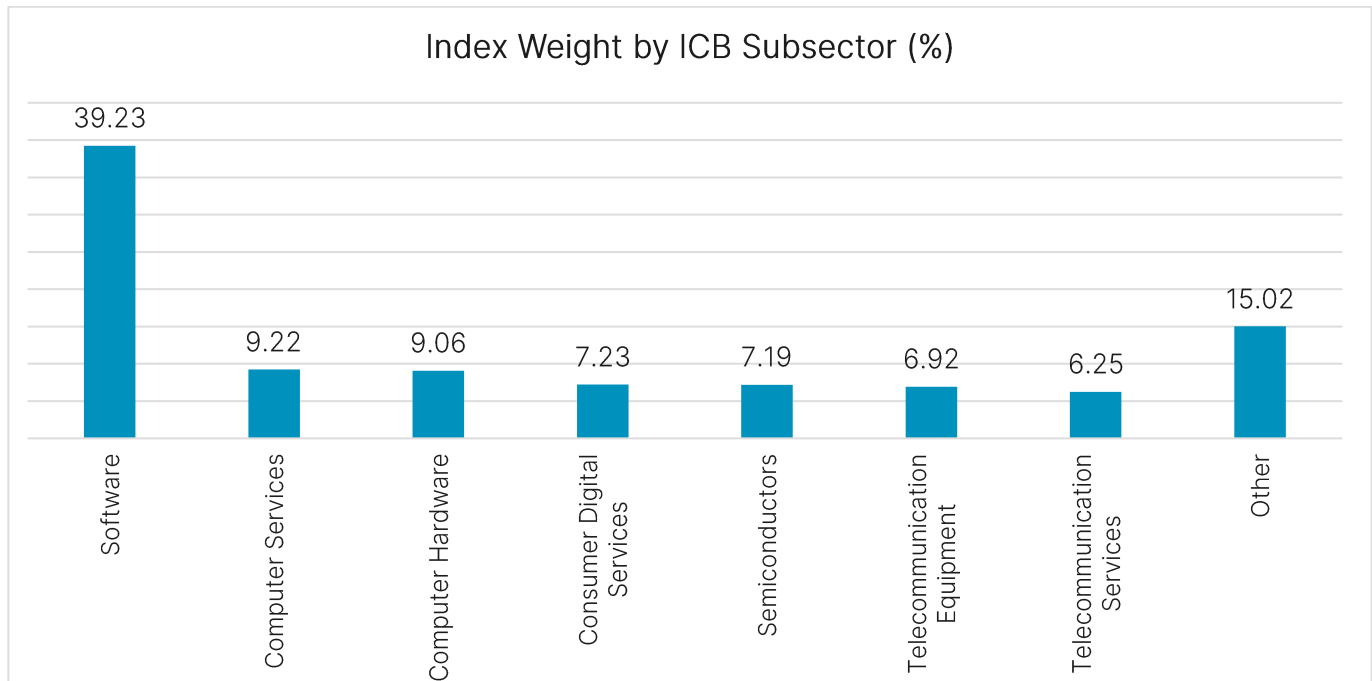
Looking at the average performance of patent-filing constituents with activity in individual thematic groups, the weakness was nearly uniform: each of the seven thematic groups, from Big Data to NLP, was down 18-21% on average YTD. In 2021, NLP was a modest underperformer, up only 19.1%, while the other six groups of constituents were up 23-25%, on average.

While the Technology sector was the clear winner in the Covid-era, there has been a rotation towards other sectors since the beginning of the year. Going forward, Technology and other high-growth industries may enter over-sold territory. Investors may tread with caution in the initial stages post sell-off, as macroeconomic concerns continue to be top of mind. As concerns abate, there should be some attractive buying opportunities. Over the longer term, we believe that many constituents in the NYGBIG Index are well-positioned for growth and are likely to offer attractive returns due to secular tailwinds across its underlying themes.

Index Weight by Market Cap (%)

■ $<2B   ■ $2-10B   ■ $10-20B   ■ >$20B

Index Weight by Domicile Country (%)

■ United States   ■ International

NYGBIG has a large-cap tilt, with close to 50% of the index weight contributed by companies with a market cap above $20 billion. Around one fourth of the weight comes from securities with a market cap from $2-10B, and only 13% of the index comes companies with market caps below $2B. If inflationary concerns persist, an index that favors large-cap is likely to perform better than one that favors small-cap, based on the available historical data.

Two-thirds of the index weight is made up of securities based in the United States while the other one third comes from international holdings. This geographic diversification may serve to offset some of the worst drawdown potential in thematic tech, as US indexes have generally underperformed international benchmarks in 2022.

Index Weight by ICB Subsector (%)

Subsector	Weight
Software	39.23
Computer Services	9.22
Computer Hardware	9.06
Consumer Digital Services	7.23
Semiconductors	7.19
Telecommunication Equipment	6.92
Telecommunication Services	6.25
Other	15.02

The index is largely made up of companies that specialize in Software (~39%), Computer Services and Consumer Digital Services (~16%), and Computer Hardware (~9%), classified using Industry Classification Benchmark (ICB) Subsectors. Semiconductor and Telecommunications companies also contributed meaningful index weights. The remainder of the index was comprised of a wide assortment of subsectors ranging from banks and retailers to entertainment and real estate enterprises, reflecting the broad-based adoption of the underlying technologies across the economy.

Artificial Intelligence is applicable across many verticals including healthcare, manufacturing, automotive, banking and financial services, foodtech, retail/e-commerce, and entertainment. If we look at a few use cases, we get a sense for how revolutionary AI is today. Palo Alto Networks, a leading cybersecurity company, is adopting machine learning to help detect threats and patterns in cyber-attacks to generate predictive value and implement protections in real-time. eBay, a leading e-commerce company, uses AI tools to anticipate the needs of buyers while providing personalized recommendations; it also generates useful data to sellers to identify the best prices. Salesforce, a leading cloud-based software company, uses artificial intelligence tools to resolve queries from customers and to improve customer engagement. As evident from these use cases, the applications of AI are broad across multiple sectors. Innovation in one sub-sector is likely to have a domino effect, resulting in significant growth.

Future of Artificial Intelligence and Big Data

Leading companies are tapping into the massive potential behind AI & Big Data. With new use cases proliferating, companies are now focusing on how to best capture value and see a return on their AI & Big Data investments. To this end, companies are likely to acquire other players in the space. Acquisitions, in turn, are likely to be a tailwind for growth. While most AI applications today reside in the cloud, edge computing is slowly emerging as a preferred choice for applications where there are privacy issues. According to a McKinsey study, the industries where there is greatest demand for AI include public sector, banking, retail and automotive. For example, within retail, AI is helping with theft detection and automated checkouts. When it comes to monetization, most opportunities are likely to come from the hardware layer and services layer of the technology stack. Going forward, we are likely to see continued shifts in the cost curve of AI, which is already rapidly declining. As processing speeds increase and the technology becomes more affordable, new applications of AI will come to the forefront.

As industries embrace AI & Big Data capabilities, there are concerns about potential risks. According to a study by Deloitte[3], the topmost concerns facing executives include cybersecurity risks, harmful decisions based on AI recommendations, and potential bias of AI decisions. Some of these concerns spill over to the socio-economic and political realm with the risk that AI might perpetuate unfair or discriminatory practices, and lead to widening socio-economic disparities. This might play out as potential headwinds for further AI adoption. On the Big Data front, the biggest risk is around data privacy. Enterprises now regularly store, classify and analyze sensitive data, and are increasingly at risk of a data breach. Such data breaches are costly both for the bottom line and from a reputation standpoint. As companies move along the maturity curve, they may become better positioned to address these challenges.

As with any new technology, there are likely to be risks that companies must grapple with as they seek to find new use-cases and a return on their investment. Spending by research labs at large companies such as Google, Meta, Microsoft, Amazon, Oracle, and IBM should serve as an anchor, potentially delivering broad industry tailwinds. While high R&D expenditure, in and of itself, does not guarantee high stock performance or profitability, it sends a signal to the market that companies are investing heavily to find commercial applications for their AI research. Over the long term, there are likely to be benefits that accrue to the bottom-line and stock performance.

The recent COVID-19 pandemic accelerated digital transformation which, in turn, made AI front and center of certain business decisions. For example, in retail, companies are leveraging AI to curate outfits based on personal preferences. In healthcare, AI was used to distinguish COVID-19 specific symptoms from influenza, thereby helping physicians with an accurate diagnosis. AI also demonstrated potential in easing administrative burdens for physicians.

AI has the potential to add 16 percent or around $13 trillion by 2030 to global GDP, according to a detailed study by McKinsey[4] in 2018. As such, we are still in the early stages of AI adoption, likely to be followed by a steep acceleration, and then a tapering off in the late stages. As with other historically transformative technologies such as the steam engine, electricity and computing, the full benefits of AI are probably not going to be felt for some time. The regulatory environment is currently evolving—since 2017, at least 60 countries have adopted some form of AI policy. There is likely to be strict regulatory oversight for several high-risk AI applications, disclosure of low-risk AI applications, and perhaps even an outright ban of some others. With checks and balances in place, end-users should be more inclined to adopt AI tools. Also, with more alignment between the EU and the US in terms of

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[3] https://www2.deloitte.com/us/en/insights/focus/cognitive-technologies/ai-model-bias.html
[4] https://www.mckinsey.com/featured-insights/artificial-intelligence/notes-from-the-ai-frontier-modeling-the-impact-of-ai-on-the-world-economy

regulatory coherence, global AI supply chains are ripe for further strengthening. These enabling factors are likely to be a tailwind for companies that comprise NYGBIG.

On the flip side, AI is expected to disrupt the labor market with the number of jobs displaced by 2030 as high as 800 million, according to McKinsey[5]. As jobs are automated and workers are displaced, there are likely to be significant political consequences as new workers re-skill to compete in an AI-driven economy. There may be a shift in the relative balance of power as economies undergo structural changes to compete on a global scale for AI dominance. Younger workers whose jobs are subject to automation will find themselves on the sidelines should they be unable to upskill to secure jobs in a new economy. Yet, despite these concerns, the economy itself is expected to benefit overall from the increased use of AI.

Conclusion

The potential impact of AI & Big Data on the socio-economic and political landscape could be game-changing. McKinsey estimates that AI could add nearly $13 trillion to global output by 2030. New opportunities for international trade are likely to arise as AI increases the competitiveness of services in economic growth, and the share of services as a part of overall trade. However, AI is expected to disrupt the labor market with hundreds of millions of jobs displaced by 2030, according to McKinsey. Despite these concerns, there is still an expectation for AI to be beneficial, on a net basis, to overall economic activity. The Nasdaq Yewno Global Artificial Intelligence and Big Data Index tracks many of the leading companies responding to this powerful technological trend and is well-positioned to capitalize on this large shift in economic activity.

ETFs currently tracking NYGBIG include the Xtrackers Artificial Intelligence & Big Data UCITS ETF (Xetra: XAIX).

Sources: Nasdaq Global Indexes, FactSet, McKinsey Global Institute, Deloitte Insights

Data as of April 30, 2022, unless otherwise noted.

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[5] https://www.mckinsey.com/featured-insights/future-of-work/jobs-lost-jobs-gained-what-the-future-of-work-will-mean-for-jobs-skills-and-wages