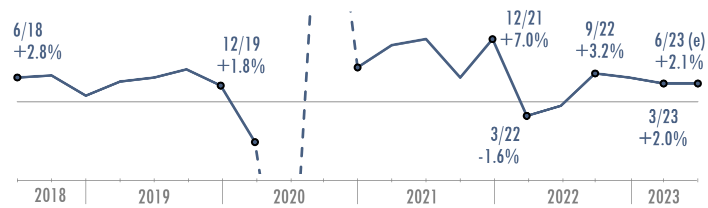
Your Quarterly Update on the Financial Markets
June 30, 2023

MARKET Recap

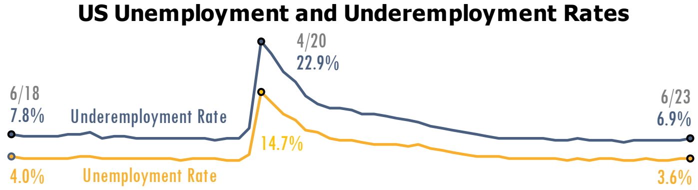
The US Economy: "Higher for a Little Longer"

Real economic growth in Q1 was positive and revised upward sharply from 1.3% to 2.0% in the final week of June. The third and final revision to GDP reflects a more complete set of data, including goods and services produced late in the quarter. This indicates strong momentum going into Q2, driven by consumer spending, and spanning every major sector except inventory and residential real estate investment.

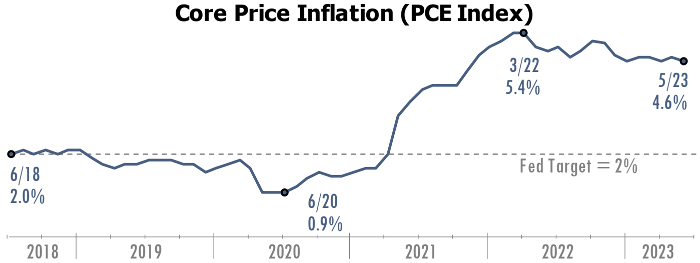
Annualized Real GDP Growth



US Unemployment and Underemployment Rates



Core Price Inflation (PCE Index)



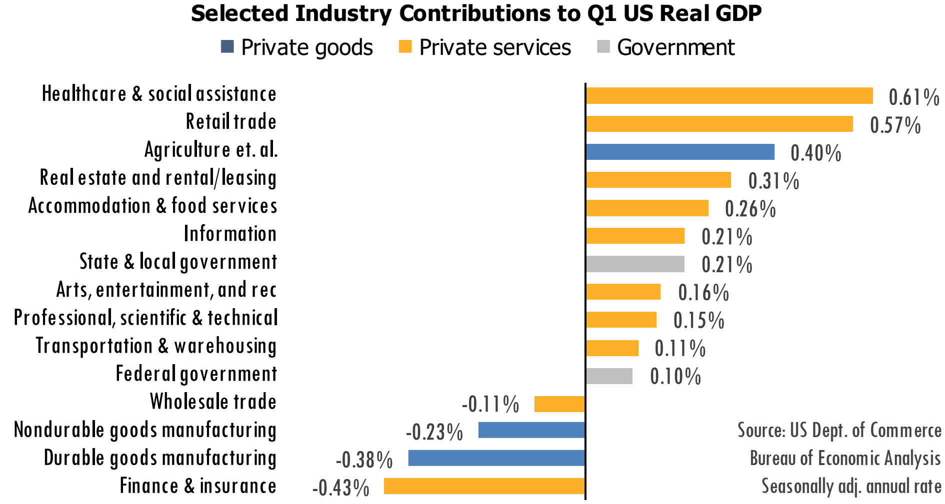
A spate of positive news in the last two weeks of June seemed to confirm that business conditions, while slowing, are still relatively robust. Consumer confidence as measured by the Conference Board rose to the highest level since this inflationary episode began. Durable goods orders were up in May for the third consecutive month. New home sales set a new high-water mark, despite lower prices due to higher mortgage rates. New jobless claims fell more than expected.

Clearly it feels like a mini-recession for manufacturers, although end-user demand remains relatively strong; companies are managing inventories lower in anticipation of recession. Notably for Q1, the only areas of weakness other than manufacturers were the banks, which struggled with investment losses due to disintermediation and the short-lived regional banking crisis. Spending on services continues to steam along, driving employment and wage inflation.

Wage pressure has led to stubborn and sticky core inflation, the key indicator which ultimately drives monetary policy. It is heading in the right direction albeit more slowly than the rate of decline previously priced into financial markets. At their June 14th meeting the Federal Reserve provided something for everyone, pausing their rate hike program to gather additional data, but reiterating their commitment to drive inflation down to target levels. In contrast to market expectations, nearly all Open Market Committee participants felt that additional rate hikes, not cuts, will be appropriate later this year. This follows surprise rate hikes by the Bank of Australia and Bank of Canada, and continued hawkishness by European central banks. Meanwhile the yield curve remains very inverted at the short end, and growth equities are surging.

So far, the economy seems to have followed the path most expected by central bankers, not market pundits. Predictions of imminent recession and near-term policy easing have not materialized, although investors in a handful of long-duration growth stocks have profited handsomely by fighting the Fed year to date. The Fed remains skeptical about the likelihood of recession; there is a clear consensus within the FOMC that rates need to move a bit higher and stay there a bit longer. In the absence of compelling data to the contrary, we are inclined to take them at their word.

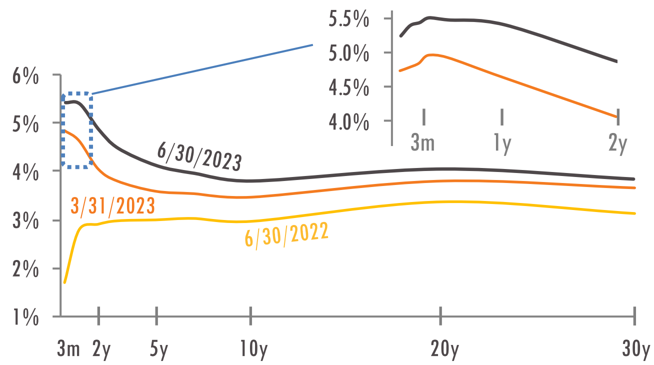
Selected Industry Contributions to Q1 US Real GDP



The US Bond Market

The Federal Open Market Committee's June meeting offered respite to the constant stream of rate hikes pursued since March 2022. Leading up to this, ten consecutive increases averaging 50 bps each had pushed short term rates above 5%. This is what led to a regional banking crisis in March that now appears to be contained, if not concluded. Credit spreads have mostly retightened and do not portend additional defaults in banking or other realms. The yield curve, though inverted through the 10-year key rate, should also not be mistaken to indicate economic peril on the horizon. Perhaps the correct, and increasingly popular, interpretation of the yield curve is that inflation will continue to moderate constructively and that this will allow (rather than force) the Fed to ease monetary policy next year. Soft landings subject to delay.

US Treasury Yield Curve

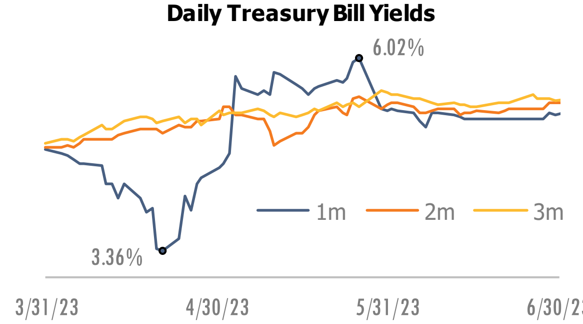


US Bond Index Returns	
Bloomberg Idx	**2Q23**
Aggregate	-0.84%
Short Gov't	0.27%
Interm. Gov't	-1.12%
Long Gov't	-2.29%
TIPS	-1.42%
Municipal	-0.10%
Interm. Credit	-0.26%
Long Credit	-0.42%
High Yield	1.75%
(CS) Lev. Loan	3.12%
MBS	-0.64%

Corporate bond issuance continued at a slower pace than achieved in the busy first quarter, but healthy relative to 2022 and on track for the largest annual volume after 2020. High yield issuance picked up, with consistent supply amid ample demand. High yield, leveraged loans, and short-duration government bond indices posted positive returns for the quarter. High yield was helped by the tightening of credit spreads. Short duration government paper avoided the headwind of rising interest rates. Bank loans benefited from both. Long duration government bonds was the worst performing sector due to the converse.

The most exciting bond market action this quarter was, oddly, in the 1-month Treasury bill. Trough to peak, this short-term key rate notched a 266 bps climb north of 6%. Neighboring securities briefly peaked above 7%. The debt ceiling standoff was to blame for both the lows and highs. The 1-month T-bill initially insulated investors from the default whilst in April. As the key rate rolled to track a different T-bill the next month, it shifted into a maturity heavily exposed to the risk of government default, due to the timing of principal repayment. When the debt ceiling fracas resolved at the end of May, the 1-month key rate immediately fell into line with the rest of the yield curve. Tune in January 2025 for the next episode of debt ceiling drama.

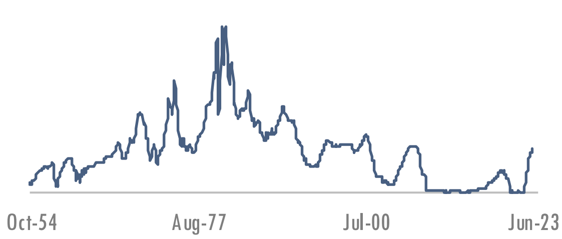
Daily Treasury Bill Yields



The Feds Funds futures market also suffered its own quirks this quarter, which have largely worked out in acquiescence of the Fed. During May, the futures market was pricing in several rate cuts in the latter half of this year. The Fed is not known for its quick turnabout in monetary policy. So, this seemed to anticipate something major and imminent that would show the Fed had already hiked too far and would be forced to recognize that cuts were needed right away. That reason would most likely have been a harder than anticipated landing as restrictive monetary policy cascaded through the economy, slowing growth.

To be fair, the FOMC is using a powerful but blunt instrument that is prone to triggering a greater or larger response than intended. So far, the economy has slowed less than anticipated, but inflation has trended lower nonetheless. As the Fed waits to see how well their hawkish action is balancing the threat of inflation against economic growth, investors continue to doubt the Fed's own interest rate projections - but reasonably so. Fed Funds futures are pricing in one hike versus the FOMC majority consensus of two hikes for 2023.

Fed Funds Effective Rates



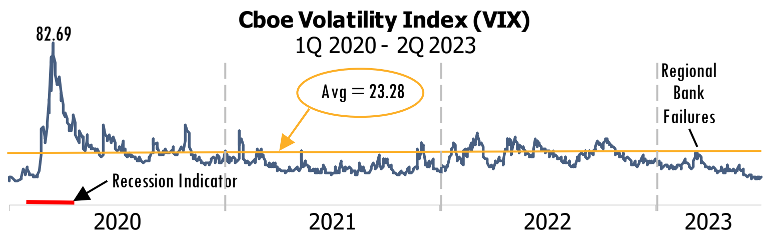
While expecting the Fed to suddenly reverse course goes against everything it has been saying publicly, history shows that quick pivots after a significant series of rate hikes is normal. There have been periods of calm where monetary policy action became infrequent. Yet, this was unusual until 2009. In most cases, the Fed has moved from rate hiking mode to rate cutting mode within 6 months, sometimes immediately. Markets are used to static zero interest rate policy, but betting on the Fed's steady hand may now (once again) be a longshot.

The US Stock Market

US stocks added a third straight quarter of positive returns across the major benchmark indices. Weakness in April and May, especially in mid- and small-caps, ultimately was overcome by a June rally. The Fed's late-quarter halt to rate increases helped investors shrug off recession concerns, at least for the time being. While it seemed an impossibility at the beginning of the year, the broader market indices posted YTD returns solidly in the double digits, as the Nasdaq turned in its best first half since the 1980's.

US Stock Indices - Total Returns			
Largecap Stocks	**2Q23**	**Midcap Stocks**	**2Q23**
S&P 500	8.74%	S&P Midcap 400	4.85%
Russell 1000	8.58%	Russell Midcap	4.76%
Growth	12.81%	Growth	6.23%
Value	4.07%	Value	3.86%
Broad Markets		**Smallcap Stocks**	
S&P 1500	8.39%	S&P Smallcap 600	3.38%
Russell 3000	8.39%	Russell 2000	5.21%
Growth	12.47%	Growth	7.05%
Value	4.03%	Value	3.18%

With inflation off its 2022 highs, growth stocks again outstripped value, fueled by another quarter of chart-topping performance in the market dominators. Alphabet, Meta, Amazon, Tesla, Apple and Microsoft led both their respective sectors and large cap stocks as a whole. But it was NVIDIA, riding the wave of investor enthusiasm for AI and its related plays, that out-paced them all with a Q1 return over 50% and a YTD 2023 return approaching 200%.



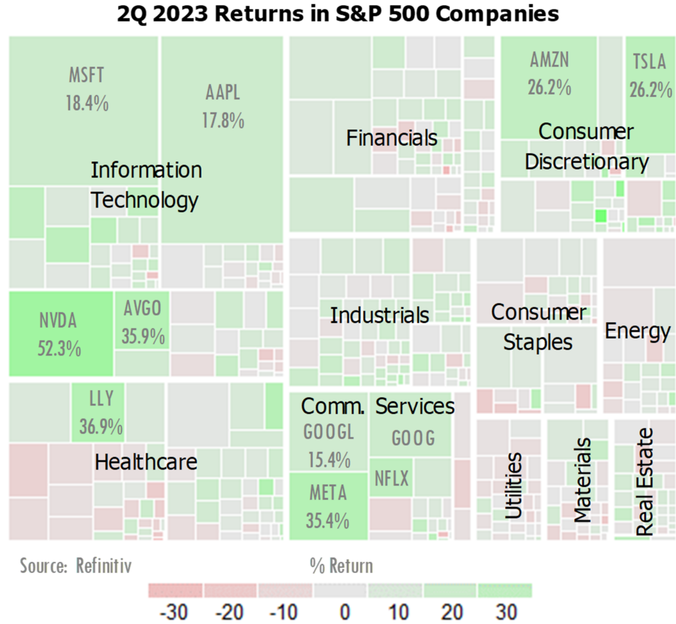
Market volatility has been on the decline in 2023. The Cboe Volatility Index, which represents the market view of near-term (i.e., 30-day) price changes, declined to level not seen since before the Covid pandemic. While economic data and Fed actions had investors on a hair trigger for most of 2022, apparent resilience in the US economy has turned them more sanguine in 2023.

Positive performance was more broadly dispersed than last quarter. Almost 70% of stocks in the S&P 500 had returns in the black, compared to 57% in Q1. However, the spread between the best and worst sectors was still almost 20%. The market dominators helped carry their sectors to the top of the table once again, where each more than doubled the returns in any of the other sectors. While less dramatic than the last few quarters, Q2 was still an environment where over- or underweights could have an outsized impact on relative performance in actively-managed strategies. The quarter closed with Apple becoming the first company to break $3 trillion in market cap. At that level, this largest constituent of the US stock market is worth more on its own than five of the S&P 500 sectors on an individual basis [Dow Jones Market Data].

S&P 500 Sector Components - Total Returns			
Sector	**2Q23**	**Sector**	**2Q23**
Info Tech.	17.20%	Health Care	2.95%
Consumer Discr.	14.58%	Real Estate	1.81%
Comm. Services	13.06%	Consumer Stpls	0.45%
Industrials	6.49%	Energy	-0.89%
Financials	5.33%	Utilities	-2.53%
Materials	3.31%		

The June rally was especially notable in materials, which outpaced both the tech and communication services sectors for the month on a standalone basis. Firms that supply the residential construction industry may be benefitting from the May rise in housing starts. Sherwin-Williams, the largest provider of architectural paint in the US, returned over 18% for the quarter.

2Q 2023 Returns in S&P 500 Companies



Energy posted one of only two negative sector returns, despite the announcement of substantial production cuts by OPEC+ at the beginning of March. After riding skyrocketing commodity prices to peak performance in 2022, the sector is now plagued by concerns that global slowdowns will suppress demand. Added to that, Russia's supply seems to be little-impacted by Western sanctions, merely shifting exports to China and India.

In corporate revenue and earnings, the Q2 EPS estimate for S&P 500 companies on an aggregate basis dropped to -6.8% YoY from -4.7% YoY at the beginning of the quarter. If the decline materializes, it would be the largest for the index since 2Q 2020. Earnings in energy, materials and healthcare companies are expected to take the biggest hits, while consumer discretionary and communication services firms are projected to experience the largest earnings growth [FactSet].

International Markets

Market performance was generally positive in Q2, although more muted than the prior quarter. According to the OECD, the global economy has begun to improve, but the recovery is expected to be weak. They project global GDP growth of 2.7% in 2023 increasing to 2.9% in 2024, with emerging markets significantly outpacing their developed peers. Headline inflation continued to decline globally, but core inflation remains stubbornly high in many countries as central banks struggle to control rising prices.

Unhedged Foreign Markets Indices - Total Returns			
Stocks	**2Q23**	**Bonds**	**2Q23**
MSCI ACWI ex-US	2.44%	Global Aggregate	-1.53%
EAFE (Developed)	2.95%	Pan-Euro	0.20%
Emerging Markets	0.90%	Asian-Pacific	-5.35%
Europe	2.74%	Eurodollar	0.22%
Japan	6.42%	Euro-Yen	-7.51%
China	-9.71%	Other Currencies	8.02%
Latin America	14.04%		

Asia

China's economy expanded at an annual rate of 4.5% in the first quarter, boosted by the end of Covid-era restrictions. Still, rapid growth seems to be over. Inflationary pressures eased in May as consumer prices gained just 0.2%, casting fresh doubt over the strength of economic growth. Factory activity also disappointed. Manufacturing PMI has been declining since February, reflecting softening export demand as retailers in the West face elevated inflation. The Non-Manufacturing PMI has declined since March.

China's Economy			
Y/Y Statistics (%)	**3/2023**	**4/2023**	**5/2023**
Manufacturing PMI	51.9	49.2	48.8
Non-Manufacturing PMI	58.2	56.4	54.5
Industrial Output	3.9	5.6	3.5
Unemployment	5.3	5.2	5.2
Producer Price Index	-2.5	-3.6	-4.6
Consumer Price Index	0.7	0.1	0.2
Retail Sales	10.6	18.4	12.7
Exports	14.8	8.5	-7.5
Imports	-1.4	-7.9	-4.5

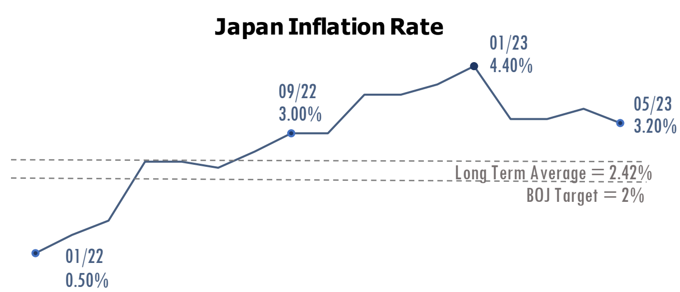
Source: National Bureau of Statistics of China

The surveyed urban unemployment rate fell for a third straight month in April to 5.2% where it remained in May. This is the lowest level since late 2021. But that good news was overshadowed by a fifth straight month of rising joblessness among young people. The unemployment rate for Chinese ages 16 to 24 rose to a record of 20.4% in April. It has steadily increased throught 2023 from 16.7% at the end of last year.

Weak statistics prompted senior officials to commit to do more to stimulate growth. The country's central bank cut policy rates in June to help spur lending. However, with consumer confidence just off its record low from last November, more may be needed. Crackdowns on China's technology and education sectors in recent years have made many entrepreneurs wary about launching new investments. Many prospective home buyers fear it could take years before prices rise again in a sustained way, due to an oversupply of vacant units. Some consumers are unwilling to spend, in part, because China has never developed a sufficient social safety net.

Driven by increased capital expenditures and an uptick in both private and domestic consumption, Japan's economy has seen strong growth for two consecutive quarters. Q1 GDP growth surpassed analysts' consensus estimates, rising 0.7% QoQ, notably outperforming the projected 0.5% increase. Falling raw materials prices and the easing of pandemic-related curbs facilitated an increase in capital investments and a surge in both private and domestic expenditures. While most global developed market central banks have been fighting inflation, soaring inflation was welcomed by Japanese policymakers. After decades of deflation, consumer prices rose in Q1 at the fastest annual pace in over 40 years. While inflation has slowed modestly this quarter, post-pandemic supply shortages are helping to keep it well above the Bank of Japan's 2% target rate.

As expected, the BOJ stood firm on its ultra-loose monetary policy, preserving its short-term interest rate at -0.1% and a 0% cap on the 10-year bond yield to support economic growth. The differences in global monetary policies drove down the value of the Japanese yen versus most other major currencies. The yen fell around 9% YoY, trading at 139 to the US dollar. Weaker currency made exports cheaper to the world's markets -- a benefit for Japan as a major exporter.



Americas

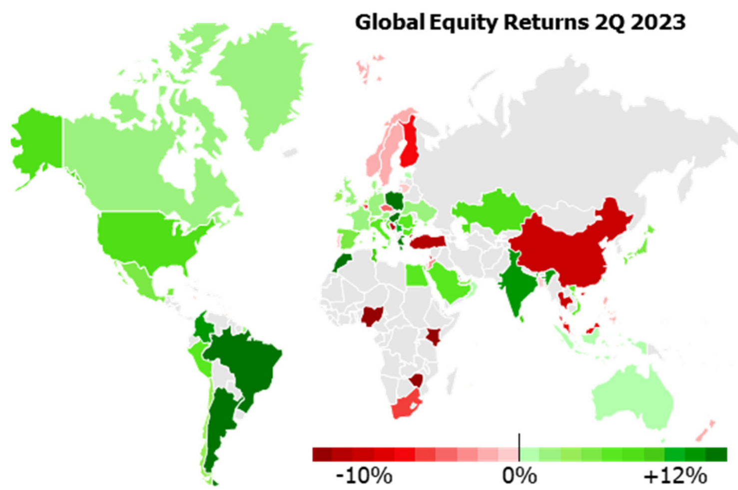
After a five month pause, the Bank of Canada raised its overnight lending rate by 25 basis points to 4.75%, surprising markets given the US Fed's rate pause. The Canadian economy performed better than expected during Q1, expanding 3.1%. Expansion of 1.4% is forecasted for Q2 driven by mining, quarrying, and oil and gas extraction. Demand levels have remained more persistent than anticipated, which may necessitate additional rate action.

In June, Mexico's annual inflation rate hit its lowest level in more than two years. Falling inflation offered the central bank an opportunity to leave interest rates unchanged at a cycle high of 11.25%, with consumer prices remaining well above the 3% inflation target. Headline inflation slowed to 5.2%. The central bank continues to benefit from an appreciating peso, which was up more than 17% against the US dollar in the last year.

Brazil's central bank revised its estimate of economic growth upward for the year, driven by a boost in Q1 from positive surprises in some industrial and service sectors, along with improved agriculture forecasts based on a record harvest. GDP growth is estimated at 2% for 2023, up from 1.2% in March. However, the central bank's outlook is for an economic slowdown due to the effects of monetary policy and declining global growth. The bank left the benchmark Selic rate unchanged, for the seventh consecutive time, at a cycle high of 13.75% near the end of June. Brazil's central bank hinted that if a more moderate inflation scenario arises, most of its policymakers may consider a "parsimonious" rate cut next.

Europe

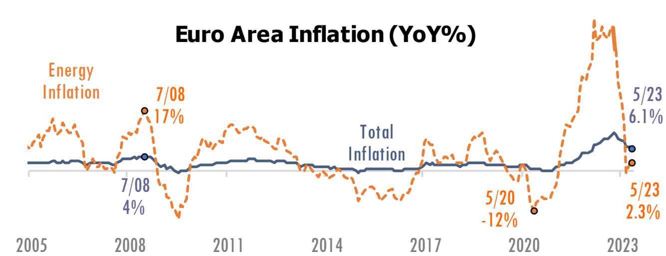
In mid-June, the ECB announced a new rate increase of 25 basis points, taking its overnight rate to 3.5% and diverging from the US Fed's decision to pause rate hikes (at least in the near term). The bank has raised rates eight times since July 2022 to bring down record-high inflation across the region. The latest reading showed prices cooling down at a faster-than-expected pace, with headline inflation coming in at 6.1% in May and core inflation — which excludes volatile items — at 5.5%. This remains well above the ECB's target of 2%. Despite recent signs of slowing, the ECB raised its headline rate and core expectations for 2023 & 2024. It now projects headline inflation of 5.4% this year, 3% in 2024, and 2.2% in 2025. The decision to raise rates was widely expected by markets, although investors remain uncertain about what the ECB might do beyond the summer.



Inflation across various countries remains mixed, complicating the job of the ECB. In Germany, preliminary readings showed prices rose to 6.4% in June, up from 6.1% in May. The increase was attributed to unfavorable base effects compared to June 2022, when the German government launched a nine-euro summer travel ticket and reduced fuel taxes to offset soaring energy costs due to the Russian invasion of Ukraine. Meanwhile, inflation has remained stubbornly high in the UK with consumer prices rising 8.7% in May. The BoE raised interest rates 50 basis points, a larger-than-expected move, as policymakers struggle to bring down persistently high prices. It was the 13th consecutive increase, raising the rate to 5%, the highest since early 2008. Conversely, inflation in Spain sharply slowed to 1.9% in June due to lower fuel, electricity, and food prices. Italian inflation also decreased to 6.4% from 7.6% in May driven by lower energy and transportation costs.

The ECB revised its growth projections down to 0.9% this year and to 1.5% in 2024. The prior quarter's estimate pointed to a GDP growth rate of 1% this year and of 1.6% in 2024. Data from early June showed the 20-member euro area entered a technical recession in Q1. GDP came in at -0.1% for the three-month period ending in March, after a 0.1% contraction in Q4 of 2022. Poor economic performance might hamper the ECB's ability to increase rates further to rein in inflation. Officials have suggested that their focus is to bring down prices rather than to avoid an economic slowdown.

According to the European Systemic Risk Board (ESRB), financial stability risk in the EU remains "severe." High inflation, a drop in household disposable income, bank failures, and rapid rate hikes by the ECB have challenged Europe's financial sector. The ESRB's concern centered mostly around the housing market. Falling numbers of transactions and credit market indicators are signaling that the correction in residential real estate is likely to become more broad-based. Rising financing costs, deteriorating business sentiment, and tightening credit standards threaten the commercial real estate market as well.



Source: Federal Reserve Bank of St. Louis

In response to bank failures, the ECB's Financial Stability Review (May 2023) highlighted the need to complete the banking union and strengthen the EU banking regulatory framework. Developing a crisis management structure and a common European deposit insurance facility were chief among the recommendations. In addition, a key element included implementing the final Basel III provisions by the January 2025 deadline to ensure banks remained well-capitalized and to provide additional opportunities for supervisory oversight in the banking system.

Focus On: The Value Generation of Generative AI

OpenAI, an artificial intelligence research lab owned 49% by Microsoft, released ChatGPT on November 30, 2022. Within two months, the website touted 100 million active users. Initially built on OpenAI's GPT (Generative Pretrained Transformer) version 3.5, a premium paid offering was introduced in March 2023 based on GPT-4. Each subsequent iteration of the GPT model demonstrates remarkable improvements. Over the past 5 years, competency (broadly) grew from toddler to college student. GPT-4, its competitors, and offshoots are poised to drive economic productivity and restructuring this decade.

The Age of Generative AI

Over 25 years ago, Deep Blue defeated the best chess players in the world by taking a brute-force approach combined with algorithms to evaluate millions of cascading potential plays. GPT is fundamentally different than IBM's Deep Blue, but shares a common lineage with Apple's Siri and Amazon's Alexa: the neural network, a machine learning process developed in 1943.

Neural networks are inspired by how brains grow and adapt to new stimuli. Collections of neurons develop connections that, with enough training, refine a complicated neural network pathway toward an optimal response for a given input. Although machine learning is inspired by human intelligence, it simplifies complex organic processes using formal algorithms and data storage instead. Transformer AI models are also neural networks, but assign varying attention weights to the individual pieces of information (e.g., words, pixels, speech frames) within larger chunks (a.k.a. tokens) of data.

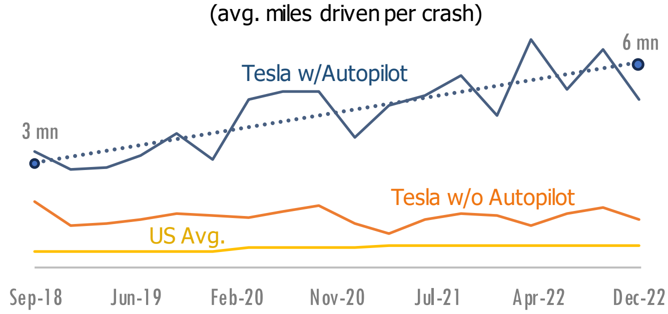
GPT is functional proof of the breakthrough that generative AI (in 2014) and Transformers (in 2017) represent. While, even the near-term impact is highly speculative, a tipping point has clearly been reached. Goals seen as achievable in decades pre-GPT, such as human-level language and social skills are now expected within 5 years. In May 2023, 3,900 US job cuts were attributed to AI [Challenger Report]. "Large Language Models can already automate 15% of tasks…this share may increase to 50%" [Eloundou et al.]. PwC predicts a 14% global GDP boost through 2030.

ChatGPT-4 has performed in the top quartile of numerous tests, including many AP exams, the Uniform Bar exam, SAT, and LSAT. These only represent a small slice of what the GPT-4 model can do. And, there are large AI models to power different generative content, such as text-to-image. Domain-specific models and larger, more powerful models driven by new AI-targeted hardware, data, and research promise highly competent AI tools for a huge variety of professions.

The Answer to Everything, Everywhere, All at Once

One of the earliest, and easiest to measure real-world examples of AI out-competing people is Tesla's Autopilot. Introduced in 2015 and continually refined over the past 8 years, Autopilot has met with resistance despite its demonstrated superiority. The software reduces the rate of accidents by almost 75% among Tesla users, doubling in efficacy over the past 5 years. Although it is easy to show that Autopilot would decrease accidents and save lives if expanded in use, it is not perfect and may never be. And, even if one death is caused by Autopilot that would not have happened otherwise, it presents an ethical dilemma.

Tesla Autopilot Safety Improvements
(avg. miles driven per crash)



As Tesla has demonstrated, combining the next generation of artificial intelligence software with the right data and hardware holds fantastic promise. Intuitive Surgical, a designer and manufacturer of medical robotics, has begun using AI to supplement the capabilities of their da Vinci surgical system. Some tasks, such as instrument tracking and needle placement, can already be automated. Real-time AI-assisted surgery is being performed in clinical trials, with several parallel tools being developed concurrently by Intuitive. Though in early development, Intuitive is working on AI (IntuitivePath) that will fully automate many surgeries by levering data on more than 10 million already performed with the da Vinci system.

What's Missing Inside AI

Since the recent explosion of interest in AI, blind faith has led to some serious miscalculations. A lawyer who submitted fabricated case law from ChatGPT is being sanctioned. Countless students have been wrongfully accused of plagiarism or relying on AI for their work by teachers who asked an AI model if the submitted work was original. Journalists have received fake quotes misappropriated by ChatGPT. Fulfilling the myriad promises of AI may take more time, maybe a lot more. The first fully AI-managed Exchange Traded Fund (ETF) launched in 2017, powered by IBM's Watson AI. Performance has substantially lagged the broad US equity market that forms its investment universe. Is this the reality of AI or its infancy?

In 2019, Elon Musk publicly forecast that Tesla owners would enjoy fully autonomous driving by mid-2020. Rapid progress from 0% to 50% or from 50% to 80% can make a 100% solution appear within reach. Yet, crossing the divide between the impractical and practical can be elusive. Understanding how AI works can help investors make pragmatic decisions.

Machine learning (ML) is able to provide a variety of relevant responses with a degree of randomness rather than calculating a precise answer which will always be the same given the same inputs. ML models are able to deal with ambiguous or open-ended queries and can make non-obvious connections across different spaces of knowledge. Yet, they work opaquely by inferring the most likely answer or next value in a pattern. Deterministic computer software works by replicating the process by which a problem can be answered or solved. This works well for clearly defined problems that are confined to specific bounds. In contrast, ML models can generate new content without explicit direction on how to do so.

ML models (like ChatGPT) do not comprehend the meaning of data, but may behave as if they do. So, receiving an obviously wrong answer can be jarring. In some cases, a simple "are you sure?" from the user is enough to trigger a critical self-evaluation and, ultimately, the correct answer. Other times, the model remains confidently wrong. These "hallucinations" suggest ChatGPT may never be fully human-level capable, though Socrates might think this a very human trait.

It's All Happening Now

A growing list of corporations are generating measurable value with AI tools and preparing for shifts in their workforce due to AI, marking a new era. IBM's CEO expects 30% of back-office staff to be replaced by AI within 5 years. Speculation aside, IBM has implemented a hiring freeze for these roles.

Adobe's new Generative Fill tool employs AI algorithms to automatically complete missing or excised portions of an image based on the surrounding content. It analyzes the details of textures, patterns, and elements present in the image to generate new content that blends with the surrounding context, amazingly cohesive and convincing to the human eye.

Mastercard's AI algorithms detect anomalies and potential fraudulent behavior, and immediately responds to potential fraud incidents by triggering countermeasures such as blocking transactions and notifying cardholders. This agile and efficient response is mitigating financial losses and reducing the impact on customers, generating roughly $1 billion in value per year.

BofA's Erica AI banking assistant has delivered personalized customer assistance through billions of client interactions, helping optimize operations and bolster security. AI is revolutionizing Boeing's aircraft simulation capabilities, design, and performance. Similarly, Autodesk is leveraging AI for product creation, simulations, and predictive analytics. Following Amazon's lead, Walmart is offloading some of its inventory management to Swisslog's AutoStore robotic AI-powered piece-picking system, resulting in better product availability and reduced costs. Salesforce is providing businesses with AI-driven sales insights and automation that has saved 10 million hours of labor.

Insilico Medicine is in mid-stage human trials with a lung disease treatment entirely discovered and designed by AI. This approach can shave years off preclinical discovery, identify patients likely to respond to the treatment, and improve the ultimate odds of success. Insilico is not alone, and competing AI drug discovery companies have met some disappointing results.

Company	AI Tool	AI Function
Adobe	Sensei	Content creation
Adobe	Generative Fill	Image completion
Autodesk	Generative Design	Product creation
Baidu	Deep Voice	Text ↔ Speech
BofA	Erica	Banking assistant
Boeing	Digital Twin	Aircraft simulation
Caterpillar	Cat MineStar	Equipment mgmt.
Cisco	DNA Center	Automation
GE	Predix	Failure prediction
Google	Cloud AutoML	Machine learning
IBM	Watson Assistant	Virtual assistant
Intel	OPT	Memory tech.
Intuitive	Firefly	Real-time Visualiz.
Mastercard	AI Fraud Detection	Fraud prevention
Meta	DeepFace	Facial recognit.
Microsoft	Power Apps	App creation
Nvidia	Omniverse	3D collaboration
Salesforce	Einstein Discovery	Sales insights
Siemens	MindSphere	Manufacturing
Spotify	Discover Weekly	Music recommend.
Tesla	Autopilot	Self-driving car
Walmart	AutoStore	Inventory mngmt.

Clipway, a private equity firm launched in 2023, anticipates closing on $1 billion in investor commitments for their first private equity secondaries fund this summer. The primary selling point of the fund is the AI model being developed to price limited partner fund interests. Reducing this part of the secondary trading process from weeks to minutes would give Clipway a competitive edge and greatly bolster liquidity for the asset class.

In 2018, Microsoft Power Apps was released as a low-code development platform that uses natural language processing to make building customized business applications more accessible, supplemented by templates and connectivity to Excel, Salesforce, etc. In 2022, M365 Copilot was added to Power Apps in a limited release to integrate OpenAI's generative models, greatly streamlining employees' access to their company's data and use of Excel, Word, and PowerPoint. Copilot can even "attend" a Microsoft Teams meeting in an employee's stead to report back with notes and relevant action items.

(Mostly) Winners and (Few) Losers

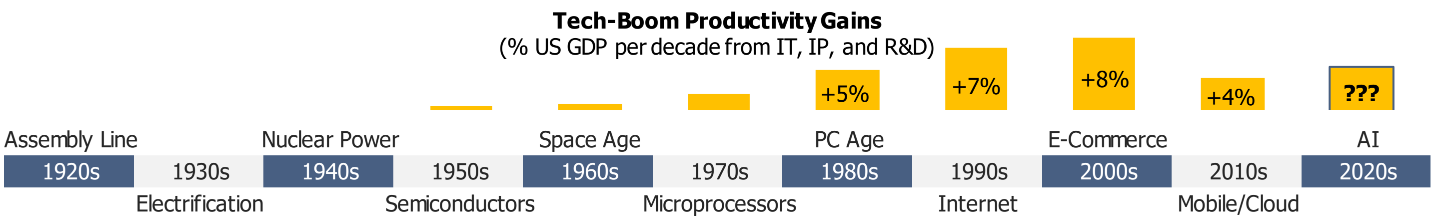
Microsoft, Alphabet, and Meta are direct winners in creating competitive AI foundation models due to their substantial investments in research, development, and infrastructure. These companies also benefit from access to extensive datasets, derived from products, services, and user interactions, which are pivotal for training foundation AI models that will be able to adapt to a wide variety of narrower downstream tasks. Moreover, these companies have established ecosystems that attract top AI talent and foster collaborations with researchers, academics and industry experts. Through strategic partnerships and acquisitions, they expand their AI capabilities and adeptly integrate AI technology into their existing offerings.

As AI investment increases, hardware companies Nvidia, Taiwan Semiconductor, AMD, and Intel have emerged as pickaxe suppliers to this gold rush. Nvidia's graphics processing units have become the preferred choice for AI training and deep neural networks, though both Nvidia and AMD will be releasing more powerful AI-targeted chips in the second half of 2023. AI-optimism is, arguably, responsible for much of the current stock market rally. Many investment managers (e.g., BofA, Goldman Sachs, RBC) have raised their S&P 500 year-end forecasts because of AI. Most of the gains have been captured, and may continue to be captured, by just a handful of companies. Yet, there is reason to believe the benefits will broaden.

While foundation models continue to improve dramatically, the applications are becoming increasingly valuable to many companies of every size in every sector. For example, PayPal, Square, Stripe, Robinhood, Wealthfront, Lemonade, and Plaid leverage AI to improve payment processing, online brokerage, lending, investment advice, insurance, and data connectivity. Conversely, there have been few losers, but that list is likely to grow as well. AI threatens to erode entire businesses built on processing modest-skilled technical work. In the first half of 2023, Infosys declined 12% amid analyst downgrades citing the threat of AI. Similarly, business process outsourcing firms Conduent and Exela declined 19% and 71% over this period.

Positioning Your Portfolio for the Age of AI

Speculation abounds as to potential benefits and repercussions. What is clear and tangible is that AI can be adapted to perform competitively versus human intelligence at a broad range of tasks, defining a new economic age of productivity.



The arrival of this new era is one of the "key insights" in McKinsey's June 2023 Report: *The Economic Potential of Generative AI: The Next Productivity Frontier*. The authors found that applications in consumer operations, sales & marketing, software engineering, and research & development represent approximately 75% of the generative AI's economic value, which they estimate will soon be trillions of dollars per year. But you don't have be heavily overweighted to the few obvious winners.

Generative AI is expected to impact all industries, with McKinsey anticipating the greatest benefits accruing to banking, technology, retail, consumer packaged goods, and pharmaceutical companies. In contrast, Joe Depa (Global Lead for Data & AI at Accenture) expects massive disruption in content creation and call centers, but slower adoption in healthcare and software development. Although tech stocks are pumped up, other sectors or industries may bound higher.

Regional allocations may also be critical as AI advances. The US and China lead AI development. The US is partnering with India to boost development and production of military arms, semiconductors, and AI. However, the Chinese government is comparatively lax on regulation and aggressive in spending, allowing China to pull ahead [ASPI].

As AI-equity enthusiasm builds, missing out on the winners could be devastating for relative returns, but far less damaging than buying near the eventual peak. AOL and Yahoo were two of the biggest beneficiaries of the dot-com bubble. They went from market caps of $62 million and $848 million to $200 billion and $125 billion, respectively. However, they were eventually acquired by Verizon for around $4.5 billion. This time, large entrenched technology companies are in command. This is not unique to the AI boom. Amazon and Apple were established companies when e-commerce and smartphones spurred new tailwinds for growth. However, it eases the burden on casual investors, as they are already likely to hold significant allocation to these companies and won't need to time an entry into volatile but potentially disruptive startups.

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