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Has artificial intelligence reached a commercial tipping point?

Key takeaways

- Publicity around ChatGPT has sparked fresh speculation around the promise and peril of artificial intelligence (AI).
- Stakes are rising fast, with an error in the Bard demonstration, Google's ChatGPT equivalent, sending Alphabet shares reeling.
- AI is likely on the brink of causing tectonic shifts across many companies and industries but, as an asset manager, digging into the details and separating reality from hype is key to our investment approach.

Artificial intelligence (AI) remains squarely in the spotlight following last November's release of ChatGPT, a bot that can produce human-like text.

Racing to a million users in five days and 100 million by January¹, this is the latest example of "generative AI", a set of models that can create content including audio, code, images, text, and videos. ChatGPT has already been put to many

¹ According to OpenAI

uses, from writing short stories and academic papers, to jokes, job applications and even music. Could this turn out to be the first killer app of the AI age?

ChatGPT comes from a company called OpenAI, the recipient of a reported US\$10 billion investment from Microsoft earlier this year, on top of US\$1 billion in 2019. Microsoft subsequently announced a public version of its Bing search engine with ChatGPT integrated, setting off alarm bells in the market that Google would need to respond, which it promptly did with its own equivalent called Bard. Showing how fast AI stakes are rising, an error at the Bard demonstration sent shares in Google's parent company Alphabet reeling, wiping tens of billions of dollars off its market value.

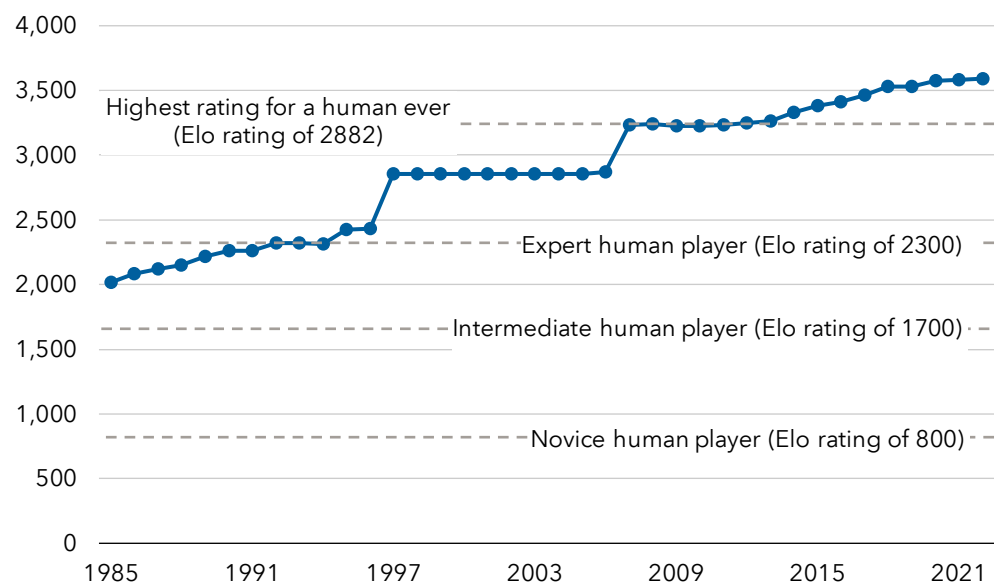
With AI now something of a loaded buzzword, Capital Group aims to cut through the noise. Equity analyst Drew Macklis explains that, amid all the exaggerated talk of the technology's promise and peril, detailed company analysis remains crucial to the way we think about investing.

"AI is likely on the brink of causing tectonic shifts in some companies and industries but the key for us is to dig into the details to separate reality from hype," he adds. "Ultimately, we must discern which businesses our funds should own to be best positioned for these changes. This ranges from spending time building relationships with the companies and management teams driving disruption, to engaging with industry leaders about the technical evolution of the field, to using game theory to think through second- and third-order consequences across sectors."

There is a saying in the tech community that AI is simply what computers cannot do yet; as soon as they are able to beat humans at chess, for example, it becomes just another programme. And mapping the rise of so-called chess engines can serve as a useful analogy, and possible trajectory, for AI in general.

Chess computing has its roots in the 1940s and 50s, with pioneers such as Alan Turing among those creating the earliest algorithms that could play against humans. As the chart shows, chess computers have evolved from never beating humans to defeating average players to routinely overcoming the best grand masters ever.

Chess ability of the best computers



As at January 2023. Sources: Chess.com (2020), SSDF (2022). Chess ability is measured with the Elo rating system, calculated based on game results. A higher rating indicates a player is more likely to win a game. The blue line in the chart represents the increasing Elo aptitude of chess computers, while the grey dotted lines indicate key levels of human ability.

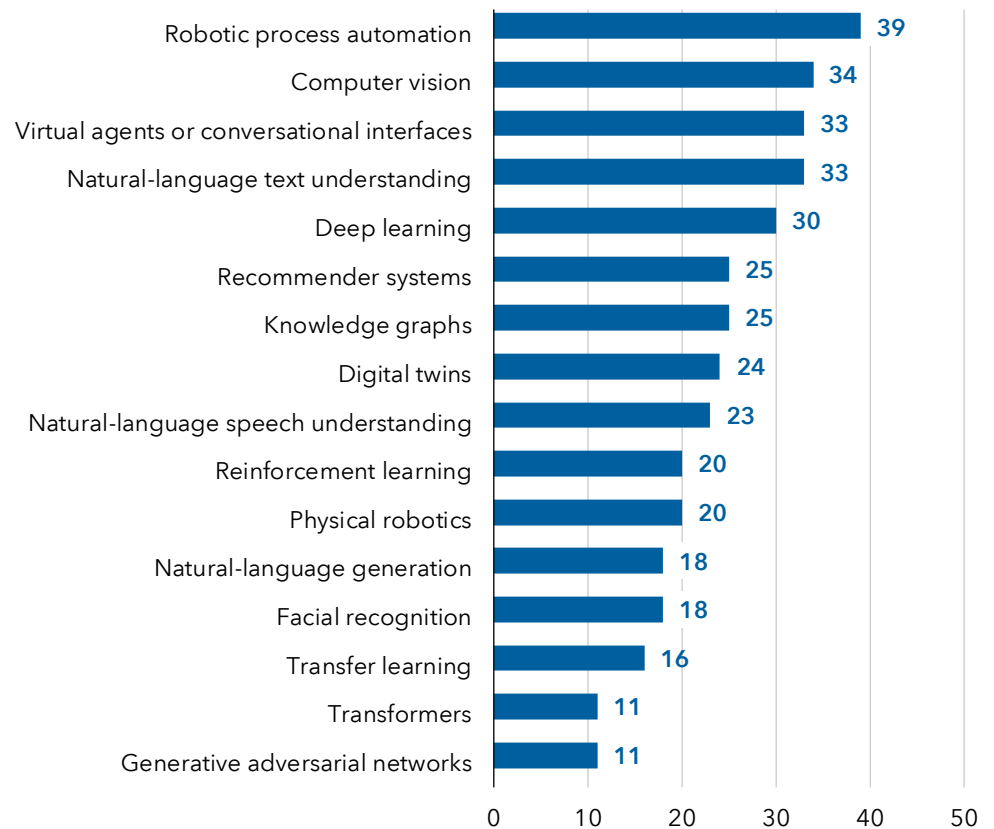
In the past, they were trained on human moves but we are now at the stage where a computer can basically play against and teach itself using AI and machine-learning techniques. This has opened up a huge range of strategies never seen in the chess world - and could be instructive for the rise of AI as systems continue to improve at rapid pace.

Despite the media buzz, widespread understanding and deployment of AI remains relatively low, apart from a few high-profile examples (such as the recommendation engines that power search and social networks).

While McKinsey research shows AI adoption globally has more than doubled over the past five years, to around 50%² of respondents using this technology in at least one business area, initial exuberance appears to have reached a temporary plateau, potentially as reality sinks in about the level of organisational change required to embed this technology.

That has not stopped a flood of global corporate investment going into AI, however, as the subsequent chart shows.

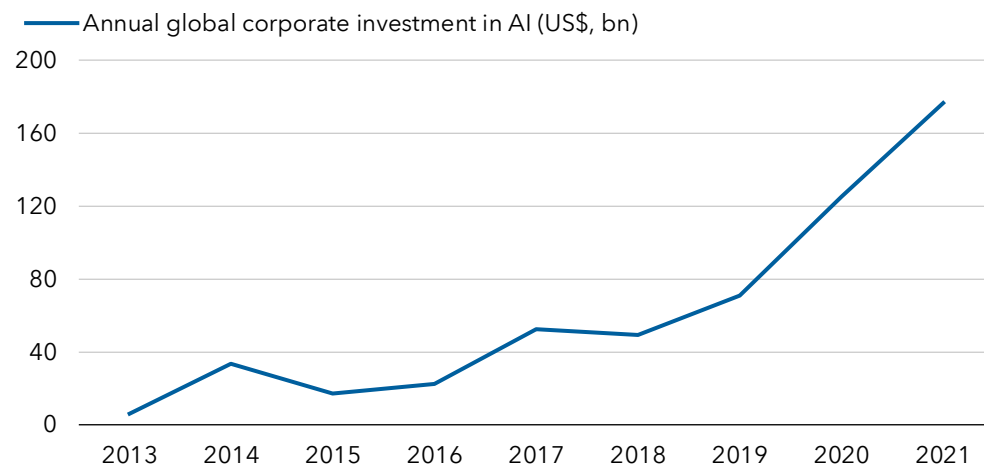
Percentage of companies where AI is embedded in products or processes in at least one business unit



As at December 2022. Source; McKinsey, *The State of AI in 2022*. McKinsey's survey was conducted in May and August 2022 and included responses from 1,492 participants representing the full range of regions, industries, company sizes, functional specialties, and tenures. Of those respondents, 744 said their organisations had adopted AI in at least one function.

2. Source: McKinsey, *The state of AI in 2022*

AI spending continues to grow



As at December 2022. Source: *Netbase Quid, AI Index Report*. Sum of private investment, mergers & acquisitions, public offerings and minority stakes. Data is US dollars, adjusted for inflation.

Technical breakthroughs

“In chess terms, AI is perhaps still only at the point of computers being able to beat the average human, or creating something like a first draft of a document,” adds Macklis. “But AI capabilities are rapidly increasing and appear to be nearing the point where deployment and impact can accelerate: through continued breakthroughs in models, along with prompt engineering and context-specific fine-tuning, AI can start to really move the needle on economic productivity.

“At its core, AI is about the ability to make predictions and decisions based on training data. What has changed in recent years is that technical breakthroughs allow AI models to be trained on increasingly massive amounts of data and therefore reach new levels of functionality. If we follow the chess analogy and AI systems continue developing, they may be on a path to become far more efficient at many tasks than the best humans, and perhaps even reach a ‘new frontier’ stage where they begin to uncover solutions and products people have never considered.”

With generative AI such as ChatGPT, the key shift has been to what are called “large language models”, which allow far more accurate chat and text features. AI systems of the early 2000s primarily used machine learning to improve an analytical model, with ad targeting from Google and Facebook the most commercially relevant examples. Generative AI, by contrast, can create new and unique content using what is known as “transformer architecture”.

In basic terms, this allows an AI to understand the relationships within a data set, such as a text or image, and establishes the contextual awareness required for creative tasks.

These developments are causing experts to dramatically pull forward predictions. Just a few years ago, estimates on when AI systems could potentially win a gold medal in the International Mathematics Olympiad (IMO), for example, or pass the Turing test³, stretched into the 2040s; today, median forecasts for both are later this decade⁴.

3. Gold medals are awarded to approximately the top 8% of IMO participants. The Turing test is a test of a machine’s ability to exhibit intelligent behaviour equivalent to, or indistinguishable from, that of a human.

4. <https://www.metaculus.com/questions/6728/ai-wins-imo-gold-medal/> and <https://www.metaculus.com/questions/3648/computer-passes-turing-test-by-2029/>

Mark Casey on robotic potential

As interesting as I find large language models, it is possible AI-powered robots of various types will have a bigger economic impact in the next handful of years. Here are four examples:

First, Amazon has started deploying a robot called Sparrow, which picks up items and puts them in shipping boxes. In 2015, when Amazon held a competition to design a picking robot, the winner picked up 10 of 12 items at a rate of two minutes per successful pick. Seven years later, Sparrow can pick up roughly two thirds of the 100 million-plus different items in an Amazon warehouse at a rate of just seconds per pick. Today, more than a million people work in Amazon fulfilment centres. With the progress in these robots, it seems possible a meaningful portion of those jobs might be replaced in the next four or five years. This is obviously not the greatest news for warehouse workers but might be very helpful to Amazon in enabling the company to address its high cost structure.

Second, self-driving cars and trucks are finally getting real-world traction. In 2016, I incorrectly thought we would start seeing self-driving cars on the road in 2020. Today, both Waymo and Cruise are robo-taxiing regular citizens around – without safety drivers – in Phoenix and San Francisco and both should launch in more cities in 2023.

Third, drones are doing a good job of delivering items in real-world tests. Google Wing has delivered more than 300,000 packages in its test markets in Australia, Finland, Ireland and Texas, and Amazon has a smaller programme in Texas and California. Walmart has partnered with a start-up in Arkansas, Florida, and other states. It is still early, but the drones seem to be getting the job done and improvement continues to be very rapid.

Fourth, if you want to see how in-home robots are evolving, have a look at the YouTube video of RT-1, a project Google recently disclosed. This one-armed robot has been trained on the same sorts of large language models powering ChatGPT and is able to perform over 700 tasks with a high success rate.

Looking forward, equity analyst Julien Gaertner agrees the key question for generative AI is the rate of model improvement from here – and he believes it is worth considering the most extreme outcomes. “Essentially, we have a situation today where generative AI systems are incredibly impressive in many areas but fail dramatically in others,” he says. “I have called this ‘the Swiss cheese model of intelligence’, with dense knowledge in most domains but also some big holes.”

With ChatGPT, for example, critics are focusing on the mistakes it makes, citing biased and offensive content: a recent piece in *The Atlantic* said “ChatGPT is dumber than you think” and urged readers to “treat it like a toy, not a tool”. Meanwhile, as outlined above, Google’s Bard got off to an inauspicious start with an incorrect answer in its promotional video, falsely stating the James Webb space telescope took the first pictures of a planet outside the Earth’s solar system.

“The most optimistic view is that increases in model size and training data continue to drive exponential progress for a while to come, and we should note the empirical evidence is pointing that way so far,” adds Gaertner. “We may also see step-change improvements in AI models, similar to what transformer architecture has done over the past few years.

“The pessimistic view would be that improvements taper off as models scale up or we hit a wall with the amount of available training data. While the jury is out on which way the world breaks, it makes sense to plot the outcomes. On one axis, you have the time it takes for AI to become good enough to be commercially

viable across a range of cognitive tasks; on the other, you have questions around speed of progress and whether we get to capabilities meaningfully beyond what humans can do. I have relatively high conviction a commercial inflection point for AI is within our investment time horizon but minimal conviction about what happens after that.”

Widespread deployment would clearly take time and while there are opportunities ahead, there are also many questions to answer as AI moves from science project territory to more of an industrialisation exercise.

In practical terms, this will include issues such as model reliability and governance; ethically, meanwhile, it is not yet clear who owns output from an AI system if it has been trained on data from many sources, or is responsible for its accuracy.

Early research from Capital Group analysts has also focused on areas such as “search economics”, comparing the cost of conventional search engines versus the new AI-powered breed. At present, it is far more expensive, relative to revenue potential, to run a search on the latter and while that cost curve will likely improve, working out whether margins could compress for all search providers will be key in our analysis.

Innovation, cost savings and reinforcing advantages

Under the more optimistic scenario, generative AI has the potential to be a massive enabler of creativity, as well as driving savings and reinforcing existing competitive advantages. At individual level, it could democratise the ability to bring ideas to life, making areas like graphic design and video production accessible to amateurs.

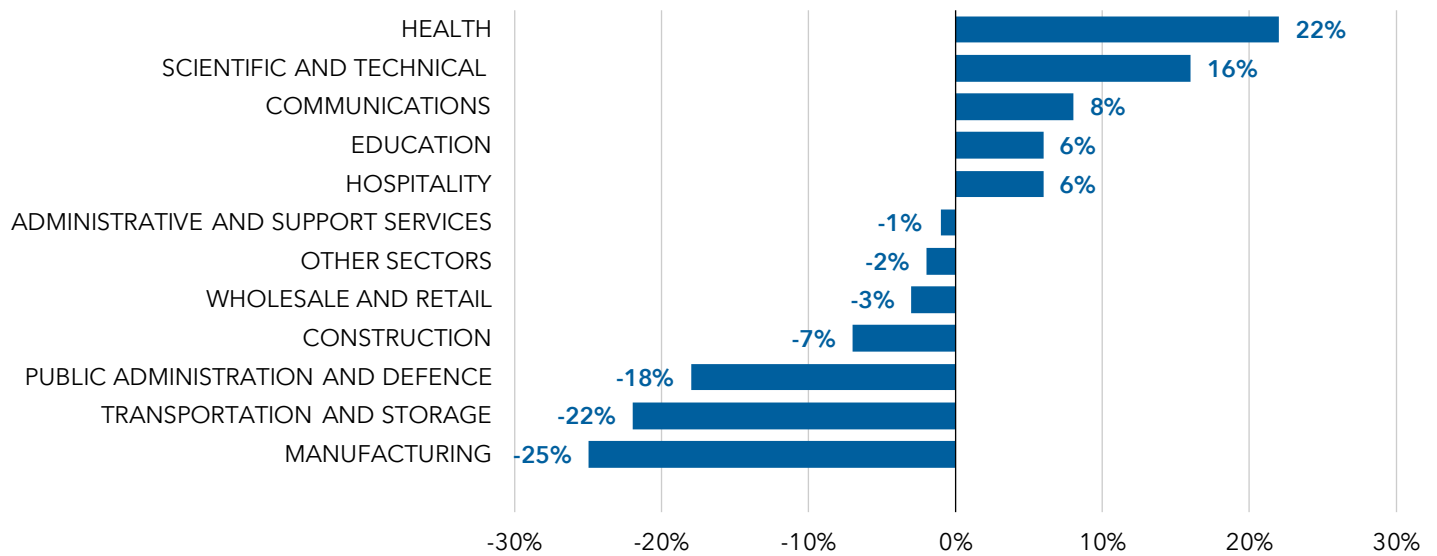
To give an early example of how AI can potentially cut costs and boost productivity, Microsoft is offering a Premium version of Teams powered by OpenAI’s GPT-3.5. Given current demand for remote working, many companies are not only paying for meeting solutions but also expensive add-on products for webinars, virtual appointments and meeting intelligence. Teams Premium is looking to offer all this for US\$10 a month, supported by AI-driven features such as post-meeting notes and tasks, and live translations.

Macklis adds: “OpenAI’s CEO Sam Altman likes to say that AI can bring about a ‘Moore’s law for everything⁵’ by driving down costs across the entire economy. And while too early to tell how broad the impact might be, at a minimum, this technology appears to be paving the way towards a sort of Moore’s law for knowledge work and content creation, with substantial investment implications.

“Fears around AI’s possible effect on jobs remain legitimate but this technology also has the potential to be more of a co-pilot rather than replacement, at least on the generative side. We are likely moving towards a world where AI can help automate the most repetitive or tedious parts of the knowledge workflow while humans remain the quality control layer on top to review the AI’s work.”

5. <https://moores.samaltman.com>. Moore’s law is a term used to refer to the observation made by Gordon Moore in 1965 that the number of transistors in a dense integrated circuit doubles about every two years.

Estimated net job creation from AI by industry sector (2017-37)



As at July 2018. Source: PWC analysis

From an investment perspective, portfolio manager Mark Casey says that if we start from the view that a lot of money will ultimately be made from AI, there is currently little evidence of that in the share prices of major companies – and the opposite when it comes to Alphabet, for example, after recent declines. Privately held OpenAI, founded as a non-profit in 2015, is reportedly valued at US\$29 billion post-Microsoft’s recent investment and, while the company has ambitious targets, it is said to be expecting only around US\$200 million in revenue this year. If reported figures are correct, there is a lot of enthusiasm in this valuation.

“If we consider other companies that can potentially deliver similar offerings to ChatGPT, it is difficult to see similar enthusiasm in their valuations. Google is the pioneer in transformer models and we are not seeing US\$29 billion in the company’s share price to reflect its AI capability. Meta, meanwhile, also has a strong track record in AI models and yet its shares remain depressed,” he adds.

So-called hyperscalers – the small group of tech giants that includes Meta, Alphabet, Microsoft and Amazon – have already spent billions on the hardware needed to create AI platforms so could potentially function as future infrastructure in this space for other developers to use.

Looking further out, Casey says AI proliferation could also have a major impact on areas such as semiconductor demand. “If you ask ChatGPT a question or the Stable Diffusion text-to-image model to draw a picture, they can take a while to answer. The reason behind this is that so much computing effort is going on as these models do what is known as inference, checking their billions of data points to produce the desired content,” he adds.

“What this tells us is that semiconductor content is very high in these applications. While it may be challenging as investors to identify stocks that ultimately make the best use of generative AI, there will only be handful of companies making the semiconductors on which these systems run.”

As Capital Group analysts and portfolio managers continue to speak to companies, there is a growing sense that while still early on the S curve⁶, we may be reaching an inflection point and AI is starting to pick up the baton from mobile and cloud in the tech space. The past 10 years in tech were characterised

6. Slow growth followed by very rapid before eventually plateauing

by a unique combination of mobile internet and cloud ramping up from low rates of penetration to mainstream adoption.

We may currently be at a similar stage to cloud computing in 2013, for example, and companies able to use AI to differentiate their product offering or ability to deliver productivity could have a major advantage in the years ahead. Beyond obvious tech and 'knowledge' sectors, areas of potential AI application include supply chain management, healthcare (in drug development and scan analysis), insurance, oil and gas (looking at satellite data), utilities (for grid and load management) and autonomous farming – and AI strategy may therefore become an increasingly important part of company analysis.

Returning to our starting point of cutting through the noise, we can look at AI in terms of now, soon and later when it comes to investment implications. The now is a fascinating but somewhat limited opportunity; the soon, that AI is on the cusp of accelerating and we are watching impacted areas closely; and the later, that this technology is ultimately likely to exceed expectations. While it is not yet clear what that means for the world, we believe the key for portfolio managers will be partnering with companies best positioned for the changes ahead.

AI in action

To give an example of what ChatGPT can produce, we asked it to provide something on the investment implications of AI. It wrote the following paragraphs without any context and in a matter of seconds:

“Artificial intelligence (AI) has rapidly evolved in recent years and has become an increasingly important part of our daily lives. From virtual assistants to self-driving cars, AI technology has the potential to revolutionize many different industries and create significant investment opportunities for those who are willing to take a chance on this innovative technology.

One of the best investment opportunities in AI is in the development of machine learning algorithms. Machine learning is a type of AI that allows computers to learn and adapt to new data without being explicitly programmed. This technology has the potential to improve many different products and services, including facial recognition systems, language translation tools, and even medical diagnosis systems. By investing in companies developing advanced machine learning algorithms, investors can take advantage of growing demand for these types of AI technologies.

Another great investment opportunity in AI is in the development of natural language processing (NLP) technologies. NLP is a type of AI that enables computers to understand, interpret, and generate human language. This technology has the potential to improve many different products and services, including virtual assistants, customer service chatbots, and even language translation tools. By investing in companies that are developing advanced NLP technologies, investors can tap into the growing demand for these types of AI products and services.

In addition to these two areas, there are also significant investment opportunities in the development of AI-powered robotics. As AI technology continues to advance, robots are becoming increasingly sophisticated and are able to perform a wider range of tasks. This has the potential to revolutionize many different industries, including manufacturing, logistics, and even healthcare.

Overall, AI technology has the potential to revolutionize many different industries and create significant investment opportunities for those who are willing to take a chance on this innovative technology. By investing in companies that are developing advanced machine learning algorithms, natural language processing technologies, and AI-powered robotics, investors can tap into the growing demand for these types of products and services and potentially reap significant rewards.”

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Mark Casey is an equity portfolio manager at Capital Group. He has 22 years of investment experience, all with Capital Group. Earlier in his career at Capital, Mark was an equity investment analyst and covered US media, entertainment, newspapers, infrastructure software, internet and document imaging. Prior to joining Capital, he was a director and product manager for Siebel Systems. He holds an MBA with distinction from Harvard Business School and a bachelor's degree in history from Yale University graduating magna cum laude. Mark is based in San Francisco.

Drew Macklis is an equity investment analyst at Capital Group with research responsibility for US semiconductors and autos & mobility technology. He has six years of investment industry experience and has been with Capital Group for three years. Prior to joining Capital, Drew worked as a private equity associate at Golden Gate Capital. Before that, he was a business analyst at McKinsey & Company. He holds an MBA from Harvard Business School, where he graduated as a Baker scholar and recipient of the John L. Loeb Award, and a bachelor's degree in economics and global affairs from Yale University, where he graduated magna cum laude. Drew is based in San Francisco.

Julien Gaertner is an equity investment analyst at Capital Group with research responsibility for enterprise software & services and technology hardware & equipment in the US and Europe, and health care IT in the US. He has nine years of investment experience and has been with Capital Group for 11 years. Julien began his career at Capital as a participant in The Associates Program, a two-year series of work assignments in various areas of the organisation. He holds a bachelor's degree in economics and international relations from Brown University. Julien is based in San Francisco.

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