Brown Advisory Technology Sector Virtual Update

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Madison Freeze:
Hi, everyone, and thank you so much for joining us for today's conversation on the technology sector. I'm really looking forward to it. For those who I haven't met, my name is Madison Freeze. I'm a member of our US institutional sales and service team, based here in our Austin office. And joining me today from Baltimore are three of my colleagues on our equity research team, Joe Pasqualichio, John Bond, and John Canning.

As folks continue to join, I wanted to call attention to a few housekeeping items up front. First, we'd love to make this discussion as relevant to you all as possible, so please don't hesitate to submit questions throughout. They'll remain anonymous and we'll do our best to answer them at the end of the session. And second, this is the first time we've hosted such an event to such a broad audience. We'd love your feedback on the content, where we could improve, and if it would be valuable to host more of these events in the future. We'll push out a survey at the end of the hour; if you're open to sharing and have 30 seconds, we would really love your honest feedback.

Now on to the discussion. To help frame the conversation, especially for those who are new to Brown Advisory, I thought I'd first kick things off with a bit of background on the firm and then I'll open the floor to John, John, and Joe to discuss a variety of topics, including the velocity of innovation across the sector, the transformational impacts of AI, and a few looming risks facing our technology holdings.

As it relates to Brown Advisory at the highest level, we are a private and independent investment firm. We manage over $70 billion across a wide range of long-only, public equity, fixed income, and private investment solutions. Whether small cap or large, growth or value, or US or global, our strategies are built on a common foundation rooted in bottom-up, fundamental research, high-conviction and long-term orientation. The technology team offers a great glimpse into our collaborative structure and thinking. John, John, and Joe each bring a specialized expertise to the sector.

John Bond focuses on hardware, John Canning on software, and Joe on internet services. They embody so much of what I love about Brown Advisory's culture. They're all partners of the firm, acting as incredible mentors and leaders on the equity research team, and they're all extremely generous with their knowledge of the sector. And I'm thrilled to be able to extend some of that to y'all today. And on that note, let's get to it.

In prepping for today's conversation, it felt as if we had an endless number of topics to cover. In the last few days alone, we started the week with TikTok going dark in the US; flipping the calendar to Monday, we witnessed many of the major tech CEOs front and center at President Trump's inauguration; and just the other day an executive order proposing a $500 billion AI infrastructure project in the US. It's hard to not be entirely consumed by the latest headlines. I'd love to start by cutting through some of that noise and first ask you all to reflect a bit on the pace of innovation throughout your careers, as I feel that historical context can really offer a nice perspective for the audience. Could you all introduce yourselves by sharing a few reflections? Maybe John Bond, you can kick us off?

John Bond:
Sure. Thanks, Madison. I'm John Bond, I cover hardware at the firm with most of my time spent on semiconductor. I've been here for a little bit over 12 years, so a while. And so for semiconductor on innovation, I'll just pull the lens back a little bit and talk about history to get us to where we are today. Semi innovation has always been very fast. After all, this is the industry that birthed Moore's Law, which stated that you'd get twice the density of integrated circuits at the same price every 18 months, which is an extraordinary pace of innovation. But for all that, semiconductor was a pretty terrible place to invest from 2000 to 2015. Growth was okay, but it was very simple: You had a bad industry structure and companies didn't do all that well. Essentially, it was a lot of innovation, but it was profitless in aggregate for the industry.

And since 2015, really when I was fortunate enough to pick up the sector, it's been a great place to invest, and innovation has changed in both pace and vector. Now, the pace is a little different in that Moore's Law no longer really works. We're not getting twice the density every 18 months, but companies have found new ways of squeezing out performance from semiconductor, whether it's architecture or materials or what have you. And so we're still getting the innovation but not quite at the same pace. But where it's really picked up is in the vector for innovation and then the application space. So from a vector perspective, it is really about the application space. And what I mean there is that the places that we can put semiconductors have changed a lot. Compute has gotten very cheap, and connectivity has gotten faster and ubiquitous, 4G, 5G.

And so what it means is that we can put compute in a lot more places. Essentially we can create actionable data in places that we never could before. Think about cars, appliances, smartphones, smart thermostats, industrial production lines. It is now profitable to put semiconductors in those edge devices or edge applications and then create actionable data that you can make decisions with. And what that means is that the growth curve for the industry has picked up. If you think back to 2015, it's sort of bent meaningfully upward. It's still cyclical, but it's faster growing.

And at the same time, we sort of had innovation in business practices in the sector. Whereas before you had a pretty terrible industry structure, some not great management teams, business models that really didn't work through cycles—as we've gone through more cycles, we've had rationalization in the industry. We've had some of the weaker companies go away. There aren't too many substandard management teams left and business models have changed to more standard concentrated production.

What it means is that we've got scaled rational competitors with most subsegments being dominated by two to three large companies. And think about when I say subsectors, I mean within semiconductor, things like networking chips, analog chips, GPUs, CPUs, that sort of thing.

And so what that ends up meaning is that you have, for a given sector, you have bigger, more focused pools of R&D dollars that are tighter with customers. So you get better, faster innovation, faster because you've got more concentrated R&D being thrown at a problem, better because by virtue of being the biggest competitors in a space, they are tighter with customers. So they get deeper into customer roadmaps, they're able to spend the R&D dollars more intelligently and more tightly with customers to create products that have product-market fit as they're introduced.

And so what that means, as I look back to 2015, is we've entered into a period of profitable innovation for the industry, which has been great. You can see it in the stocks. The SOX, the Semiconductor Index in aggregate has been an outperformer over the last nine years. And that's before we even get into generative AI, which has happened in the last two to three years, which I think is the next leg of growth for the sector. And I'm sure we're going to discuss in some detail here today. I'll pass to Madison.

Madison:
Great. And I might just, while we're going around the horn and ask Joe and John to briefly share their perspectives too, and just a handful of reflections in a brief intro would be great.

John Canning:
Sure. So thanks everyone for joining. My name's John Canning. As Madison mentioned, I'm focused on software at the firm. I've been here about 10 years. I think the biggest change in the software industry, in my view has really been the advent of the public cloud. And while a lot of those companies were founded in the mid-2000s—AWS on the pure infrastructure side, but also companies like Salesforce.com, NetSuite, Workday, ServiceNow—I think the last 10 years has really been marked by meaningful adoption of both public cloud infrastructure, but also public cloud applications or software as a service that we know today.

That distribution paradigm shift has enabled customers to take advantage of innovation of vendors much more quickly. You used to have a situation where you bought a license and then you had maintenance, but in order to take advantage of any sort of innovation at the vendor level as a customer, you had to go and re-implement or do an upgrade of the system. The public cloud distribution has really enabled customers to take advantage of constant progress. And you have software as a service—companies that are releasing new updates to their product on your daily cadence—which is driving a much quicker realization of the innovation that the vendors are delivering, and I think has created more value for customers as a result.

We've also seen as a result of this elastic compute availability for software vendors—many of which are now building directly on the public cloud, as opposed to the initial software as a service vendors who had to build their own data centers in order to deliver their product to customers—a more modular kind of software design architecture, a more modern architecture. And I think that's enabling companies to move more quickly whenever innovations like generative AI come out and add that into their product portfolio and then leverage the distribution that I just alluded to to push that out to customers all in a capital-light way.

So you've seen the nature of products continue to evolve very quickly as a result of both those functions, but a lot of that has really been realized because of the innovation that the companies that John covers and the hyperscalers' capital investment have delivered.

Joe Pasqualichio:
So hi, I'm Joe Pasqualichio. I cover internet at Brown Advisory. I've been covering and following the space for 15 years, including the Facebook IPO, which was in 2012. Since then, the pace of innovation has rapidly increased and one of the ways I measure that is the time it takes to reach a hundred million users on these internet platforms. And so if you go back to LinkedIn, that took seven years. Facebook took four and a half years, Instagram two and a half, YouTube took one and a half, TikTok took only nine months. And then recently you've had ChatGPT, which just took two months to get to a hundred million users, and Threads, which was launched by Meta, took just five days to reach a hundred million users. So the pace of innovation is rapidly increasing, and I think a few things have happened over that time that has allowed for that increase.

First, since 2000, we had about 50% of US adults having access to internet. Now that number's over 95%, and many of those have high speed broadband. The second is we've moved from desktop internet usage to mobile, where everything is just one click away on an app store, through an app. And then third, the trust of people on these internet platforms has really increased over that time. If you go back to the start of it all, people used internet handles. They made funny names instead of using their real name, and everybody was worried about people knowing who you were. Now people have pictures of their friends and family and details of their lives out there for everyone to see. So all of those factors have led to this faster pace of adoption. That means that our companies have to innovate really fast and stay ahead of trends.

So one example of a company that couldn't do that would be MySpace. At its peak, MySpace had about 300 million users. It was valued at $12 billion. At this point, it's defunct. You can compare that to companies like Meta with Facebook where they've basically innovated, adapted, and copied other people's innovations as well to basically stay alive and thrive. And so it's really our job to find out what companies are staying ahead of that and which companies might be falling behind.

The last thing I'll say in terms of the pace of innovation is all of my companies, different from John and John's companies, make money on advertising. The real business is selling advertising. And so I think for this whole period of time I've been covering the space, people have thought of internet companies as secular growers and looking forward, we're spending a lot of time just thinking about the actual advertising and business cycle. Now that these systems are fully penetrated and it's become the dominant way that advertisers reach their audience, will we start to see more cyclicality when there's a down cycle in the economy?

Madison:
Thanks everyone. Joe, those stats were just wild about the time it takes to reach a hundred million users. It's a really great microcosm, I think, of the overall velocity of innovation and the reach that these companies are having. Maybe just doubling down on that and turning to the company level—of course as bottom-up investors, that's really what matters to us, right? So when looking through that lens of the pace of innovation, can you all speak to just how companies are balancing that rapid pace with the length and complexity and investment cost of the development cycle? I know particularly John Bond within hardware, there are high barriers to entry and costs there. So maybe just some examples to help bring it to life.

John Bond:
Sure. So I guess within hardware, I alluded earlier to the fact that we've got a more concentrated industry structure within subsegments and that really helps drive the pace of innovation, just because when you have high relative market share, it means that you are spending more R&D dollars than your nearest competitor, or sometimes a multiple of the R&D dollars of your nearest competitor.

If you think about why is Nvidia able to innovate so much more quickly than its sort of largest competitor AMD in GPU? Nvidia spends more on R&D in GPU than AMD has revenue. And so when you've got companies that are at that scale, they're just able to innovate so much faster. And so, one of the things that we focused on is trying to figure out which are the capable companies, which are the scaled companies that going to drive even more market share and even more scale and get closer to customers? And so as I think about specific examples, Taiwan Semiconductor has sort of run away with the leading node market. They've got on the order of 90% share at the most advanced technology nodes in semiconductor production. And how did they do that? They got scale. They took more wafers away from Intel. That was sort of a strategic blunder by Intel, but TSM took advantage. Semiconductor production is an iterative learning process and the more wafers you put through your process, the better you get at it. And so even as Moore's law has slowed/gone away, they've been able to do things like innovate with 3D packaging, putting more different chips in a package or materials or architectures like taking the power that powers the integrated circuits and flipping it onto the backside of the wafer to increase semiconductor density without actually decreasing the geometric size of the integrated circuits.

And TSM being able to do that has driven innovation across the sector. When you have new nodes that are offering better power, better density on an almost annual cadence, it means that it makes sense to move more quickly. And so you've seen Nvidia in particular has moved to an annual cadence on products. Until last year, every two years they'd introduce a new GPU architecture that would be at a more advanced technology node with much more advanced software and AI capabilities, but they're going to a one-year cadence now. And when you are the biggest company in the space, you pull everyone along behind you because everyone wants a piece of that Nvidia bomb. If you think about what Nvidia delivers, they don't deliver chips anymore, they deliver systems. So think about the most recent generation, not the one that's coming out as we speak, but the Hopper generation was delivered as a server that weighs about 300 pounds with eight Nvidia GPUs in it, but it's got 135,000 total parts in it. 99%, 95%, I don't know exactly, of which are not made by Nvidia. And so when you have the leaders setting a pace like that, everyone else gets pulled along behind or they get left behind. And so what we've tried to do is find the companies that are able to keep pace with that.

John Canning:
I think one thing that we focus a lot on in software is the underlying platform that these application companies have built upon, which they then deliver specific services. And I think ServiceNow is one of the companies that's really been a leader in their workflow engine, then applying that underlying platform across IT workflows, HR workflows, customer service workflows, ERP, et cetera. And I think the distribution advantage and the ability to push out innovation that I alluded to is compounded by scale, particularly if you can have this core R&D platform. And what happens is you can innovate, but you can iterate your innovation, as opposed to a more transformational innovation that you might have going from one system to another, and push that out at scale, which really I think improves your returns on that investment. You have this install base that you can leverage without having to reinvent the wheel each time. So it's a bit of a different dynamic, but that's certainly something that I think eases that development cycle challenge as these companies think about what's next on their roadmap.

Joe:
For internet companies, I think of innovation and development on two sides. One is supply, which would be the users that are on the platform and the time they spend there. I think that as the supply side. And then demand, which is the advertisers who want to seek out those people to advertise to. If you're an internet platform, you really have to innovate on both sides of that equation. So because of this, we really have to monitor changes on both sides. We do a lot of channel check calls here, talking to ad buyers, talking to people in the industry who are looking at these new products as they're rolled out and telling us if they're good, if they're spending more money, if they're seeing a higher return on that spend or not.

And sometimes innovation with new products means that there is a bit of a downturn in the company for a period of time. And to give you an example of that, Meta has done this many times with Facebook. They went from desktop to mobile. That was a difficult transition. A lot of people were worried. It's a much smaller screen. Will advertisers still pay to advertise on a small screen versus a big desktop? We went from looking at people's individual page profiles to the newsfeed. When the newsfeed came out, people were up in arms about privacy and their information being put on this newsfeed. That became commonplace. That newsfeed went to stories. Stories has now gone to reels, which looks a lot more like TikTok.

So every time they've innovated, the issue is you have a new product that needs to be adopted, accepted by both the users first and then advertisers. Usually you have a very low ad load to get the users to use the product so you have a period of time where you're not selling as many ads as time shifts to that new product. And so we've seen that happen many times. Often it's been a good entry point into the stock. In our Flex strategy, we actually upgraded and bought Meta pretty close to the bottom near $100, when people were worried about reels taking away time from newsfeed. People were worried about IDFA (Apple's Identifier for Advertisers), technical challenges, tracking. And the fact is these companies have a large body of very intelligent people that can figure out these technical challenges.

And we've seen them do it over and over again. Fast-forward to today, a lot of the innovation is starting to be focused around AI, and there's clearly a lot of cap ex being spent, and my companies I think are already taking advantage of AI and actually using it to make real revenue today. And I'm sure we'll get into that more later.

Madison:
I think actually that's a great transition point as we dive a little bit deeper into AI and the profound impact it's had really across the sector and across all of the portfolio companies that you all cover. John Bond, looking to you, of course clear and early winners have emerged within hardware. Could you just shed some light on how we're thinking about the current state of the subsector across our investment portfolios with respect to hardware and AI developments?

John Bond:
Sure. Well, Nvidia is obviously the poster child and the one that we get the most questions about and the most prominent company. But as I mentioned earlier, there's lots of ways to play AI and we've been fortunate enough to own Nvidia in our large-cap growth portfolios. But in portfolios where NVIDIA doesn't fit, we've found ways to take advantage of the trend. And so if you think about there's complementary players and then there are suppliers into the Nvidia supply chain.

On the complementary side, we've had a position in Marvell in a number of strategies—international large-cap growth and mid-cap growth—for a while. Marvell is sort of a dual player. They make optical modules that provide the connectivity for the Nvidia GPUs to one another and then to the outside world, which is a large and growing market because Nvidia ships more and more units every year and each one has to have that connectivity. But they're also complementary in that if you think about compute workloads over time, Nvidia is really sort of a sledgehammer for a problem, if you will. It's a general-purpose compute platform, meaning that you can bring any workload to it and as long as it's coded right, it'll run it, but it's not the most efficient way to do most workloads.

And so if you have a scaled enough workload—think Google search, think Microsoft Co-Pilot, think recommendation engines within Facebook—that workload is big enough that you may want to encode those software lines actually in silicon. So one of the things that Marvell does is it has a design team that will design specific chips for specific workloads. So as I think about hyperscale workloads over time, some portion of those will be internal workloads that are scaled up enough that they will require their own chips to be profitable workloads. And Marvell has a huge position in that. So thinking about the growth of AI and how it evolves over the next 3, 5, 7 years: That shift will benefit Marvell.

And then on the other side, I talked about 135,000 parts in the Nvidia Hopper product. A lot of those are power delivery or smaller compute products. So we've invested in Monolithic Power that does power delivery from Nvidia, but also some of these other products like the Google TPU that comes in a system; they do power for that. Lattice is a small-cap holding that has a FPGA that's a somewhat configurable small-compute form factor that does some of the power on, power off smaller workloads that help the DGX, the Hopper product actually work. So those have been really interesting, good investments for us. And AI requires data and network delivery. So networking products: We've owned Cisco in our value strategy and Micron as well, from time to time.

If you think about what makes AI work, well, yes, the compute, but also bringing data to the compute. And you can't have data without storage. And I think there's a memory cycle that's very interesting that we've played in the past. And then as you think about further back in the supply chain, all roads lead to TSM, Taiwan Semiconductor. As I mentioned before, they have sort of 90-ish percent or greater share in the most advanced technology nodes, which is where all this compute is constructed. And so we've owned TSM, Taiwan Semiconductor, in our international and Flex strategies for a number of years, and they've taken huge advantage of these trends. They’re Nvidia's and Marvell's primary supplier. And they've taken some share in Intel computers. Intel has not executed on production nodes.

And then even further back than that, and this is sort of an interesting subsector, there's an entire industry of companies that produce industrial tools that make semiconductors. And we’ve found some really interesting investments in that sector. And they sell to Taiwan Semiconductor, they sell to Samsung, Intel, across the spectrum. We've owned ASML in Global Leaders for quite some time; KLA in our growth strategies—they make sure the semiconductors are being produced correctly—and then Applied Materials in our large-cap value strategy for quite some time. And they've all been taking advantage of the growth vector of AI.

John Canning:
And even Cadence Design Systems in the software space really benefits from this velocity that John's talking about. Chip design requirements are getting more complex, and Cadence delivers that software to enable customers like Nvidia and others. So it extends really throughout that entire value chain.

Joe:
With my companies, they're monetizing AI today. I think on the user side or supply side, engagement is going up. And so even on platforms like traditional, original Facebook, where people might have a thought that that's declining. It's actually not. People are actually spending more time. And part of that is the company and all social media companies are starting to move their video ranking algorithms and their feeds to GPUs from CPUs and putting AI algorithms behind deciding what to serve next. And that's causing people to spend more time on these platforms, which in turn gives more opportunity for advertisers to sneak in ad load. And so you're seeing profits rise as engagement rises due to these AI enhanced algorithms.

And then on the ad side, the demand side, the buyer side, you're seeing a lot of automated AI-driven algorithms being used. So at Google they have something called Performance Max, which we've been following closely and doing a lot of checks on. Meta has rolled out something called Advantage+. Not to be outdone, Pinterest combined those two words and came out with something called Performance Plus, or I don't know if it's Advantage Max, I'm losing track at this point, but they're all coming out with an automated buying platform. What that allows buyers to do is you don't have to be that sophisticated, you just need to know you want to spend money on that platform. You need to know what kind of return on ad spend you need, and this system will automatically keep spending as long as you can get that kind of return and put your ads in different parts of the platform, whether that's in text, video, display, whether that's going to be on reels, or it's going to be on stories or feed. It can decide where to put that to get the highest return without you doing anything. And so that's increasing the amount of spend advertisers get, and it's taking efficiency out of a system and making it more and more efficient to bring higher returns. So that's one way that it's working on that side.

And then I'll say scale really matters here. The companies that have the scale and can spend more money on these tools obviously will create an advantage and get engagement shifts towards their platform. So that's something that we're thinking about a lot as well.

Madison:
These fundamental strengths are just really profound. How do you all combine that with thinking about valuation? A couple of questions have come in around are these stocks successively valued? Of course, the growth path seems really bright, but maybe talk through how y'all are thinking about valuation, at least with respect to some of the top holdings that you spoke about.

John Canning:
You going to start?

John Bond:
Sure. Well, we take a three- and five-year view on everything we own. I think that it's interesting to look at this year and next year and that can inform decisions. But when you're thinking about such a long-term growth trend and such a powerful innovation cycle that's taking hold, an investment cycle really, that's happening right now. This year isn't necessarily indicative. So as I think about Nvidia in particular, actually on a multiple basis, whether it's a multiple of earnings or a multiple of free cash flow, it's cheaper today than it was 18 months ago, and it's been, I can't remember exactly, but more than a double since then. If you think about, say, a Marvell, which we own pretty widely as well, it's expensive and it's more expensive now perhaps relative to history, certainly above average and maybe close to an all-time high.

But as I think about where we are now, we're troughing in some of their cyclical industries, so they have some businesses that are not AI that have been pretty bad for a couple of years. They're troughing, and you are about to hit a growth inflection in these complementary to Nvidia businesses—those custom chips that I talked about—whereas I look out three years and I can easily see doubling or potentially tripling of earnings. So does it look expensive today? Absolutely. Does it look expensive on a three-year basis compared to peers? Not really. So I think it is all about your time horizon and what cycle you're investing for.

Madison:
And John Canning, less of a concern for you perhaps, given that the state of software has been a little bit less euphoric.

John Canning:
It's a bit of a have or have nots in software, and we are so early in enterprise adoption of generative AI tools. I think when you think about the hardware space, the good thing is as long as there is a vendor who delivers value with these tools, John's companies are going to benefit, right? Whereas at the application layer, ultimately that is where value will be created and value generated for the enterprise and for the consumer. At the end of the day, there is less certainty as it relates to who those vendors may be. The incumbents have clear advantages, they have a ton of data, they sit in existing enterprise workflows, they have the trust of their customers, which is really important given we're still in a situation where correctness is a question, particularly as we think about taking action with generative AI solutions.

But we do have a paradigm shift. I started this conversation talking about the cloud and the opportunity that created for a wave of new vendors to really become the leaders for decades. This is likely the beginning of a situation where the way in which we interact with software evolves, right? People have probably read about and heard a lot about agents in the last six to 12 months. Marc Benioff's been very public talk about Salesforce.com's Agentforce solution. These are very early, I mean, we're talking low to mid-single digits of revenue next year for the companies that are furthest along in monetization, but demonstrating to your customers and to the marketplace that you're going to have a solution, as agents and the potential to really drive significant automation in a new way evolves, and the interface evolves, is being rewarded, whereas questions around your relevance is being punished significantly.

So when I take a step back, I do think, as I mentioned, we're early. The distribution that I started the conversation with will matter if the companies have the right architecture and can deliver agents or whatever generative AI solution into their customer base and leverage their trust. One thing that's very interesting—I was on the West Coast last week—that's happened, is traditionally enterprises were very cagey about contributing their data in order to train any AI algorithms at vendors. Obviously the vendors who have scale want to leverage the amount of data that's flowing through their system. And the opt-in rates in those terms and conditions has really gone up in part because in order to leverage a generative AI solution from a vendor, you often need to contribute your data into that pool to enable the algorithm to improve correctness.

So I think the jury is out, it's early, the uncertainty level is certainly much higher than probably in hardware, at least the shape of the adoption curve. And so what you've seen is companies that are really providing the infrastructure, so not necessarily the application layer, have also benefited in a

similar way the hardware companies have, whether that's Microsoft with Azure, Amazon with AWS, Oracle with OCI, even though that's a smaller product. Because again, likely these solutions are going to sit on top of that infrastructure. Datadog, which is a company we own in multiple strategies at the firm, which provides observability of infrastructure. And you've seen a lot less certainty at the application layer as people try to digest, are these incumbency advantages going to be realized or are they at risk of a disruption as the interface potentially evolves and agents really change the way that we interact with software.

Joe:
In internet, I think valuation's always tricky. I think the way these companies develop, especially when they're earlier on, is you generally lose money for a reasonably long period of time—in order to get enough users on your platform and build a critical mass to then attract advertisers and you eventually profit sometime in the future from this massive attention that you're getting. And you don't always know exactly how that's going to play out when you build the platform. So when Facebook IPO'ed back in 2012, I think it was close to a hundred billion dollar valuation, and people were really upset about that. There was a lot of writing about how absurd that was and how the company will never achieve that kind of valuation. And of course, now it's in the trillion dollar club, and so it is hard sometimes to see where these things will wind up, and it's hard to digest some of the early spending and losses that have to take place. So you really have to have a long-term perspective on the total addressable market size, the penetration of that market, and how these products might evolve over time. So certainly a lot of creativity in the early stages. As these companies become more mature, it becomes a little easier to set the valuation as the range of outcomes narrows a bit.

But I think recently that's become tricky again, because with the spending on AI cap ex, you've had a divergence in PE multiples for internet companies and free cashflow multiples. And so a lot of these companies look very reasonably priced on PE, maybe even cheap in some cases, whereas on free cashflow, they're starting to look quite expensive. And so the key question really is how long will this heightened cap ex and capital intensity last? If you think it's just a period of time and then it's going to come back down or revenue will catch up to it, totally acceptable. If you think this is going to stick around for a lot longer and not produce the kinds of returns that people are expecting, you definitely have a problem with valuation. So that's the key question that I think we're trying to answer.

So far, I think my companies have gotten a pass because they've produced real products and they've shown that they've been able to monetize the spend already. And so for now, I think people have trust in the management teams to manage this appropriately. There's a lot of hand-wringing about what the forward year guide will be on cap ex, but I think when you take a longer term view, it is similar. You have to spend ahead of the innovation, and I don't see the valuations as unreasonable at this point in time. I'd point out that companies like Netflix, which we own in some of our strategies, Uber, DoorDash, Spotify, all owned in one of our strategies—those companies were all profitless just a year or two ago, now all profitable and starting to be included in indexes.

John Canning:
The only other thing I'd add on software, that I should have shared and that Joe's comments made me think of, is in certain cases, the software businesses are having to evolve their monetization mechanism, which is different than what's going on in advertising models, subscription models and consumer or in hardware models where they're selling just better chips, but they're selling chips to the customers: You have historically seen a lot of businesses price their solution on seats. How many employees, how many users are there? We've seen with the advent of cloud, a push towards a more consumptive pricing

model, which has been very well digested for infrastructure use cases, certain kind of data use cases. You can think like a Snowflake where there's a warehouse and there's a real scale component that's not tied to the usage. But as we move into this new paradigm, there's a question of what's the right way to monetize the innovation and the productivity gains that one may see leveraging a generative AI tool. And you've seen some companies lead with a consumption model and realize that actually going with a per user model, but just a higher price because there's more value is the right way to pursue monetization. You've seen other companies start with the per user model and realize that maybe for their particular use case consumption is the most relevant way to go about it. Others have taken the tack that this is not even about direct monetization: it's about better conversion through their product-led growth funnel or something of that sort. So I think that is the other element here that is impacting valuations as people try to get their hands around, okay, what do the numbers look like in the next two, three, four years? You might be in a great competitive position, but if people can't really gravitate to this is what it's going to look like because we're going to deliver this ROI and this is what customers are going to be willing to spend, it's just created, I think, a little bit of a pause as it relates to certainly incremental capital flows and what the finances are going to look like three years out, as John alluded to.

Madison:
Thank you for that perspective. As we think about common questions or themes that come up as it relates to AI advancements, of course monetization and valuation are up there. I would say disruption too. Search—Joe, looking at you—naturally comes to mind as something that could easily be disrupted. Emerging AI-native tools like ChatGPT and Perplexity are gaining traction. So maybe just an example there: You spoke to the monetization that Google and other companies are starting to see, but your perspective on risks would be great.

Joe:
Yeah, yeah, it's a real risk. Up until recently, we didn't even know what ChatGPT was. Google had a relatively unchallenged monopoly, they probably wouldn't use that word, but they had 92% share globally in search, over 95% if you just look at mobile search. So for all intents and purposes, a monopoly in search.

More recently, consumers have begun to sample generative AI platforms, whether that's through Google. Gemini is Google's platform. When you Google search now, a lot of times you get an AI description right at the top, so that's one way, but also, they're going into external platforms, whether that's using ChatGPT or Perplexity is another one that I personally have used and tested. And so there is a risk that the moat is starting to come apart a bit, but I think we have to ask what is searched in the first place and how is it monetized?

So to start, only about 15% of searches are actually new each day. The other 85% of searches have all been asked for before, and so we're not as unique as we might think. A large portion of that search, probably up to a third, is really just people searching, I call it navigational search. People are just trying to get to another website, but they're doing it in their browser bar or they're doing it on Google because that's their landing page and they're just going to places like Amazon, Facebook, Walmart, whatever it is. And that search can be monetized by Google, but it's not the best monetization and it's not the best use case for generative AI because you're just trying to navigate somewhere quickly.

Another big portion of search is what I would call informational. So people are just looking for an answer to a question. It's very transactional. Once they get that answer, they're done. That's about half of search or up to half of search. That's actually a great use case for generative AI. It can get the answer for

you without having to do a whole lot of searching, could sort through a lot of different answers, give you a summary, save you a lot of time in how much you have to read to understand that answer, but it's not really great for search monetization and making money off searches in the way that Google does today. And finally, we get into what I would call the money spot, which is the commercial searches. So people actually looking to buy something or preparing to buy something and doing research, that's probably 15-20% of search today in terms of queries. So that's the real battleground for monetization. And that's the question, is that really a valuable search going to move into other platforms?

And so it really comes down to where the search takes place and who owns that distribution. And Google's had a great moat on distribution. So whether that's through their Chrome browser and Android phones, which are very popular around the world, or whether that's on Apple iPhone with a Safari browser, which currently has a default deal with Google for their search product. That's the real moat for Google is just owning that distribution channel. So I think that's a pretty tight moat still, even though people are sampling generative AI. Obviously there's regulatory cases out there. The DOJ has investigated. Google's going to appeal the results of being classified as a monopoly, and so there'll be many years until we get a resolution there. But in the meantime, consumers are changing their habits, they're deciding where they're going to go to search, and so we're paying close attention to it.

I will say the stocks have overreacted sometimes to the headlines. In Global Leaders, we took advantage of a big sell-off in Alphabet when ChatGPT was announced. There was definitely a huge sell-off. People thought it was over, forgot that Google was actually the original AI researcher. They have a lot of research there. They own DeepMind. They combined that with other parts of Google AI. And so they're still a leader. They have some of the best minds in the world working on this. So we thought that was a great opportunity. Fast-forward to today, the stock seems a little more fully valued. They announced quantum computing advancements with Willow, even though we're probably really far off in commercializing that, but the stock gained a lot on that headline. So we're paying a lot of attention to these headlines in AI, and it is giving us a sense of how the size our positions in some of our funds.

Madison:
I want to come back to quantum computing because a guest asked a question on that, but maybe just while we're talking about risks, John and John, I would love to get your thoughts too. John Bond, I'm looking at you as it relates to some geopolitical risks. Of course, we saw an example of that earlier this year with the export restriction on US chips. So how are you thinking about geopolitical risks within hardware. And John Canning, feel free to opine, as well.

John Bond:
Well, it's something we pay attention to a lot, obviously. And I do think as you think about what the US government has done over the last couple of years in terms of export restrictions, there is a rational basis for that. Particularly as you get to the most advanced AI chips, you can do all sorts of things that were never possible before—so break hard encryption, use them to simulate advanced nuclear bombs or hypersonic weapons, or create new drugs for good or for bad. So I think that there certainly is a reason that we want to understand where they're going and what they're being used for.

That being said, Nvidia can't produce to demand right now. And so there will be a time when Nvidia can produce to demand, but I think the bigger risk would be having broad proliferation of some of these technologies. Let's think back to the most recent ones that came out, I guess it was maybe Friday. We've tiered the world into three categories of countries, friends, sort of friends, and enemies, if you will—where you get full access, partial access, no access. So if the goal is to stop our adversaries from getting

these advanced capabilities, which I think you can have a discussion as to whether that's a good thing or not, and I personally think it's probably a good thing, these restrictions are needed.

The previous regime was fairly restrictive, but I heard a story of a Chinese company building a data center in Malaysia with the most advanced Nvidia chips to do something that was allowed—so all well and good within the rules. Then Nvidia comes out, they send an inspector out by law 30 days after it's built and running, to make sure everything's doing exactly what it's supposed to do. Great. He leaves. They disassemble the entire thing, ship it to China and do who knows what with it.

So when you think about smuggling, it used to be that you think about a guy taking a bunch of Intel chips and taping it to his leg and going through the airport. This is much more on an industrial scale. I think about it all the time. When I think about geopolitical risks, export/import's a big thing. A much bigger geopolitical risk really is China/Taiwan, and I get a lot of questions about that as well. And to be clear, it is a risk, and I think of it more as catastrophe risk, if you will, very low probability outcome, but high risk.

And as we think about valuation, that's something that comes into it for Taiwan Semi and for the companies that buy from them. But I do think that it's a very low probability outcome, and the risk of not owning these companies in the context of this current investment cycle is probably higher than the risk that China will do something. I think the US government recognizes that, as well. If you look at some of the CHIPS act money, that is partially geared towards alleviating that risk. So Taiwan Semi is now building factories in Arizona funded by the US government. Now, in the event that China invades Taiwan, that's not going to completely replace Taiwan Semi for consumers. You will probably not be able to get a new iPhone for a couple of years—not the end of the world—but key buyers in the US DOD supply chain will be able to get what they need, and that's what the US government is doing there.

So all that to say is: It's something that factors into our thinking and I pay a lot of attention to it, but the worst outcomes are pretty low probabilities and we think of them in the context of valuation, not in the context of can we own or can we not own.

Madison:
Before we move on from that, just a question that came in around that same topic, John, around the time required to build out semi fab capacity here in the US. How are we thinking about that?

John Bond:
It takes a long time, and it's difficult. I mean, you've seen Taiwan Semi had a false start on the Arizona fab because they didn't think about the fact that American construction workers are generally in unions. That doesn't exist in Taiwan. You have certain protections for workers that don't exist in Taiwan. So it is a multi-year process. But they fixed it. They got it right. The first chips are rolling off the production line, as we speak, or imminently at a five-nanometer fab in Arizona right now. Samsung is having similar issues for different reasons, but similar reasons as well, but they're building four-nanometer fabs in Texas. Intel has their own issues, but they're going to get it up and running. And then on the other side, Micron for memory—as I discussed memory is a crucial input to AI—they're also going to build that.

So certainly there is a timeline. I think we were in a much worse place 24 months ago, when money was still going out the door. There was still a lot of learning going on from companies that aren't based in the US as to how you actually build in the US. But where we sit today, the capacity is coming online and there's a lot more capacity coming. And from 24 months ago, the pipeline or roadmap for building these

fabs has sped up. So Taiwan Semi used to talk about one giga fab in Arizona at five nanometer. They're already talking about a two-nanometer fab coming online in '28, and then the node beyond that, probably 1.4 nanometers coming online around the end of the decade. So, it's a long timeline, but I think we've done a reasonable job of putting the road in place to get it done.

Madison:
Helpful. Thank you. I'm mindful of time. I want people to continue to ask questions, and we'll of course address them offline if we don't get to them in the remaining minutes that we have today. But Joe and John Canning, I know you both touched on some risks as it relates to your sector. I'll give you some space to elaborate a bit on any other regulatory considerations, environmental risks, anything that you want to touch on. And then maybe we can pivot to a rapid-fire question at the end.

John Canning:
You want to go on antitrust?

Joe:
I think we could spend an hour on antitrust on Google, so I can't do it justice in a minute, but obviously all of my companies are undergoing some kind of regulatory challenge, whether that's privacy in Europe, self-preferencing in Europe. In the US, regulatory scrutiny over monopolistic activity. Google has three separate trials, including their search business, their app store business, and their ad tech stack for their ad tech business. So it's coming from everywhere. These companies gotten really big and people are starting to question how that happened.

Look, these trials are going to take a lot of time. There's going to be appeals; they're probably go all the way up to the Supreme Court in some cases. Maybe under the new administration's DOJ, there's some kind of agreement reached. But ultimately we think these companies will figure it out, and in some cases we're looking backwards. I mean, the search monopoly and some of the regulation on search, will that even matter that much if ultimately the judge does not put any constraints on AI development. We might just move past that in terms of an issue. So we're focused on it, but we know it's going to take a lot of time, and it's something that will play out over multiple years.

Other risks, aside from regulatory: It's just changing technology, right? Regulatory is important, but I think we spend more time on just changing technology. A good example of that is autonomous vehicles. We look at Uber; the business became profitable, generating meaningful free cashflow, taking share globally, and then AVs came around. AVs have been around for a long time, but recently, scrutiny there has accelerated because Waymo's launched in a few cities commercially. They're in Phoenix, Atlanta, Austin, Miami. And then Tesla just had big robotaxi debut where Elon Musk claimed he would be able to create a $30,000 robotaxi in under two years from now. So that's really put some of the risks in the spotlight; we can go into more on that if we have time, but as much as regulatory risk is there and in headlines, I think technology risk is equally important.

John Canning:
I talk a lot about some of the fundamental risks of some of these companies that could happen with the technology transition as well as the opportunities. I think from a stock perspective, we just need to be aware of sentiment and where we are in a potential hype cycle or trough disillusionment as it relates to enterprise adoption. Joe mentioned productive cap ex. Enterprise adoption of these technologies is going to be critical to ensuring that resources that are being put both in the ground and in software

development are realized and in productive manner, and correctness is really important. So we spend a lot of time talking to customers, understanding how they're using the technology, the scale at which they're willing to deploy it, some of the hurdles, whether it be legal or otherwise, and just try to ensure that when there's sentiment that's really positive, but maybe it's going to take longer, we're aware of that on position sizing, as Joe alluded to.

And on the other side, there's companies that are potentially overly penalized by the market that actually have a very clear, articulate strategy and will benefit as the enterprise adoption happens over years, even though the market may want it in quarters in some instances.

Joe:
I'll just point out one other thing on regulation, which is historically when regulators impose some set of restrictions on a group of companies, it tends to benefit the incumbents and the scale players because you need a lot of money and resources to either fight the regulatory environment or to work around it by just developing a different product or changing how you do things. And usually that benefits the scale players. I think one interesting thing that might be different in the Alphabet or Google case around search is they're looking at going directly after their default deal with Apple. The people who have iPhones are actually the highest value users in the world, very wealthy typically compared to the rest of the world, their searches generate a higher revenue stream—and therefore Apple's deal with Google actually accounts for a tremendous amount of that search revenue. So if they were no longer to pay Apple at all, whether it was for default or just as part of a traditional deal in terms of the share that they get, that would be a huge problem for Google's search business. So I think in that case, we're paying a lot of attention to that particular detail, but typically regulatory winds up benefiting the incumbents.

Madison:
Great. Thank you all so much. I'm mindful of time. We do have a handful of questions left, so I'll just pause and let the audience know that we'll follow up with you directly and would love to continue the conversation offline. So maybe to end on more of a positive, just a rapid fire of one thing you're excited to follow throughout 2025; whether it's a company or a secular theme that we touched on today—one innovation that you're really excited about within your respective subsectors.

John Canning:
Blackwell?

John Bond:
Yes—Blackwell. Nvidia has a new platform coming out that's a step function better than the previous one. I was at a data center last week and saw the first one that was ever installed. It's a full rack of compute, it weighs a ton-and-a-half. The guy who was taking us through the data center had to shout to be heard over it because of the cooling fans. So, super interesting to see that roll out. It has been a somewhat choppy rollout. It's such a complicated system that inevitably there are going to be hiccups in making it work, and scaling it up, and connecting them together—but it's a really interesting thing to watch happen.

John Canning:
On the software side, I mentioned correctness—which means some of the back office applications maybe are going to take longer to see this adoption occur; you just can't have those systems having correct data being edited in the system by an agent. But where we are seeing, I think, more willingness to participate in this generative AI innovation from enterprises is in the customer service space. And I'm

excited as a consumer to hopefully have a much better customer experience 12 months from now with a lot of the brands we interact with as these agents get implemented and hopefully what I would call the dumb chatbot experience that we currently experience ends up with a much more productive use of our time.

Joe:
There's a lot of debates in my sector. I think there always will be. I think the hottest debate right now is around autonomous vehicles and what actually happens—fact or fiction—over the next year. Elon Musk has claimed a lot of things in the past. I think in 2015, he said that Tesla cars would achieve full autonomy within three years. Well, that hasn't happened. In 2016, he said Tesla would be able to make a cross country drive without requiring any human intervention, but that didn't happen. In 2019, he said we'd have a million robotaxis on the road in a year or two. Didn't happen. So we'll have to see where the fact or fiction is on AVs, but I think that's the hottest debate, and I'm excited to see what winds up happening there and how that market develops.

Madison:
Amazing. Well, thank you all so much for your time and thank you to our clients and friends of the firm for joining. We really hope you found today's conversation insightful and we look forward to more. Have a great day.