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Insights Series | Semiconductors

Podcast Transcript

Host (intro):
Tune in to the Boston Partners Insights Series, going beyond the headlines with our investment team to provide a deeper perspective on the capital markets.

This edition features a conversation with David Kim, Emerging Markets Portfolio Manager, about the world and inner workings of semiconductors, their broad reach, and what we consider as an investor and active manager. Listen to the podcast below.

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Chris Villalba Investor Relations:	Welcome to Boston Partners Insights, going beyond the headlines with our investment team to provide a deeper perspective on the capital markets. I'm Chris Villalba from Boston Partners Investor Relations Team. On this episode, we dive into the world and inner workings of semiconductors.
Voice Over:	*By producing revolutionary new semiconductors such as transistors, this remarkable new science has helped make micro miniaturization possible.*
Chris Villalba:	It's amazing how something so small can have such a large impact on almost everything in our day to day lives. From the cell phones in our hands to the cars we drive and even the appliances we have in our homes, name the device, chances are it runs on a tiny semiconductor chip. These semiconductors, also commonly known as chips for short, are a foundational technology of our time. Some would go as far as to describe semiconductor manufacturing as the steel industry of the modern age and the impact of this technology has been causing political waves since as far back as the late 1980s during the Reagan administration, decades before the electrified world we live in today.
Voice Over:	*Inexpensive microchips that keep track of maintenance needs and enable engines to run better on less fuel.*
Chris Villalba:	In 2020, we saw much of the world locked down due to the Covid-19 pandemic and with that, this vital industry experienced crucial interruptions. So, a side effect of the pandemic was a global shortage of semiconductors. In turn, that chip shortage impacted many sectors, none more so than the American auto industry, with the consequences broadly felt across the U.S. economy, supply chains of products that relied on semiconductors were stalled. Concerns about how critical and far reaching the shortage might be rose to the upper levels of the U.S. government. Investment into the semiconductor industry has even been included in the latest infrastructure bill.

Voice Over:	*As you know, the President has called for Congress to appropriate at least 50 billion dollars to strengthen semiconductor manufacturing here in the United States.*
Chris Villalba:	Needless to say, there is a lot to talk about and to help us unpack all of this, I am joined by David Kim. David Kim is co-portfolio manager on Boston Partners Emerging Market Strategies and has deep knowledge of the semiconductor industry, its broad reach and what to consider as an investor and active manager. David Kim, welcome to Insights and thank you for joining us today.
David Kim Emerging Markets Portfolio Manager:	Thanks for having me today.
Chris Villalba:	Let's dive right in and start with where we are right now. We're recording this on June 22nd. What's happening in this sector today?
David Kim:	You know, I think I'd really break it down into two trends that are just coincidentally happening at the same time. One is the shortages that we've been seeing in the auto industry most visibly, but also really across broader global economy. And then there's a second issue that we're seeing also in the news about the geopolitical ramifications of so much of our critical semiconductor supply chain being based near China, specifically in Taiwan. I think both these topics are very important, very influential, but really are just two almost completely separate topics that happened to be happening at the same time.
Chris Villalba:	Maybe we should step back and talk about how we got to this point and spend a little bit of time on the past history of semiconductors. And maybe you can give our listeners thoughts on the geopolitical nature of it as well.
David Kim:	Yeah, if we think about the history of the semiconductor industry, you know, we start seeing the invention of these semiconductor chips in the middle of 20th century, 1950s around there. And for the first 20, 30 years, all the way until the 1980s, these chips are really designed and built inside the same company. What I mean by that is the same company, say, like Intel or AMD (Advanced Micro Devices), what design, what a chip circuitry would look like and also own the factory that's actually printing and manufacturing these chips. Around the 80s you start seeing a shift that's really been the start of a 40-year trend, which is an increasing share of outsourcing of the semiconductor industry and these outsourced manufacturing companies. A prime example of this would be TSMC (Taiwan Semiconductor), GlobalFoundries or UMC (United Microelectronics). These companies don't do any of the design and instead take their customers chip designs and manufacture them within their own factories. Every year, the share shift has been in one direction, increasing outsourcing. And the reason for that is the nature of outsourced manufacturing is a business where scale begets scale. In other words, the more business you have, the better you become at manufacturing the better you are at manufacturing and the more business you get. So, it becomes a virtuous cycle where the outsourced manufacturers slowly gain a technological edge to the integrated manufacturers that are manufacturing their own chip to the point where if you look today, in the last just few years, TSMC, the leading global chip manufacturer, has surpassed Intel, kind of the U.S. champion or really the global champion for the longest time in terms of their manufacturing capabilities. Now, it's really TSMC has become the undisputed champion of global manufacturing, of semiconductors.

Chris Villalba:	Just for our listeners, TSMC. Can you just say what that is for those who may not know what TSMC is?
David Kim:	Sure, so it's the Taiwan Semiconductor Manufacturing Company. They're based in Taiwan, as their name would imply. They started in the 1980s and what they do is they take chip designs from the leading chip designers in the world. These are household names like Nvidia, AMD [Advanced Micro Devices], Broadcom and Qualcomm. They take the designs that their internal engineers have worked on and in their large factories in Taiwan, they're printing these designs onto almost always silicon wafers today. So, you get a flat, what's called a raw silicon wafer that has no designs on it, and they're literally carving out a chip circuitry based on the specifications of their customers.
Chris Villalba:	How are these semiconductors utilized today in industries?
David Kim:	Yeah, and one of the, you know, this is a great question because one of the big trends that's happened over the last few decades is the computerization of essentially everything. If we think about where computers were 20, 30 years ago, they were discrete items that may exist in your computer lab or in a large research facility. You started seeing personal computers in the 1990s and early 2000s grow where now everyone had a computer in their household in the form of a desktop or notebook PC. And in the last decade or two, that shifted to essentially everything around us becoming a small minicomputer. It's not just the most obvious computers like your notebook PCs, but things like your washing machine, your microwave, your blender, your toaster, your car, your television. All of these have a small what is essentially a computer inside of them. If you have a washing machine that has a feature that says, you know, start not right now when I press a start button, but five hours from now when I'm outside of the house so it's not too noisy. We have a TV that doesn't just show the channels but can also load Netflix or Hulu, can show you what your past favorites were and make recommendations. That's a small computer inside the television that is running the data and making those computations. So, what's happened is this massive proliferation of computers where essentially everything that even has the smallest amount of intelligent capabilities, is essentially a small computer.
Chris Villalba:	You've laid out a lot of interesting things about Taiwan Semiconductor and how they're the leading-edge technology manufacturer for the semiconductor industry. What implications does that have on the U.S. / China geopolitical environment that we're experiencing right now?
David Kim:	That's the most significant part of this current situation that the U.S. finds itself in. As I mentioned, TSMC has become the undisputed global leader and manufacturing the leading edge technology. We're talking about somewhere between 90 to 100 percent of what's called leading edge technology in the semiconductor manufacturing space. The problem for the U.S. is that TSMC has all their most advanced fabs (fabrication) in Taiwan. Taiwan is not only very near mainland China, China actually still considers Taiwan as a part of their country. So, everything that relies on TSMC's latest technology is dependent on China allowing essentially on a longer-term basis, say these exports, and without using force to prevent those experts from reaching the U.S. Now, currently, obviously, Taiwan does not look to China for permission on exporting these. But if something were to break out, it'd be very difficult for the U.S. to defend that manufacturing capabilities. The most obvious area where this is the biggest concern is U.S. military technology.

David Kim (con't):	If you actually look at the very first orders of semiconductors going back to the 50s, the first 100 chips that are coming out of some of the earliest fabs, they're actually going through U.S. military. And that's the same situation today. If you look at the most advanced U.S. technology today, you know, you're thinking about the latest generation fighter jets or the next generation of fighter jets. It's the guidance systems. All of these are relying on the leading edge of technology and that's really only coming out of one factory. And that factory happens to be very close to China and that is the major concern of the U.S. and that we found ourselves in.
Chris Villalba:	So, Taiwan is so far ahead because of their highly skilled labor as well as they have built these processes around keeping their factories ultra clean and making sure that they are experts at this manufacturing process.
David Kim:	Right. So, this manufacturing process is quite different from really anything else. The way a chip is manufactured today, given how narrow and small these circuitries are, is that it's literally carved out with light and we've come to the point where not only can we not use anything broader than a light wave, the light waves that we used to use even just a few years ago, even that became too small. Literally, the width of a circuit design inside a chip was smaller than the size of a light wave on the red spectrum. So, they went to ultraviolet and at a certain point, even that became too big. An ultraviolet light wave was too big, so now they're on what they call extreme ultraviolet waves. Now, only the very few companies that are in the leading, leading edge of the world are harnessing this technology. But, you know, that's what we're talking about. That's how we are manufacturing these chips. And the way they do it is they have a chip design that's carved out of a mask, they float that mask above a lens. They shoot these ultraviolet lasers through the mask, which shoots through the design of the chip, hit the lens and the lens focuses that onto a tiny, tiny part of a raw silicon wafer and they essentially burn out what they want the circuit design to look like. They do this for months, just, you know, laser shooting through a mask, burning off a chip design. And it's just done slowly, slowly, slowly, layer by layer. And not only are there very few companies who can even achieve this kind of technology, then you think about yield. And what I mean by that is if you even get one small speck of dust that lands on this chip, that area of the chip is ruined. So, you have to throw that part out. The more complicated the chip, the larger the chip design, more area that dust can fall on and you have to throw out the entire chip. So, if you look at the companies that are doing this and how they're manufacturing this, if you get over the hurdle of actually being able to harness this technology, then you need to have a workforce that's so precise that you can actually manufacture these chips without flaws. And, you know, this is just hurdle after hurdle. If you look at TSMC and who they're hiring for their factories, they're hiring people out of the Taiwanese military because they have the skills, which is following orders consistently to perfection and that's what's required inside of a chip factory.
Chris Villalba:	So how can the U.S. regain the leadership? It's not like you just go out and build a factory overnight and start producing these chips, I imagine there's a lot more involved in creating something so small and so complex.

David Kim:	You know, I think that's a great point and the trend over the last 40 years has been these outsourced manufacturers, as are called foundries, slowly gaining share and gaining ground on this technological edge until they've actually surpassed the leading integrated manufacturer, which was Intel until recently. And that has never gone the other way as far as I'm aware, there has never really been a situation where the leading outsource manufacturer, started losing ground to the integrated manufacturer. So now that the leading outsource manufacture happens to be TSMC right next to China, the question is, can the U.S. create a foundry inside the U.S. physically that can be at par with TSMC? And I think that's a big question. You know, if you look at the leading players after TSMC, it'd be Samsung in Korea and Intel in the U.S. Intel has really struggled in the last five years and that gap has really only widened even in their latest plan that Intel is putting out. They are only really targeting, reaching back to parity, not surpassing TSMC and there are major concerns about whether Intel can ever even regain parity with TSMC, you know, reversing this multi decade trend that's been really going on in one direction.
Chris Villalba:	One more question on the geopolitics. We know the U.S. government does seem to understand the chip issue, but given the partisan gridlock on Capitol Hill, what are your thoughts on whether something will actually get done and will it be sustainable?
David Kim:	You know, I never want to bet on Washington, D.C. working, but this may be one of the few areas where both sides can come together. There's obviously enormous pressure from all across the U.S. economy, whether you are running the auto plant or your worker that's been furloughed from the auto plant because they can't get access to chips. This is a critical part of our economy today not only that, if you think about the geopolitical issue, the threat of China has been something that's also become a much more of a bipartisan issue. When we look at how China has been acting in the tech landscape, if you look at the actions that Congress has taken on, for example, 5G [5th generation mobile network], there seems to be wide bipartisan agreement that this is an area where there is significant geopolitical risk in terms of the global telecommunication industry. Now, that being said, [Washington] D.C. may be willing and then there's the question of are they able? The shortage issue, I think they're potentially able to fix. That's a question of expanding capacity, ideally in the U.S. The technological gap that they have behind TSMC, now, that may be a much harder problem to fix. Even with bipartisan consensus, it just may be a bridge too far just coming down to science.
Chris Villalba:	Shifting gears, let's focus on the current chip shortage. Is it a onetime shock to the system due to Covid-19, or was this more structural issue?
David Kim:	Yeah, I think that's a great question and it's a question that the investment community is split on. I tend to favor the side that it's a structural longer term issue that we're going to be dealing with for the next decade. The reason I think so, can be really explained by if we look back on the development of the semiconductor industry to this point, the consistent trend within the semiconductor industry is that chips have been getting smaller and smaller and smaller and the real driving force behind this is that the transistor, which is the smallest piece within a chip, the smaller you can get that single transistors down, the smaller the overall chip can be. And there are big benefits to this. It makes the overall chips smaller, obviously, but it actually also improves your battery life by improving power consumption it makes the chip faster and it makes a chip cheaper.

David Kim (con't):	So until now, we think about the consumer technology that's really driven semiconductors in the last call it 20 years, smartphones and notebook PCs, those features that I mentioned, being cheaper, smaller, longer battery life and faster are huge drivers. Consumers want that in their technology. So, the companies that have been able to come up with the smallest transistor technology have been the share gainers and winners. So, people have spent a lot of money on research and development, as well as capital equipment to get that transistor down as small as possible. What typically happens at one of these foundry factories is that you come up with the latest technology, the smallest transistor node you can manufacture, and you start manufacturing all what your customers want on those latest technologies. And now all the smartphones and notebook PCs are being printed on that note. Now, the problem with this is that whatever investments you've made in the capital equipment two years ago, the demand drops off a cliff because nobody wants to buy a smartphone that's been built with two year old, four year old technology. So, you have all this excess capacity in these what's called legacy nodes and these legacy transistor nodes. Fast forward to the present, there has been a slow but steady shift more recently, say, the last four or five years or so of what is driving incremental technological demand and that's been the hot buzzwords that I'm sure you've heard about in terms of IoT [the internet of things] industrial tech, sensor technology, EVs [electric vehicles], autonomous driving--
Chris Villalba:	Pretty much everything
David Kim:	Pretty much--yeah, pretty much everything that's been the hot buzz words in the last few years. You know, those actually, you're looking at different needs in those chips. On a smartphone, the semiconductor chips are a big part of the total cost of a smartphone. In an autonomous vehicle or a normal vehicle that has some smart features, the chips are actually a very small percentage of the cost of the whole automobile. So, you're not as concerned about costs either. So, all these drivers have shifted in terms of what are customers looking for in their chips from the latest technology. And if you look at the shortages today of who is really having a hard time printing their chips, it's not actually the leading technology that's been coming out in the last two to three years. It's these equipment and factories that have been around for a decade plus potentially that has not really had the demand to fill capacity and suddenly now they're at capacity and that's become the issue.
Chris Villalba:	Realistically, how can or should the United States become less reliant on these foreign suppliers?
David Kim:	So, the shortage issue is going to be a different solution from the geopolitical issue. And I would argue it's actually a little easier. The geopolitical issue is the tough problem of can you even come up with a technology that we don't have today? The shortage issue is more of a profitability issue. The reason why we haven't added more capacity for these decade plus old technologies, is because for the longest time, it just wasn't profitable to build a factory that's doing the technology from 2005, 2010 and from 2005, it was profitable and then every year after that, there was an incremental demand, really. So if you have subsidies in this space, if you really think this is a critical area for your broader initiative to succeed, then you can buy new equipment to start manufacturing this technology. This technology is far more commonly available than the leading edge that TSMC has. This is a problem that can potentially be fixed with funding or just the market sorting itself out just by buying equipment that hasn't been bought in over a decade.
Chris Villalba:	And the process to make these chips is also less specialized than cutting edge technology that a Taiwan Semi is coming out with. Is that fair to say?

David Kim:	Absolutely. The things that TSMC are doing at the leading edge borders on what sounds like science fiction, we're talking about transistors that are one one thousandth the size of a human hair with each transistor, you're counting literally the number of electrons in that transistor going down into less than twenty electrons per transistor you're really talking about incredible, incredible technology. Those might be, say, five or seven or ten nanometers. . The shortage right now is actually nanometers that are 65 nanometer, 90 nanometer or even older. So, you're talking about ten times as large. That technology is a lot easier to come by. The equipment to build those is more commonly available and if you wanted to start a new foundry, it's a lot more realistic solution it's really just more about can you profitably do it? Or I guess do you care about doing it profitably.
Chris Villalba:	Does the government want to subsidize it? So, what does the production of a larger node versus the smallest nanometer look like? Can you give us a sense of what that process looks like?
David Kim:	Sure. If we wanted to add capacity today at the legacy node, you're still talking about a matter of months. The tough part is that whatever factory had all these node manufacturing capabilities in 2010 and had been underutilized, that's spread all over the world. You know, there's actually a long tail of small factories that are not manufacturing at their full capacity. So, bringing back those online, you know, you can do that pretty quickly, especially if you have something that's just, say, 50% utilization, could bring it back to a 100% or a line that's been lying fallow. You turn that back on and even to start a single—to print a single chip, you're talking about potentially a matter of months. But that's very different from trying to get additional capacity at a five nanometer or seven nanometer chip. You know, that you're talking about in a matter of years, not a matter of months.
Chris Villalba:	But it is possible to put a foundry on U.S. soil that could produce these legacy nodes more easily than it would be to create the leading-edge tech[nology]?
David Kim:	Yes. And, you know, there is a fab that's being built by TSMC in the U.S. that's been planned between the essentially the U.S. government and TSMC. Now, some of the concerns have been that TSMC is not building their latest and greatest technology in the U.S. that's still being reserved for within Taiwan. So that's not going to solve our geopolitical issue, but it should solve our shortage issue if they are willing to commit incremental investments and do it in the U.S. Really, whether they do it in the U.S. or anywhere in the world, as long as they're willing to add capacity, that should help out with a lot of this shortage issue that is really what's been hurting the auto sectors and all the other shortages that you're seeing.
Chris Villalba:	That brings us to investment. I mean, after all, you are a bottom-up fundamental investor and from that standpoint, how should one think about a potential investment in the semiconductor industry?
David Kim:	Yes. So, to play these two different trends that we're talking about, the geopolitical issue and the shortage issue, I think there are different answers there. So maybe starting with the shortage issue, you know, the semiconductor industry really has been, for the longest time, a very cyclical industry. Capacity is built, there's excess capacity, demand slowly fills to catch up to it and eventually that capacity is filled. There's a shortage and then there's more capacity that's come online and you go back and forth between a surplus and a lack of capacity.

David Kim (con't):	Currently, we are clearly at a very tight capacity situation where there's just not enough capacity at these legacy nodes. I think in the very near term, it's much likely, in my opinion, to get worse rather than better in terms of this shortage. We are, you know, about as tight as it can be on capacity and we, historically, and I believe going forward, we are going to see this alleviation of this capacity shortage. I think the disagreement, I think in the industry is, is this a long-term problem or a short term problem? I think that despite a potentially worsening in the short term for these foundries, I think in the long term, the outlook is good. When I think about where's the next 10, 20 years of technology demand coming from, I think that's going to continue to be from sensors, industrial, auto and things like that, rather than smartphones and notebooks. So that would indicate that these eight-inch legacy foundries should continue to see demand. On the geopolitical side, I think the question really is, can anyone catch up to TSMC. Is TSMC's lead going to persist over time. Or are the investments from the U.S. government or subsidies going to be enough to help a U.S. champion be able to regain parity or actually surpass TSMC. Again, here, I think that the historical trend will continue. I think TSMC lead should be maintainable in the foreseeable future. I don't see anyone being able to catch back up to them anytime soon. So the outlook for them, I think looks great.
Chris Villalba:	Thinking about it from gaining exposure to if you wanted to put these names into your portfolio, let's just say, are you taking on more risk by going direct with the foundry or maybe even, let's say, a designer? Or do you want to get exposure indirectly through the chip buyers or somewhere along the supply chain?
David Kim:	We think about the industry in two segments. One, the companies that are manufacturing the chips, so the foundries, TSMC, Vanguard versus, say, the chip designers or what's called fabulous in the industry. The fabulous companies, I think in the long term will survive regardless of who wins. They're going to find someone to manufacture the chips. And the companies who should win over time are companies that have the designs that are faster growing areas, the AI chips, the IoT chips and things like that. You know, auto, autofocus chips within that space. I think the chip designers that are focused on the fastest growing sector should be the winners over time. On the foundry side, I think it looks a little different. For a very long period, there have been a fairly negative sentiment around the companies that couldn't, quote unquote, keep up in the technological progress of foundry technology, UMC [United Microelectronics] being a great example. For a while, they had been trying to consistently move down the no transitions, along with the rest of the industry, trying to invest into R&D [research & development], buy the latest equipment. It just became more and more expensive; they fell further and further behind and until they finally threw in the towel and said, look, we're just going to stick to our legacy nodes and we're just going to milk these for all they're worth. And that's kind of how the industry viewed them, that they're a long term decaying asset. That mindset has changed in a good part of the investor base as well as mine, in that these companies should be able to actually be positioned very well for the next 10, 20 years of tech demand. That's coming right where their sweet spot is.
Chris Villalba:	What about valuations? How do those look across those sub industries and the buyers of the chips? I have to imagine some of them are trading at pretty high multiples at this point, given that there is a shortage.

David Kim:	Yeah. So, you know, the foundries, especially the eight-inch foundries, given that they've been able to pass through fairly significant price hikes onto their customers, have really skyrocketed in terms of valuation over the last 12 months or so. I think currently those are at peak multiples. Historically, there was a misunderstanding of the market in terms of where those companies should trade. Given that, are they companies that are riding a declining demand trend? Now, it seems that that's not the case, that they're actually companies that are manufacturing that, something that should be continued to grow over time. So, there should be a permanent rerate aside from this cyclical trade up in terms of valuation. I don't think this is the right time to get into those names, given what I expect to be near term MO [momentum]. But when I think about when the cycle shifts to the other side and where we're at troughs, I would expect this industry, a foundry, should trough at a higher level than they have in the past, given the long-term demand outlook in this space. In terms of the chip designers, the fabulous companies, many subsectors of those have been able to pass along price increases that are even greater than what they're getting from their foundry manufacturing partners. I don't think that would last either. A lot of these chips, again, are not the latest and greatest technology in terms semiconductors. They're quite old technologies that they're able to just pass along higher price increase because of the shortage. I think current valuations won't last. I think those companies actually, the downturn is going to be a lot more long term, especially, you know, if you look at, for example, some of the chips that are used in television display or notebook display, those are fairly commoditized chips that are manufactured by many different companies that have seen margin compression over time. They're really just taking advantage of what should be a near-term short-term gain in terms of shortage in order to pass along the higher prices and gain pretty big margins.
Chris Villalba:	I'm going to leave you with one last question. Where do you see this industry in the next 5 to 10 years?
David Kim:	I think TSMC continues to gain share. You know, they just announced a one hundred-billion-dollar CapEx [capital expenditure] plan over the next three years. They represent close to a quarter of all CapEx in the semiconductor industry. Just give you a sense of how large that is. TSMC is a company that's fairly prudent, in my opinion, on their CapEx plans and what I mean by that is they spend when they have a fairly high conviction and fairly high visibility on what the demand is going to be. So, for them to put out such an aggressive plan, I think shows that there actually is a very good runway for growth for them. So, I think TSMC should continue to gain share in the industry and widen into their lead over their competitors. I think the shift in industry is what happens to these eight-inch foundries. Sure, in the next year or two, we're going to see a correction in terms of the eight-inch foundries. But I think we're at a turning point in that sector where we're at the beginning of a long-term growth period for that sector, where we're going to see increased demand for their manufacturing and they're going to, you know, potentially start to add capacity in that space by even ordering new equipment for technology that came out over a decade ago, which is something we really haven't seen.
Chris Villalba:	Interesting, certainly a lot to keep track of. David, thank you for joining me on Insights this time and thank you all for joining us. For more investment perspectives, check out our website at www.bosoton-partners.com. We look forward to having you back for future shows, including our next episode, A Deep Dive into ESG, hosted by our director of Investor Relations, Paul Heathwood, and featuring Bill Butterly, our Head of Sustainability and Engagement. For now, I'm Chris Villalba. See you next time with more at Boston Partners Insights.

Christopher Villalba
Investor Relations

Mr. Villalba is a member of the Investor Relations team at Boston Partners and joined the firm in 2010. In this capacity, his responsibilities include sales and relationship management of Boston Partners products within financial intermediary channels. Prior to joining the firm, Mr. Villalba was a regional private banker with Wells Fargo Bank, N.A. Before that, Mr. Villalba held the role of investment associate at Morgan Stanley in the firm's Global Wealth Management division. He holds a B.B.A. degree in finance from Pace University and FINRA licenses series 7, 66, and 3. Mr. Villalba has fourteen years of industry-related experience.

David Kim
Co-Portfolio Manager

Mr. Kim is a co-portfolio manager for Boston Partners Emerging Markets strategies, including Boston Partners Emerging Markets Equity and Emerging Markets Dynamic Equity. Prior to this role, he was an emerging markets industry analyst with Boston Partners specializing in fundamental research of stocks held in our Emerging Markets Equity portfolios. Mr. Kim was previously at Great Hill Partners, where he was a private equity associate focused on technology companies. Mr. Kim holds a B.A. degree in economics from Amherst College, as well as an M.B.A. degree from Harvard Business School. He has six years of investment experience.

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