

Peterson Institute for International Economics

The US-China AI race

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[00:00:17.10] - Anjali V. Bhatt

Hi and welcome to PIIE Insider Live. I'm Anjali Bhatt, Communications Manager and Research Fellow here at the Peterson Institute for International Economics. I often say that one of the best parts of my job is that I can just walk into the office of some of the world's top economics experts and just I ask them questions and they answer. So with PIIE Insider Live, you're coming with me to ask those questions and get those answers that you won't hear anywhere else. Today we're speaking with Martin Chorzempa, a senior fellow here at PIIE. Before we start, if you're watching on Zoom, feel free to put your questions in the Q&A box and try to get them in early before the end so we can, we can get to them on time. So, hi Martin, thanks for joining us.

[00:00:54.19] - Martin Chorzempa

Thanks for having me.

[00:00:55.17] - Anjali V. Bhatt

Okay, so we've been seeing this incredible investment in AI in the past sort of year or so. We just saw yesterday Nvidia blew past even their, their profit expectations. So things are certainly happening in this field. What is all of that investment racing towards both here and in China? Is it, is it to make better AI models? Is it to get more people to use existing models? What is that money going for?

[00:01:27.10] - Martin Chorzempa

Well, you know, first of all, the scale of investment is just extraordinary. And you can see it in that, you know, essentially any chip Nvidia makes, they can sell immediately and prices are rocketing up for, for chips all around. And, and the reason for that is because there's a lot of economic value that's being created already. So one of the things that I'm asked pretty regularly is, is this all a bubble? You know, what's all this for? Is it vaporware? This kind of thing. If you use the most advanced models, you can see they could stop progressing today and not get any

better, and it would already have this immense scale of possible applications throughout the economy. So initially, this buildout of computing power was really focused on training, which is essentially you get like the whole internet of data and then you put it into this gigantic kind of like a regression, like linear algebra, like many, you know, way more dimensional kind of thing. And you just come up with these weights, which is like a bunch of coefficients in a, in an equation. You're like, that just sounds like regular math, right?

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But somehow there's this emergent property that if you put enough computing power and enough smarts in how you analyze it and put it together, these models can figure out a lot of things. And we went from, you know, can you write a limerick in a paragraph, to now potentially having the ability to do hours of coding on its own. But then at the end of last year and beginning of this year, there was a new paradigm which I called reasoning models. And that includes DeepSeq, it includes OpenAI had these models, O1, O3, and now, you know, many of the models people use are thinking models. What they figured out is that if you give a human a task and you have them come out with an answer right away, it's not going to be as good as if they have some time to think about it, consult the internet, read some things, put it all together, and then come back to you with a summary. The computing power that's used to actually give you a response, which is called inference, where actually your query goes into the model and it figures out how to handle that, that's using a lot more computing.

[00:03:32.29]

It turns out the same model gives you something that's way better if it has more time to think. A lot of the data centers that are being built actually around the world now are being designed not just to train models but to serve them to you in a better way. Very few people are actually using reasoning models as of now. I personally think that once people realize how much better they are, a lot more people are going to be willing to pay \$20 a month to get access to this and are going to be using that. That then creates this immense demand for additional compute even if you're not training new models.

[00:04:08.16] - Anjali V. Bhatt

So a lot of this investment, the data centers, all of the money we're seeing to go into this. So this is about compute and compute power. What is that? Those are semiconductors that it's all built on. So is more computing, having more computing power, is that having more semiconductor chips? Is it having better semiconductor chips? Is it sort of all of the above? What does getting better, having more compute power mean?

[00:04:36.06] - Martin Chorzempa

So the answer is yes. So the chips are getting way better. At an incredibly rapid pace. That includes both graphics processing units and also the memory. Memory in particular is really important because these models are getting very large. You know, they're huge. And to be able to actually run the model, you need a lot of memory. And this is where Korean firms in particular thrive, but also a US firm, Micron. But most of it is from Korean firms. And what's happening is a few years ago, you were talking in the tens of thousands of GPUs. That would be which are which, the graphic processing unit. So the thing is, this was mainly used up until recently for games where, you know, you take lines of code and you can generate a world with it. But it turns out that that's really good at doing a lot of computing in parallel all next to each other. And that's exactly the kind of computing you need for training models. But there are also different, uh, different models. So Gemini 3, the latest Google model, is trained on TPUs, tensor processing units, uh, which are a whole different way of, uh, of organizing it.

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So there's not just one way to do this, but the scale of, uh, of number of chips that are in the data centers that produce the most frontier models today are just rocketing up. So Elon and the Colossus, uh, cluster is now— has blown past 100,000. And, you know, now people are talking about million GPUs, and we're talking about data centers that are so large that they need their own power plant, effectively like gas, natural gas turbines, because the U.S. grid can't handle the, uh, the interconnection there. As a basic rule of thumb, the estimate is it takes about 4 times more compute every year to train a frontier model, uh, or that's gone up over the last few years.

[00:06:29.16] - Anjali V. Bhatt

And do you think it will continue to be about fourfold every, every year?

[00:06:33.24] - Martin Chorzempa

Uh, it's really hard to say. I mean, there are interesting things like Moore's Law is something that's talked about a lot that lasted a long time, which is, you know, essentially like over a period of short period of time, you get a kind of doubling or so in the amount of transistors on, on the chip. Uh, there are kind of different ways to frame it, but one of the things is it— the reason it has continued is not because of some rules of physics. It's more like people took it in the, in the industry, internalized it, and said, okay, this is our goal, and they've managed to keep, uh, to keep hitting it. In this case, there are all these predictions about, you know, is scaling, as they

call it, going to hit a wall? Is it, you know, usually you can't just keep throwing more data throwing data at a prediction problem and just having it get better. But so far, that kind of thing has continued. There's also been a lot of computing power used in what's called reinforcement learning. Instead of just throwing the internet at it and see what comes out, they also look at, okay, what's working and what's not, and then they give the model feedback.

[00:07:31.14]

They can generate synthetic data and have it learn math problems based on huge datasets of math problems that it generates, that kind of thing. It's just a really dynamic space and it's very early. So nothing is really hard set in stone law at this point.

[00:07:47.18] - Anjali V. Bhatt

So in this very dynamic industry, there are some really important players that do different things. We've mentioned NVIDIA, you mentioned Google, there are some Korean firms. What are— we all know of TSMC, the Taiwan Semiconductor Manufacturing Company, Corporation?

[00:08:05.00] - Martin Chorzempa

I think it's Corporation.

[00:08:05.23] - Anjali V. Bhatt

Corporation. What is that ecosystem like? I mean, and TSMC makes the actual physical little chips. Where does NVIDIA fall in that? Where does Intel fall in that? What is— what are the companies involved here? Google does things. Hot take, they do things. What does that ecosystem look like?

[00:08:26.14] - Martin Chorzempa

It's an amazing, incredibly complex supply chain. But just to simplify it for you. So like NVIDIA doesn't make any chips, they design. There are companies called EDA tool, electronic design automation. And they, uh, they create the software that people use to, uh, to design chips. So Nvidia will probably, I think, use one of those, like, 3 largely US firms that dominate there. And that's like, it sounds like, oh, just software, pretty basic, but it's like software that incorporates the laws of physics because you don't want to design a chip that doesn't work. And so it has to include, like, you know, the materials and all this stuff. It's, it's amazing how difficult these things are. So there are like kind of the people who make the environment, uh, and then the chip designers. And Apple Apple, for example, designs its own chips. Google designs its own chips,

and many other companies are looking at designing their own chips too. So it's both competitive and in some cases incredibly concentrated, because to be at the cutting edge, which continues to move fast every year, you, it takes an enormous amount of investment. And then generally, so previously, you know, a firm like Intel was dominant, including many steps of this process.

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So they would design and produce their own chips, but now it's separated. So they call them fabless companies. They don't have a fab. So they send their designs. So Apple or, um, Apple or Nvidia will send their designs to TSMC, which doesn't compete with them, right? Because they don't make any chips themselves that they design. So they take your design and they'll make it as best they can. And interestingly, TSMC is kind of focused in logic chips. So when you get this GPU from Nvidia and, you know, the whole rack and the server, there are many different kind of fractal layers of, uh, of understanding this. Uh, there are Korean companies that are separate from TSMC, which are making the memory.. And then that has to get all get packaged together. So the memory and the GPU, and maybe there's a central processing unit altogether that then gets put onto, you know, a board and then packed and packaged together and then put into a rack, which then goes into a data center. And then of course there is a whole layer of companies that, that TSMC relies on to, with the super advanced equipment that then, you know, tests, make sure the chips are coming out right and actually etches or, you know, does deposition and other kind of steps to make the chips, which is thousands of steps.

[00:10:52.28] - Anjali V. Bhatt

Yeah, I mean, I feel like the semiconductor supply chain and industry is just one of the most complicated things that we have done.

[00:11:01.25] - Martin Chorzempa

Yeah.

[00:11:02.09] - Anjali V. Bhatt

And given that the complexity of that supply chain and the importance of semiconductors in all of this. So we know now that the US has export controls on advanced semiconductors.

[00:11:17.07] - Martin Chorzempa

Yeah.

[00:11:18.13] - Anjali V. Bhatt

And as I think, as you've said before, that's largely about constraining China's compute capacity so that in the US we can have as much compute power and capacity as we can while limiting China's ability to do that. So what do these export controls, especially because a lot of these chips are not made in the US, what are these export controls? How does the US get to decide to control who gets these chips?

[00:11:44.17] - Martin Chorzempa

Yeah, it's, it's a really interesting story and like one of the most important maybe in the world, uh, economy going on right now. So the US, uh, had put controls on Huawei and ZTE and other companies before, but this really starts in October of 2022, which is the month before, uh, OpenAI releases ChatGPT and launches this wave. So the US comes out with this rule that says, uh, No one in China can buy the best chips for training AI. And this is justified explicitly in the rules as saying we don't want China doing advanced nuclear and hypersonic missile. It's all about military modernization. But then when you see how it's actually discussed later on, it's pretty clear that AI, not just for military, but, you know, the whole idea of kind of competing national systems and as a strategy that this becomes core. And as you say, we discovered with the initial Huawei controls— when I say— I don't say we, I wasn't involved in them. But the US discovered when it put the Huawei controls on, uh, back in the end of the first Trump administration, that actually not many of these chips were made in the US.

[00:12:54.02]

But pretty much every chip in the world today, at least all the advanced ones, are made with, you know, one of these 3 design tool companies that are design software companies from the US, or 3 of the top 5 equipment companies that make the, you know, the equipment that makes the chips in the TSMC fab are American, and there is no way to just swap those out for a foreign equivalent. And in addition, we found out that, you know, say a company in Japan or the Netherlands that makes— that round out the other 2 of those 5, they have a lot of chips inside their equipment that are in turn made with American equipment. So like the US has kind of closed off every possible way to say, You know, you have no jurisdiction over my chips. And so they created this thing. Well, it already existed, but they applied this thing called the Foreign Direct Product Rule, which says, you know, if you're doing something off a US blueprint or using US manufacturing in your facility, we're going to claim that we can do that. And it's kind of like seed companies which say, you know, the seeds that come from what we sold you, we continue to own that because we, we, we designed that.

[00:14:07.10]

And it's so it's an extraterritorial control which says TSMC in Taiwan or Samsung in, in Korea can't sell a certain chip somewhere else.

[00:14:19.01] - Anjali V. Bhatt

And of course, because it was made with American designs.

[00:14:22.07] - Martin Chorzempa

Exactly. And so they could say, hey, America, you know, get out of my business. I— this chip is not American. What do you have? And then, of course, the US response would be, okay, you don't get any more equipment. So for everyone so far, the deal has been, other than Chinese companies, obviously, it's made sense to comply with the US regulation.

[00:14:44.01] - Anjali V. Bhatt

So through the Foreign Direct Product Rule, this means that, that TSMC and other companies can't sell any of these advanced chips to China for ostensibly, I guess, first military applications. But now we know that it's largely about constraining their AI ability on these advanced chips. So now that China can't buy these advanced chips, they do still have an AI ecosystem. What does, what does this mean if they, if they can't access these advanced chips? What does that mean for their AI systems?

[00:15:19.04] - Martin Chorzempa

So obviously, if you control something and say you can't buy this and it's something of critical strategic importance, I want to say there is a clear link to national security of having advanced AI systems, as we've seen recently in a wide variety of domains. So, so there is that link there. Um, but, uh, sorry, I lost the— what was the second half of the question?

[00:15:41.13] - Anjali V. Bhatt

So, so now that China doesn't have those chips—

[00:15:44.22] - Martin Chorzempa

oh yes, what does it mean? So what— so yeah, so they, uh, they have been able to buy lots of powered-down chips. So what's happened is the US has set kind of something like a speed bump— uh, not a speed bump, sorry, that's something that, uh, former Commerce Secretary

Raimondo has said the controls are like a speed bump for China, which I think is actually pretty accurate as well. But they kind of set a speed limit and say, if you want to sell a chip to China, it can't go faster than this amount. And they've adjusted— the, the US Commerce Department has adjusted those over time because, you know, this space moves so quickly, models can get more efficient. They might discover that, you know, this speed limit wasn't actually as effective as they would have liked. So China has not only tried to produce its own chips, which which has been really challenging, in part because the US also shut off their ability to buy a lot of the advanced equipment that they would need to make those chips. They've smuggled some, so like told TSMC, for example, allegedly, you know, a Chinese company saying we're buying Bitcoin mining equipment.

[00:16:46.19]

It was actually maybe an AI, the die for an AI chip. So there are smuggling issues involved in kind of getting those. Under not exactly accurate premises, but China has bought also a lot of these tuned-down AI chips. And one of the things that China has that the US does not have is massively abundant power. China is installing tons of renewables. It's also continuing to build out more traditional power plants. So if you talk to people who go around China these days and talk to AI labs and data center operators, they essentially say power is not an issue. Which is the complete opposite to the US. And some major US CEOs have said, actually, you know, although we're still buying tons of chips, we're actually more worried right now that we won't have the power. So we could have all these AI, you know, data centers full of amazing chips and no power to make them run. Of course, the, the chips that we allow to sell to China are less powerful and less, um, less efficient. They use a lot more power. It's worse for the environment. But despite all these restraints, they've actually managed to still come up with really, uh, effective, powerful models, which is something that causes a lot of consternation in Washington.

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And it's not obvious what you should do. Is it shut them off altogether, cut them off so that you hope that then they'll be slowed down even further and the rest of the world won't build on Chinese open models? Or do you say maybe controls aren't as effective as we would have hoped and can't be as effective as we'd hope because China, as a fast follower, can adopt a lot of the innovative innovations that happen in the US and be really efficient with computing power and get something that's, you know, not going to surpass what the US can do, but gets close enough that a lot of people might say it's cheaper, it can do something similar, let's go there. It's really a continuing open competition.

[00:18:37.21] - Anjali V. Bhatt

So even with the less advanced chips that they do have, obviously China does have a flourishing AI industry. And so you just said that people could use Chinese open models.

[00:18:51.07] - Martin Chorzempa

Yeah.

[00:18:51.14] - Anjali V. Bhatt

And so these are models that they've built, even with this constraint on compute, but they have the power, so they are running things. So what is a Chinese open model versus a closed model? What does that look like?

[00:19:04.18] - Martin Chorzempa

Yeah, so there's a whole open source software community that is very specific about the use of the word open source. So I have to be careful not to step on any of their toes. But one of the things about most of the leading Chinese models is that they're what are called open So I guess the equivalent is, you know, I could have Raising Cane's special sauce and keep it secret. And therefore the only way you can get that is through me. And that's generally the way that the US labs have been releasing their best models, is they're really focused on models where they have the special sauce. You can't get access to what it is. I mean, there's good reason they spent hundreds of millions of dollars in some cases to train these things. And there's also a safety concern of you put a lot of safety, you tune the models and put a lot of safety protocols in so you can make sure that someone's not using these models in a, you know, to try to invent a nuclear, you know, build their own nuclear bomb or like build some biological threat or something like that, or automate a cyberattack, that kind of thing.

[00:20:12.08]

But if the weights are open, then you don't really have control over how it's used, including by, say, North Korea. Now, the Chinese models, in part, I think because of the compute controls, because they didn't have the computing power to serve you their, their unique models, they have opened the weights so you can go on to Hugging Face today, which is the main— it's a wonderfully named thing where kind of it's a hub for the open AI community. Open, not OpenAI the company, but the open AI community. And you can just download one of these models. And if you have the computing power yourself, you can just run them and you don't need to pay the Chinese model model anything. So they spent a lot of money, a lot of effort to, to make this model, and they just make it openly available, and you can run it at the cost of compute. You can also today open up pretty much any US cloud provider and run Deepseek or run Alibaba.

[00:21:06.08] - Anjali V. Bhatt

Deepseek is the, the Chinese— one of the Chinese—

[00:21:08.25] - Martin Chorzempa

one of the Chinese open models. Or Alibaba, which is a major Chinese tech company, they're another real leader in open, open-weight AI models. And so a lot of startups and researchers and others they use these open weight models because they can open, look under the hood, change it, fine-tune it, but they also don't have to pay, uh, anything back to the person who developed it. So it can be a lot cheaper. And now there's a lot of angst in the US where we clearly lead in capabilities of the best models, but China has generally been leading in recent times with open models. And there's this question: do we need to lead in both? And what's the security risk if we continue— US and China are competing and we're issuing these super powerful open models, maybe without the right protections.

[00:21:56.14] - Anjali V. Bhatt

So an American company could go and get a Chinese open model and then run it on American compute power. So how— this is happening clearly. How prevalent is this?

[00:22:12.09] - Martin Chorzempa

It's actually a lot more prevalent than you would think. There was actually this big headline that was oversold where it was saying that 80% of US startups are using Chinese open weight models. Turns out the actual VC who said this, that's not the denominator. It's actually something like 20% or so of startups that come in and talk to them are building on top of Chinese open weight models. But then a lot of researchers and others are too. There are also headlines about companies in Africa, for example, that are building on top of Chinese models. Anytime cost is the main constraint and you don't care about super frontier capabilities, often people will go to those Chinese models. The interesting thing is a US company can make money renting out access to the Chinese model on the best US computing stack. And one of the important features of this community is that, you know, NVIDIA's software ecosystem is called CUDA, and that is an open-source system. So when Deepseek or Alibaba or some— or, you know, ByteDance team that runs TikTok, in, uh, in Beijing, it comes up with a cool new way of training AI. They're doing it generally within that ecosystem, and people in the US can see what they're doing and immediately implement those improvements in the US.

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So even though you have this kind of geopolitical issue and export controls, you still have some areas where the US and China are working together. They're on the same platforms using the same software and stuff, and there's this big question Can that continue? Uh, NVIDIA is now saying we expect zero revenue from China on, uh, on these going forward because China has actually said we don't want your stinking, uh, tuned-down AI chips. Uh, we are gonna make our own.

[00:24:05.08] - Anjali V. Bhatt

So can they make their own? I mean, the US has, as, as we've said, the US sort of has control over most, if not all, of the semiconductor supply chain. Are they making their own?

[00:24:15.20] - Martin Chorzempa

They are making their own. This is the hottest question in export control land, because if China can make its own chips without much supply constraint, then it means that, uh, you know, the export controls are going to be a lot less effective going forward. If they're still really constrained, then the U.S. retains a lot of leverage. And so projecting that going forward is, is very difficult because China already wanted to indigenize its supply chain, was investing a lot to do so, but wasn't really able to. So you see these estimates range from all the way down to maybe only able to make 200,000 chips per year. So, you know, Huawei is out there saying, well, you know, each chip we have isn't as powerful, but we can combine a lot more and put them together and still come up with something that's competitive. But if you can't make that many of those chips, that's not going to work. So I don't know anybody who thinks that China is going to be able to make enough in the very near term to even touch a small portion of their overall demand for computing. But there are also a other projections which, which say they're getting better at making their own equipment, they're getting better at mastering and figuring out bit by bit why they have defects in the, in the process, and they'll be making more and more going forward.

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Uh, that's very difficult to, uh, to look for, but, but I, I think they're still quite constrained.

[00:25:38.17] - Anjali V. Bhatt

So, I mean, but it sounds like, you know, the, the export controls, by, by cutting off their, their ability to access these advanced chips, that just kind of forces them to figure out how to do it themselves, right?

[00:25:49.16] - Martin Chorzempa

Yeah. So this is, this is a very difficult trade-off in export control policy, even beyond chips. And going back in history, there was— and Jake Sullivan, the previous national security adviser to Biden, pointed out this kind of— said that there was the sliding scale before. And the thinking behind the sliding scale is is if you're willing to send your adversary or competitor equipment that's kind of 2 generations behind what you have, you retain an advantage. And then they're going to have to think, okay, am I, am I going to be able to compete with them at the cutting edge, or am I better off investing somewhere else and just importing this stuff even though it's not as good as what they have? It's probably better than what I can make at home. I don't have the resources to keep up.

[00:26:36.25] - Anjali V. Bhatt

Up.

[00:26:37.08] - Martin Chorzempa

So, you know, all right, we'll just go that way. And that retains leverage over a longer period of time, uh, whereas if you completely shut off your adversary, then they have no choice and that puts them all in. So I think a lot about the incentives of Chinese firms in this case. So like, and, and it's a, it's a long-term short-term trade-off. If you're an AI lab in China and your choice is import tuned-down Nvidia chips or buy super buggy overheating, failed training run Huawei chips that you might not even be able to buy because they can't make very many of them. Plus you have to migrate all of your training onto this new software ecosystem called CAN, which is super buggy and problematic. What that means is you— even if the Chinese government's telling you to do this, you do that, what's going to happen? Your competitors who are buying the Nvidia chips, they're going to be ahead of you and you will be forgotten. Your models will fall behind, people will stop using them and go for your competitors, and you're dead. So you followed Chinese government's, you know, indigenization, uh, imperative, and you died.

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Uh, not a good choice. But of course, if China can say no one can get them, then, you know, you're maybe on the same ground as your competitors in China, but you're probably going to fall further behind players outside of China that don't face those, uh, those constraints. Of course, if

you sell China chips today that they otherwise wouldn't be able to build, they're going to be more capable today. But maybe it reduces their ability to indigenize. And that trade-off is really, to me, the fundamental trade-off of export controls today.

[00:28:16.20] - Anjali V. Bhatt

And we don't know how that's going to end up.

[00:28:18.11] - Martin Chorzempa

No.

[00:28:19.08] - Anjali V. Bhatt

Okay, so let's, let's turn quickly to, um, AI use, uh, and investment outside of, of the US and China. I mean, a vast majority of it is in the US and in China and some in EU. But what does this, both the boom in investment and then just broader AI use, mean for other countries?

[00:28:37.28] - Martin Chorzempa

Well, it's the fact that at the top level of frontier models, there are really only two choices. There are US companies and Chinese companies is really, really interesting and kind of fits past technologies. You know, if you think about social media, for example, the US just completely dominated that. And you look at for example, operating systems. Pretty much everybody on their phone is using iOS, uh, by Apple or Android by Google. So there's, uh, but then you think about China adapting and getting better. So now it's not just, uh, are you using WhatsApp? A lot of people are using TikTok. Uh, and, and so China has shown that it's not obvious that the US is just gonna completely be the platform that the whole rest of the world builds on. There's a real competition. And so what that means for companies in the chip supply chain is, you know, the US is you can't supply China, you can only supply the US for now. That is not a bad deal because there's so much demand that they're just making money hand over fist. But for the other countries, they have to think, do I want to choose between the US and China?

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And generally the answer is not. Even in Silicon Valley, they're not choosing between the US and China. They're, you know, sometimes adopting the best US models and sometimes adopting the cheapest Chinese models depending on what they want. So I don't think we can expect that countries will necessarily choose. And one of the interesting things about having open models that you can run from China just on the cost of compute is I think that puts a check

on the ability of US companies to charge what they would like to for access to their models because there's always a, you know, you could always run it on a cheaper Chinese alternative if that's a better cost-benefit for you. So that is a potential wrinkle and concern for their ability to ultimately capture the value value of what, of what's being created, although they're trying to build in, you know, the applications themselves so they can capture some of that value. But one of the interesting comparisons to past general-purpose technologies, if you look at electrification or telecoms, the countries that wanted to adopt those and use them in their economy had to make this massive investment. And it had to be— that investment had to be there, whereas the investment that's happening in the US in particular can serve, you know, of obviously it's better for inference if you have the chips closer to the people that are using them because you, you don't want to be shooting those halfway across the world running the model and then shooting it back.

[00:31:11.17]

But you, anyone anywhere in the world with a smartphone, and, you know, pretty low-income people in some pretty, you know, remote regions can, uh, do have mobile internet and smartphones that can access the best models in the world today. And that's not been true of past ChatGPT technologies. And so with check on the ability to really gain monopoly profits and the ability to access it without necessarily needing there to be a massive data center right next to you, that is a huge opportunity for other, uh, other countries and companies in other countries to be able to adopt and get value from AI without necessarily having to, you know, put hundreds of millions of dollars into data centers.

[00:31:59.14] - Anjali V. Bhatt

Okay, well, we are at time. There was so, so many places we could go, but 30 minutes is not a lot. But, and I know that we said we don't really know how a lot of these export controls especially will play out in the next couple of years, but in the next 3 to 6 months, what will you be keeping an eye on?

[00:32:17.11] - Martin Chorzempa

I think the thing I'll be keeping most an eye on is whether the releases from China slow down, whether we see that China's decision to stop importing US chips chips really, uh, leads the, uh, the U.S. lead over China to extend. Because I think, you know, it might be that they're doing this out of a negotiating leverage position. Maybe they're saying, you know, we're not going to buy your tuned-down stuff, but if you make us a better offer, we'd be willing to import it. Uh, or it could be that they really just want to put all in on indigenization. And then, and if that is the case,

then the U.S. could actually, because it continues to build out way more than, than China's doing, it could actually extend its lead, and, um, and that would be really interesting.

[00:33:04.24] - Anjali V. Bhatt

Okay, well, thank you, Martin, for joining us, and thank you to all of you for joining us as well. Um, what did you think? What do you want to see more of? Let us know at meetings@pie.com, and if you're not already, subscribe to PIIE Insider, the newsletter, at pie.com/subscribe. Uh, the next episode will be on December 16th with Monica de Bolle, where we'll be discussing Argentina Latin America more broadly, and economic nationalism. Thanks again to Martin and to all of you. We'll see you next time.