



A podcast about the economics of trade & policy
with Chad P. Bown

Episode 212. America's semiconductor policy and the AI race with China

[Episode webpage](#)

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Transcript

(lightly edited)



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Chad Bown: Artificial intelligence is sustaining the American economy. Stock market gains are often due to the performance of a handful of companies in the tech sector. The buildout of data centers has been a short-term benefit for construction and employment. After a year of tariffs, imports of servers and other components going into those data centers are one of the few bright spots for international trade.

As Soumaya Keynes and I were working on our book, semiconductors was the sector that everyone kept talking about. Chips are the foundation of what drives all that artificial intelligence: No chips, no AI. Semiconductors are also a really deep part of the U.S.-China trade war.

That is why I am so excited about today's show, where we tackle the American government's policy odyssey into semiconductors.

The book is titled, [How to Win a Trade War](#). If you preorder your copy today, you can receive a free bookplate signed by Soumaya and me, while supplies last. Just follow the instructions on the Simon & Schuster [website](#). I will put a link to those instructions in the show notes.

And with that, here's the show.



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THE EPISODE

Chad Bown: You are listening to an episode of *Trade Talks*, a podcast about the economics of trade and policy.

I'm your host, Chad Bown, the Reginald Jones Senior Fellow, at the Peterson Institute for International Economics in Washington.

In this episode, we are going to talk about semiconductors and the massive American policy interventions taking place in the chip sector today.

From subsidies to tariffs to export controls, why is the government doing it, and how is the policy working out so far? To make sense of all this, I will be joined by a very special guest.

Dan Kim: I'm Dan Kim, TechInsights.

Chad Bown: Dan Kim is Chief Strategy Officer at TechInsights. Dan is a PhD economist and has been my go-to expert on chips for a long time. He's worked in senior roles at companies like Qualcomm and SK Hynix.

And from 2022 to 2025, Dan Kim was the Chief Economist in the CHIPS Program Office at the U.S. government's Department of Commerce, working on implementation of this massive American semiconductors industrial policy, the one which continues on to this day. Hi, Dan.

Dan Kim: Hello.

Chad Bown: Today's conversation is going to be all about artificial intelligence. Why are semiconductors essential to AI?

Dan Kim: Well, there is no artificial intelligence without semiconductors. When you use a chatbot, whether it's ChatGPT or Claude or any other models that you might be using, you're effectively talking to semiconductors.

But advancements in semiconductors that have been advancing for the last 60 years, that's what is enabling artificial intelligence to happen. And that's what actually is going to drive it even further. You can't talk about artificial intelligence without semiconductors.



A podcast about the economics of trade & policy
with Chad P. Bown

US SEMICONDUCTOR SUPPLY CHAIN VULNERABILITIES

Chad Bown: To understand what's happening today then for AI and chips in the United States, we really do need to go back about a decade.

How did US policymakers learn about America's vulnerabilities, as we might call it, in the semiconductor supply chain? What happened?

Dan Kim: I think there were a couple of moments. I joined the International Trade Commission in 2015, and there were two people in the entire federal government that were focused on semiconductors. Two.

There was one person at the ITC, and there was one person at the U.S. Commerce Department.

And when I joined the ITC, my division chief pulled me aside and said, you're covering semiconductors, but there's really nothing happening in that sector. The US already dominates. Trade? There's no tariffs here. There's really not many trade disputes going on. So, you probably want to find another thing to focus on while you're covering this.

And so I said, well, I think it's going to be important, actually. Semiconductors are very important.

And then later that year, China declared publicly its intention to be completely self-sufficient in semiconductors. And that set off alarm bells throughout the industry.

And they lobbied the government to say, hey, we need you to pay more attention to this because we know, as an industry, we've been telling you, hands off, no government intervention, other than just making sure that free trade of goods and ideas flow.

But now, we might need you to intervene. But exactly how we don't know yet – that was the tenor of it. Now, this was during the Obama administration.

Chad Bown: And this was the *Made in China 2025* policy.

Dan Kim: This is *Made in China 2025*.

In the meantime, the manufacturing competitiveness of the United States was declining primarily because the foundry model that TSMC in Taiwan has really perfected with the introduction of the iPhone – that really supercharged that and that relationship between Apple and TSMC – all of a sudden, the United States found itself with a shrinking share, ever shrinking share of manufacturing capacity and manufacturing leadership at the same time.



A podcast about the economics of trade & policy
with Chad P. Bown

And at the same time, China was declaring its intention to be a technology leader and to be self-sufficient.

Now, contrast that to trade policy that's been happening to effectively enable the most globalized supply chain that I think of any industry we've ever seen. A chip travels many, many thousands of miles before it gets inserted into your phone or your PCs.

The whole trading system was designed to make sure there was no friction whatsoever; that you could completely leverage your relative competitiveness in whatever your economy has to participate in that.

And the US was a huge beneficiary of this, but some things happened along the way in which the manufacturing share had declined to close to 10 percent – from making all of it when semiconductors were invented in the United States, to China being a threat and all of a sudden no longer being the manufacturing leader – so that was all lurking in the background.

Then COVID happens. There was a huge demand for compute, work from home, school from home, and electronic devices were flying off the shelf, if you can find it in the stores.

And it turns out that the same semiconductor factories that are making those chips for computers and others, were also similarly making semiconductors for automotives, industrials, your refrigerators, and dishwashers.

When there was a huge demand for these goods, all of a sudden the semiconductor industry could not quite keep up. It is not designed to keep up with that kind of demand. So the shortages of semiconductors – it's a very visual, visceral thing when unfinished cars are sitting in parking lots in Michigan and Indiana and other places. And your car prices are going up for no good reason. And you can't find that laptop to send your kid to online school. And more importantly, price is going up because you couldn't buy these things. A lot of inflation was because of shortages of input goods like semiconductors.

And for some reason, I had the front row seats in both government and in industry through this growing interest of semiconductors by the US government, and quite frankly, all governments around the world.



A podcast about the economics of trade & policy
with Chad P. Bown

CHIPS AND SCIENCE ACT RATIONALE

Chad Bown: So US officials see these vulnerabilities and decide to act.

They've ultimately used a lot of different policies to intervene in the semiconductor supply chain ecosystem over the last few years.

But let's start with subsidies. Let's talk about the CHIPS Act. What was the CHIPS Act designed to do and why?

Dan Kim: Well, the theory was when the question was asked, why has the US lost so much of its share manufacturing of semiconductors?

The answer that was given primarily by the industry was that the cost of production is just too high in the US compared to others, like in East Asia, particularly Taiwan, Korea, and China.

The argument they made was that a lot of the cost difference was because of government support in those countries, of which the US offered none. Therefore, if we want to get in the game again, then we would need to offer the same. That was the argument. And there was a bipartisan congressional agreement that that was the case.

I remember actually being in the industry when this was being debated. I was the chief economist of a company called SK Hynix. I remember there was a conversation within the industry as to what to lobby for. Do we lobby for a tax credit? Do we lobby for a grant program?

There are advantages and disadvantages of both. They didn't think they would get both, so they had to make a choice. So they lobbied for a grant program.

The theory was that if there was sufficient supply-side support; i.e., that if you can just lower the cost of production enough to have the companies justify building in the US, then you don't really have to worry about the demand, they'll just build it.

Subsidize and they will come. I think it was the theory.

To everyone's surprise, Congress offered both. They offered the tax credit and the grant program.

So 25 percent fully refundable tax credit, meaning if your tax liability is zero for whatever reason, then 25 percent of your eligible capital expenditures you would get back in cash, which is an incredibly powerful tool.



A podcast about the economics of trade & policy
with Chad P. Bown

And 25 percent of a \$20 billion fab is quite a bit of an incentive. And the tax credit will be a noncompetitive one, meaning there's no limit that the Treasury has. I.e., if there is a trillion dollars' worth of investments, all qualified for, then there will be \$250 billion worth of tax credit that the Treasury would give.

And on top of that, there was a competitive grant program, direct funding, meaning there was a finite number of dollars out of the \$52 billion of CHIPS Act, \$39 billion would be allocated.

And so companies would compete for those funds for the next four or five years.

Chad Bown: You've been on both sides of this, but before you came into government, as you said, you had just started to work at SK Hynix, a company headquartered in South Korea.

How much subsidies had the Korean government been giving to semiconductor firms to build factories there?

Dan Kim: So I was the chief economist of SK Hynix, and I asked our team that was building a fab in Korea, I said, "How much subsidy are we getting from the South Korean government?"

They came back and said, I don't think..., they thought that they had misunderstood the questions. The government doesn't really support us here.

And so immediately I realized, actually, government subsidies were really not the driving factor here, at least for this company deciding to build in Korea.

Chad Bown: Okay, but what factors would then drive the decision of where to locate one of these semiconductor fabs? If there were no subsidies, why did SK Hynix build there?

Dan Kim: The easiest answer is that they already have fabs in Korea, so they know the ecosystem works. There is a supplier base already built in. A fab uses something like 3,000 suppliers to keep the factory running 24-7.

They know that the workforce is there. There are engineers, there are factory workers that could run that fab 24-7. They know that the infrastructure is there.

And then obviously the cost competitiveness has to be there. And it's a mix of all those things.

If you're imagining that, oh, if you just have low cost of labor, you're going to build fabs there. If that was the case, then every fab would be in Southeast Asia. And there are almost no fabs in Southeast Asia.



A podcast about the economics of trade & policy
with Chad P. Bown

If you're imagining that it's only high skill labor that's going to drive this, well, then every fab will be in Silicon Valley, and there's no fabs in Silicon Valley. It's the sweet spot of where everything has to be present.

And so given all of that, I think I intuitively understood that the financial support that a government can give is just one piece of the picture.

Chad Bown: When you were in the private sector, you did site selection for SK Hynix. What did you look for?

Dan Kim: So I actually had to make a checklist of all the “must haves” and all the “nice to haves.” All the must haves have to be there in order for any site to compete.

And the nice to haves then become a point of, what can the government do to make up for some of the deficiencies that a place might have, whether it's cost, workforce, infrastructure, whatever it may be.

The must haves – I'll give you a couple of examples. Is it going to be near a place where there's sufficient people and workforce? And surprisingly, that's not always the case, right?

Another must have is absolutely reliable energy grid. Another one is absolutely reliable water supply. Those are just some examples that a site selection requires you to consider.

It also requires you to consider what kind of vibration there is in the ground or in the air even. So it can't be too close to an airport, it can't be too close to a railway, because when you're working at a nanometer scale of the semiconductor manufacturing, then any kind of vibration could actually make your chips production really difficult.

The nice to haves then become about costs, and in some cases, political buy-in. So, do you have local, state, federal partners that will work with you to get the right permitting to make sure that it's done on time?

Because if you're sinking 20-plus billion dollars into a factory, if there is a six-month delay because of some permitting issue, that six-month delay is extremely expensive, because you are building a fab, and every second that you're producing, you make money. Every second that you're not producing, you're losing money. And so a delay of a day is actually a multi-million dollar cost to you.

Another nice to have, I think, is universities nearby who's willing to work with you to do R&D.



A podcast about the economics of trade & policy
with Chad P. Bown

You can do R&D separately from your fab. And so if you have a university partnership that you really like, that's actually really nice to have. Some might consider that an essential, but some might consider that nice to have.

If you combine the nice to haves and the must haves, sometimes the easiest decision you can make is you look at an area and say, is there already a semiconductor fab somewhere in that area?

And if that is, then you know that there's a supplier base, the workforce is there, the universities are there, the government officials are used to doing permitting for a large scale fab.

And so the easiest thing might be to say, where in the United States are there already fabs at the scale that I'm looking to build? And if there is, I'll just go near there.

So I don't think it's an accident that TSMC looked at Arizona and said there are Intel fabs there. They've been operating there for many, many years. So it's an obvious sight for them to try.

Samsung, too, they've been operating fabs in Texas for many, many years. There are other fabs in Texas in that Austin area. So, choosing another site near there makes a lot of sense.

It becomes a bit riskier if you're going to an arena and an area in which there's never been a fab before. So you have to take a chance and think about, can a new ecosystem be developed around you? You're the center of it. Will there be 3,000 suppliers around you? Will there be a university supporting you? Will there be government officials supporting you?

All those questions have to be asked.

I think in those cases, there's probably more fierce competition due to government funding. So in those cases where government officials know, this is a risk that a company has to take. Then you have to offer something to them to sweeten the offer.

I don't know if any company will go out there and say, whoever gives us the highest dollar of incentives at a state level, we'll go there. I can't see that happening because you have to meet all these requirements.



A podcast about the economics of trade & policy
with Chad P. Bown

THE CHIEF ECONOMIST'S ROLE IN THE CHIPS OFFICE

Chad Bown: In 2022, after Congress passes the CHIPS Act, you're still working at SK Hynix.

The US government ultimately hired you to be the chief economist in the brand-new CHIPS office that the Commerce Department had to set up from scratch to implement this new law. How did that come about?

Dan Kim: I was actually called into an interview with Secretary Raimondo with the premise that we would just share some ideas. I did not know that it was going to be a recruiting meeting.

And I sat down, Secretary Raimondo, any cabinet secretary, they don't have a lot of time for you. We sat down. I'm sitting across the table from her in her office.

And she asked me about my family and I'm an immigrant to this country. My grandfather was a refugee in the Korean War. The US Marines helped save our family. So I owe a lot to the service members there. So I told the story because she asked.

And we talked a little bit about semiconductors. She pauses at the end and she says, Dan, you owe a lot to this country. I need you to serve. And she appealed to my sense of duty to this country.

And now, mind you, I had already served in the government before. So this wouldn't be my first time doing it.

But she emphasized that this is a national economic security program. It's not a political program. And she told me at the time that she would do her very, very best to shield the team from politics, to enable us to do the right things. And quite frankly, it didn't really give me a choice other than to join. I had to fly back to Korea to tell my CEO that this had come about. I had no choice to accept and do it.

Chad Bown: So tell us now about what does a chief economist of the CHIPS office do?

Why is it important to have a high-level economist involved in the strategy here?

Dan Kim: That's a good question. I like to joke that I was chief economist of a team of one economist. But my team actually consisted of what we called the economic security team.

I had three titles. I was the chief economist. I was the director of strategic planning. And then I was director of economic security.



A podcast about the economics of trade & policy
with Chad P. Bown

We created a team of industry experts, technical experts, and data scientists. I was the economist. They could actually formulate a strategy around what does economic security mean in this sector, what does the country need most and actually come up with a metric of success and evaluation criteria for companies that would come to us with their applications.

So we would be setting requirements as to information they would be giving us and then we would effectively have a rubric of deciding how companies ranked depending on the answers.

Chad Bown: What were the priorities for economic security? How would you characterize those?

Dan Kim: Yeah, and that was the first assignment that I was given when I joined CHIPS, is to actually formulate what we call a “Vision for Success”¹ paper, which articulated what we thought success looked like. What do we need to accomplish? What do we need to have in this country to say CHIPS succeeded? So, we outlined certain types of production that we thought was necessary in this country to have and that we were willing to incentivize.

We outlined, for example, the need to have the most advanced logic foundry production in the United States. And by most advanced, I mean at nanometer scale, the finest techniques that actually can cram the most transistors onto a chip to have the most functionality.

That's really important because it's a bit of a winner-take-all situation where in order to enable your smartphone or your PC or now your data centers that's enabling your AI, you need the most advanced manufacturing techniques.

That's what we would call leading edge. So, we needed to have that because we didn't have any at the time that could serve multiple customers at a foundry model, like a contract manufacturing model.

We signaled very clearly that we wanted not only one, but multiple manufacturing clusters of that type of factories. And by clusters, what we meant was we wanted a growing set of factories within a site that would drive down the cost of manufacturing sufficiently to compete globally.

¹ National Institute of Standards and Technology (NIST). 2023. *Vision for Success: Commercial Fabrication Facilities*. February 28. Available at https://www.nist.gov/system/files/documents/2023/02/28/Vision_for_Success-Commercial_Fabrication_Facilities.pdf



A podcast about the economics of trade & policy
with Chad P. Bown

We wanted and emphasized the need for memory production, particularly DRAM, of which there is a very severe shortage in the world right now.

But we also signaled that we wanted advanced packaging, which has become increasingly important to enable advanced functionalities such as AI chips.

If you open up an AI chip, it's got a GPU in the middle, but it's got multiple high bandwidth memory DRAM modules around it. That is packaged together in a way that is very advanced, so that there is quicker communication between those chips.

Chad Bown: So GPUs, those are the AI chips, say that Nvidia and AMD and those types of companies design, and that TSMC will make. And high bandwidth memory – that's the fancy memory chips that companies like SK Hynix or Micron will make. And this advanced packaging is basically taking all those chips and putting them together in the right way so that they work.

Dan Kim: That's right. And I think most people understand what GPUs are, because it's in the news all the time. Most people probably have not heard what a high bandwidth memory is.

It is a specialized type of memory of DRAM that is stacked. So if you imagine stacking eight different dies of chips together, and then you have to drill precise horizontal holes in these chips so they communicate with each other - something like 2,000 of these, what we call through-silicon vias. And then you have to control for the heat in between each of these dies in a way that doesn't warp. This is extremely difficult to do. Probably the most difficult manufacturing technique out there other than logic.

Now, mind you, when I was writing this strategy paper, and I say we, there were multiple people writing it with me. When I joined CHIPS, it was November 2022.

That's the same year that ChatGPT was launched to the public. The whole conception of AI was really just at the very, very beginning. We did not see coming, for example, Nvidia being the behemoth that it is in terms of both market size and the importance of the chips that they make, or AMD for that matter.

Leading edge, for many years, we effectively equated with your personal computers and your smartphones. In order for you to have the next iteration of your smartphone, what does it take to make your next smartphone smarter and faster? It is effectively the advancement of the chip.

We did also want that, but as we thought about trade-offs, we made very clear that we wanted to have the ability to make chips that would go into our compute infrastructure.



A podcast about the economics of trade & policy
with Chad P. Bown

I think now if I were to write it again, I would be very specific that it's more AI-related. But back then, again, AI really wasn't in the jargon as much as it is now.

But we made it very clear that compute infrastructure was a critical end use that we wanted to have some production capacity to supply.

Chad Bown: I want to ask you about Taiwan. TSMC in Taiwan is the concentrated source of production of the most advanced chips. That concentration means supply chain risks, and then there is the geopolitical risk of President Xi Jinping's stated desires to reunify Taiwan with the mainland.

What sorts of questions did your office face on Taiwan?

Dan Kim: One of the questions was, can we use the \$39 billion to completely offset our exposure and risk to Taiwan? And my response was, no, that is not possible with the amount of money you're talking about.

And I think within that question is this concern that more than 90 percent of leading-edge foundry manufacturing comes from Taiwan and one company, TSMC. Practically, all your iPhone chips that are most advanced come from there.

Practically, all your Nvidia AI chips, at least the GPU part of it comes from there. Same with AMD. Pretty much anything that you could conceive of, that is driving some kind of compute power in your life, has been manufactured by TSMC.

And the concern for some was that that's a very geopolitically sensitive place. What can we do to offset that risk? So, the question comes to me, can we use this to completely offset that risk?

And then the economics has to come into play. Which is, the answer is no.

There is too much volume that's already coming out of Taiwan, meaning there's so much volume there that to completely off-risk it, you would have to build so much more in the United States, or at least away from Taiwan, that it would be completely impractical, at least with the money you're giving me. If you're giving me \$3 trillion, maybe. But not \$39 billion. Each fab costs somewhere around \$20 billion.

And by the way, Taiwan does an amazing job. They've enabled so much compute to happen. They've enabled pretty much all of our semiconductor design companies, like Nvidia, like Qualcomm, like AMD, even Intel, to thrive in their respective businesses.



A podcast about the economics of trade & policy
with Chad P. Bown

They've been an amazing partner for us. And so, I understood the question, but I had to gently push back and say, no, that's not going to be the driving factor here, although it is a background that is important for us to understand. But at the same time, if that's what you wanted, then this is not the tool to get that done.

And secondly, I'm not sure if I agree with the premise that we need to completely zero out our risk there. I'm not sure if that's the right move either. Now, that wasn't my job to dictate that, but I could understand the fear of it.

So that obviously was lurking in the background.

THE IMPACT OF THE CHIPS AND SCIENCE ACT

Chad Bown: Let's turn now to the impact of the CHIPS Act.

Unlike the Inflation Reduction Act – so that was the US industrial policy, passed right around the same time in 2022, but for electric vehicles, batteries, and other green tech – President Trump did not kill the CHIPS Act. It lives on and has been enhanced in some ways. We'll come back to that. Now we're nearly four years on since the legislation passed.

What can we say so far? Maybe let's start with positives. Have parts of the CHIPS Act worked?

Dan Kim: The parts that worked is that now people are talking about it.

Remember when I came into government in 2015, there was almost no attention to semiconductors. Now there almost seems to be too much. There's so much attention on it that people talk about it.

So I think that's a success. The fact that there is a team, multiple teams, one at Commerce, there's other folks at the State Department, there's other folks at the Department of Defense and others, that are so focused on semiconductors now, I think is a good thing.

I think there's a recognition of the criticality of this industry. That's a good thing.

In terms of sheer investments, I think it's a bit hard to conceptualize because when we left, we had announced that there were about \$400 billion worth of announced investments out of the result of the \$39 billion worth of committed funds. So that's effectively 10 to 1.



A podcast about the economics of trade & policy
with Chad P. Bown

I think that's a pretty good return on taxpayer money, especially if you consider the multiplying effects, not only in economic security, but the jobs they would create and the investments downstream that they would create.

I think the administration has announced now it's north of \$600 billion, so there's more committed funds to that.

Chad Bown: What about leading edge and American manufacturing of the most advanced chips?

Dan Kim: There's about five companies that are able to do leading edge manufacturing of semiconductors. On the logic side, there's TSMC, Samsung, and Intel. On the DRAM memory side, there is Samsung, SK Hynix, and Micron.

All of those companies have committed to large-scale manufacturing in the United States in one form or the other, whether it's in front-end fabs or advanced packaging.

No country in the world has all those companies. This is an industry which has national champions. So you go to Taiwan, you got TSMC, obviously. You go to Korea, you have SK Hynix and Samsung. In the US, it was Intel.

But now we have manufacturing presence, a committed manufacturing presence, by all those companies. And I think they then pull in R&D, they pull in the skills training. I think that kind of ecosystem being created, to me, is the biggest success.

And I also don't want to ignore that companies like Texas Instruments and GlobalFoundries and others are also building out in large scale manufacturing. There were many other smaller scales manufacturing, also very important for end uses, like critical infrastructure and defense goods. MEMS production, of which we didn't have too much before, we have some committed funds to that.

There's a lot of attention now on critical minerals. I think having the CHIPS Act there for there to be a conduit of conversation, to have those conversations, I think is an excellent thing too. I think those are good things that have happened.

When I take a look back and I look at it, I had really high ambitions. And would I have done things differently? Some things, absolutely.

But I have to be realistic in setting expectations because the US manufacturing ecosystem, particularly in semiconductors, was quite atrophied at the time that we started this.



A podcast about the economics of trade & policy
with Chad P. Bown

And the fact that these big successful companies with unbelievable manufacturing precision and discipline would say, we're going to take a chance in the United States again, I think to me is just a huge unqualified success.

WHERE THE CHIPS AND SCIENCE ACT FELL SHORT

Chad Bown: Those are the successes. How about examples of things that didn't quite work? Where did the CHIPS Act go wrong?

Dan Kim: I think what didn't go well, and I'm not sure how much it could have been helped, is that we had to stand up a new team, new process, new procedures to receive applications, go through them, and give the grants out.

I sensed that there was frustration that it was going too slow, even though I could assure you, we were working day and night. We were all very tired, we were all very overworked in the background.

I think we could have taken a little bit more risk, pulled triggers a bit earlier in some cases. I think sometimes we did have a tendency to live in our heads a little bit, and I think that showed.

Chad Bown: When you were engaging with the private sector, with these companies, what did they complain about most when it came to CHIPS Act?

Dan Kim: That we weren't giving enough money. A lot of the complaint that we heard was that they had underestimated how much the American manufacturing in the semiconductor ecosystem had atrophied, and therefore, how much more costly it was to get the fabs up and running, and they had underestimated the cost that it would do it. And we didn't have the flexibility to plus up those funding if it was. So that's one complaint.

The other complaint, obviously, was the amount of information that was required, and the time that it was taking for the applications to go through.

But I could understand why the bureaucracy can be really frustrating from a company's perspective, especially if they're global companies, and if they had experiences, like in East Asia, where you go to South Korea or Japan, they're so used to these permits and other things. And even when there are some financial incentives involved, they would often comment that they would never have to jump through as many hoops as they had to jump through with us.



A podcast about the economics of trade & policy
with Chad P. Bown

And so that is something to consider as how to streamline all of that.

Chad Bown: When Soumaya and I were interviewing semiconductor executives for our book, one of them said to us that – and this was the grants part of the CHIPS Act – they said it was the most expensive free money they'd ever received. It seems like the companies really did prefer the tax credits to the grants.

Was there anything particular with the grants that really helped move the needle, things that wouldn't have happened but for that particular part of the CHIPS Act?

Dan Kim: So, for some types of manufacturing 25 percent tax credits simply would not have been enough to push the investment decision over the edge. In which cases, you had to have the grant push that. So simply the math of it would not work without a grant program.

I think also for the companies, when they would receive a grant, it was a signal to the market too, that the government had given a stamp of faith that this technology was important, that it would be supported by the US government.

And they've never really had that before. We would sometimes get feedback like, when we mention to our potential customers that we are in line to receive CHIPS grants, they're all very interested. Because the customers are evaluating you, not only in technology front, but also on the financial front. And so having a government backer pushes down that risk quite a bit.

And because the government grant is a competitive program that is not easy to get, that there is some sort of due diligence built into it, that your customers would validate at the end of it. So we've heard that example as well.

THE LIMITS OF SUPPLY-SIDE TOOLS

Chad Bown: The CHIPS Act is all about supply-side tools. You can incentivize TSMC and Intel and Samsung maybe to all build leading edge capacity in the United States. But there's still the question of demand.

For Nvidia and AMD, who do they take their designs to actually do the manufacturing of their AI chips? They all still seem to want to go to TSMC.

One problem with the CHIPS Act, of course, is that there were no demand-side tools in the legislation. You had nothing to work with. All you could do was give out money. The legislation



A podcast about the economics of trade & policy
with Chad P. Bown

did not give you authority to do off-take agreements or to otherwise incentivize AI chip design companies to use this new capacity.

So let's brainstorm a little bit.

Are there creative ways policymakers could incentivize these AI chip design companies to diversify away from TSMC a little bit to maybe use an Intel or a Samsung Fab?

Dan Kim: One example I could give you is there is a cost, an actual cost, of porting your design from one fab to another fab.

So if you're already at TSMC going to a Samsung or an Intel, there is actually significant, hundreds of millions of dollars in some cases, to design your chip specific to this other fab.

Could the government play a role in effectively zeroing out that cost risk so that you can try it for free or even give you something on top of that? Something that effectively says, we're going to really incentivize you to try these other sources, or R&D together, or whatever it might be.

I think if we were to really put our brains to it, we could come up with a range of options that we may not have thought of before, rather than you must use this other fab that you don't want to use otherwise.

It may be tempting to think, well, you got to force these companies to use a fab they don't want to use. That's the only way to get them to use it. I'm not sure if that's the case.

These are long decisions that a company has to take. When you choose a fab, you're effectively saying, you are my technology partner going forward for the next decade or so. That is not a light decision to take.

And we've had experiences, Chad, from other countries doing local content requirements and others to try to force these kinds of happen with varying degrees of success.

And secondly, I think you need to understand that from a company's perspective, because there is limited clean room space at whatever fab you want to fab at – TSMC or Samsung, wherever – if you don't fill that space, your competitor might. And if there is a fab or clean room space somewhere in the world, that's going to give you the most bang for your buck to use that facility. Unless you use it, your competitors might.



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And so how could you tell them not to use it is a really difficult question. Unless, perhaps, you force everyone to not use it or to use something else. And so I could totally understand why demand side questions are difficult.

And so I think we need to be very careful in thinking about how to design those.

Chad Bown: Now, for leading edge manufacturing, we've got the relative success you mentioned about getting the most advanced makers of these chips to do more in the United States. What about the older chips, the less fancy, mature nodes?

You spoke earlier about how shortages of these less fancy chips during the pandemic meant consumers were hurt when companies not getting these chips couldn't make cars, washing machines, refrigerators.

How successful has the CHIPS Act been at getting more mature nodes semiconductor production in the United States?

Dan Kim: One regret I have is that despite our efforts to focus on mature nodes semiconductors, we did not have huge success in attracting really high-volume semiconductor production in mature node. And that's actually purely due to economics.

The economics are just really, really tough. And because we had a universal set of tax credits, despite what kind of types of chips you were making, or the economics of that particular node of manufacturing, it's just 25 percent. Now it's 35 percent with the One Big, Beautiful Bill in place. But the economics actually is quite different. And we didn't account for that, at least in the tax credit part.

And I don't think we also appreciated that China's overproduction of mature chips would effectively make so much hesitance in investing in new factories and that the fact that we didn't really have a renaissance of mature node production is a regret that I have.

And I frequently think about what else we could have done differently to do that.

Chad Bown: Why are the economics different for mature node semiconductor manufacturing?

Dan Kim: At TechInsights, we actually do what's called economic models for semiconductor manufacturing. So we could actually tell you, at a given wafer for semiconductors, what the component of the cost was.



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And if you look at a leading edge, most advanced node, manufacturing wafer or chip, somewhere between 60 and 80 percent of that cost is in depreciation of new equipment. Because the depreciation schedule usually is five years or so for equipment.

Because the equipment is so expensive, and because constructing a new fab is so expensive, for the first five years or so, by far the largest cost is the equipment. And that's how it's priced in. That's how you price in the chip.

It's quite expensive. It's expensive to design it, it's expensive to get it. And so, once you have the scale, then you're off and running.

But for mature-node production, imagine competing against a fully depreciated fab in East Asia by building a new fab in the United States.

The fully depreciated fab in East Asia is no longer having to pay off that equipment in the five-year depreciation schedule, whereas you are in the US. And so all of a sudden, you might be two-to-one disadvantaged economically.

So in that scenario, if you want to help companies overcome that disadvantage by inviting greenfield investments, then you have to do something about the economics, and 25 percent just isn't going to do it in a lot of cases.

So we leaned into modernization of pretty much every semiconductor fab or site in the United States. I think we've received modernization applications from pretty much all of them, if not most of them.

And we liked those because all of a sudden now, then it's about modernization. So it might be some new tools, but the depreciation aspect of it, there's less pressure on that.

And so I think that's a really good thing for the buck. But if you really want to move the needle, then you have to think a little bit bigger.

That gets even more difficult when you consider that China is really just building out most of the mature node capacity that is being built out into the world right now. They seem to not care about the economics of it.

If you have a production place where the economics don't matter to them, and overproduction does not matter to them, and that's the case not only in semiconductors, but in other parts of the economy that we've seen, then how do you compete with that?



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You can consider trade restrictions. Those are tough to pull off. But on the supply side of it, it's the most predictable thing that a government can give to a producer to say, if you build that thing, then we can give you a financial runway here.

Unless that's present, I think it's just very difficult for you to have commitments to build large-scale manufacturing and mature-node production in the US.

TRADE RESTRICTIONS IN MATURE-NODE CHIPS

Chad Bown: Let's talk about import restrictions.

We've talked a lot about the Chips Act and subsidies, but it's certainly not the only policy the US government has been using in the chip space in the last six to eight years. Start with trade restrictions for mature-node chips. What's the story there?

Dan Kim: I don't see universal support for a tariff in the industry right now, even for mature-node chips, partly because the users of semiconductors, your automotive manufacturers, your medical devices, any kind of tariff increases their bill of materials costs directly, and so I can understand why they're not a fan of it.

But my prediction is that in the next five years or so, when the Chinese economy, their downstream economy from their semiconductor production has absorbed all of the production capacity that China has to offer, it's not quite there yet, but I think it's starting to sort of reach saturation.

In the next five years, when that excess capacity then gets exported out for very cheap around the world, including here in the United States, then I think that tune is going to change quite a bit. That is my prediction of it. In the next five years, there will be a clamoring of protectionism against flooding of mature node production from China.

And I think we'll look back at that time to say, maybe we should have done something about it a bit earlier.

Just as we say the same thing about solar panels, about printed circuit board manufacturing, and other things that we say, the best time would have been to fix it when we actually had some manufacturing back then to protect. Now you protect it, who's going to come back? I think you're going to have similar discussions.



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You can't rewind the clock. And there's only so much effectiveness that those measures can have. Once an industry has completely fled, it just takes time. And then you have to commit to protecting that industry indefinitely in order for that to come back.

Especially if you think it's really critical for national security. And mature-node production of semiconductors is absolutely critical for national security. Most of the stuff that's in our missile systems, in our defense systems, they're all mature node, pretty much. And so unless we have a robust manufacturing ecosystem around that, it's just really hard to keep it going.

Chad Bown: So how would you strike the right balance? This is going to be unpopular with the using industry. Suppose we did something right now.

But how would you structure it to ease the burden on them, but also to sustain a mature-node manufacturing base in the United States?

Dan Kim: First, I think I would ensure or at least encourage transparency. BIS did a survey not too long ago, asking companies of their awareness of Chinese mature-node chips and their systems.

And these are companies that are fairly close to the semiconductor industry, if not chip makers themselves. A surprising number of companies were just simply not aware of how much was in there.

These are 10-cent or one dollar pieces, really, that are often distributed not directly from the manufacturer, but through distributors, you just get it. Often tier two, or tier three suppliers are in charge of it, not you.

And so the awareness of it just was very shallow. And so even if you were to ask companies what would be the impact, I don't think they could really tell you. And so gradually increasing the awareness of it I think is the first step.

I have a unique view now because TechInsights, we have the most extensive building materials database in the market. So we actually can tell you how much Chinese made chips are in our systems, in our smartphones and whatever else. There is quite a bit.

And if you give enough lead time, supply chain managers can adjust. And so I don't think it's something that you announce and say, this needs to be implemented tomorrow. But I think it is something you need to signal.



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And I know that, at the moment, it might seem alien for government to say, let's have a measured, phased-in approach when it comes to tariffs, really consider the impacts and implement it over time with the support of our allies, with consultation with the industry, with a recognized problem and to stick by it. We're sort of in a mode of I guess tariffs go up when there is a post from the president era. So it can't be like that.

But I think understanding the exposure, gradually increasing the transparency of it, either through encouragement or through requirements, and then going from there, I think, is probably the best way to do it.

Chad Bown: So that would be a rational argument for a US tariff to incentivize supply chain managers to think about sourcing their mature node chips out of China in ways that might sustain production elsewhere, including potentially in the United States.

So in September and October of 2025, there was this moment where the United States decided to expand the coverage of its export control regime, to now include subsidiaries of companies that were already on the entity list.

This caught up a company called Nexperia, and it turns out that Nexperia makes a lot of mature node chips, especially ones that are important for the automobile sector.

The Dutch government ousted the CEO of the Dutch subsidiary of this company, and then the Chinese government got unhappy and banned Nexperia's chips exports to the world.

Suddenly, the automobile sector's production was almost nearly shut down worldwide because they couldn't access these chips anymore.

So was that a wake-up call for users of these chips like these car companies? Have you seen any change in their chip sourcing behavior since that experience?

Dan Kim: I think it was a wake-up call, but I have not seen any change in behavior.

And I think maybe we'll look back at this era and say there were a lot of risks, but because there are so many risks that companies didn't quite know what to do with those risks.

So, yes, automotive chips are very important for automotive manufacturing, but there are substitutes. If you give it enough time, there are other substitutes that could take place from Nexperia.



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This is not a comparison to TSMC making the most advanced node that no one else could possibly do at the scale of the costs or the yield that they do. That's not the case here. This is not highly sophisticated manufacturing. The economics is different. If you give enough economic signals for their competitors, they could come in and fill it with enough lead time, and supply chain managers can deal with it.

And it's not just automotive manufacturing, by the way. We went back at TechInsights and found next period chips in smartphones and in AI data center servers. For example, we found a super micro data center server that obviously the Nvidia and the HBMs are highest value that made up for most of the bill of materials costing there. We counted about 15 Nexperia chips in that server, all adding up to about a dollar. But the server does not function without those Nexperia chips. So it turns out if we're talking about asymmetric impacts, this is it.

Again, if you give it enough time, supply chain managers can figure it out. But China can threaten to say, no, and then the impact is immediate, right? Because there's not enough time to adjust.

I think economics is about substitution and tradeoffs and time costs, and that's what we're seeing. So it is a wake-up call. I am not personally seeing a huge amount of change as a result of it yet.

Chad Bown: But if we don't see any behavioral change happening on its own, that's where policy comes in.

And policy makers need to create the financial and economic incentives for supply chain managers to make alternative decisions if they're not willing to make it because the underlying economics, in the absence of that, don't cause them to.

EXPORT CONTROLS AND THEIR IMPACT ON U.S. SEMICONDUCTOR FIRMS

Chad Bown: Let's talk a bit more about export controls and the semiconductor odyssey there. US export controls in the chip sector really got going back in 2019 with restrictions on chips sent to Huawei.

At the time, the US government was concerned with Huawei's 5G telecommunications equipment, so base stations and things like that. And the government restricted exports of high-end chips to the company.

But Huawei also made smartphones. You worked at Qualcomm at the time, and American chip companies suddenly were at risk of not being able to sell to Chinese smartphone companies.



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What do policymakers need to better understand about American companies when they design these sorts of export controls?

Dan Kim: Well, that the costs are real, and they should be taken seriously.

I've had more than one conversation where when the companies present, these are the kind of revenue hits that we're taking because of the export bans or whatever, and these are the kind of costs on R&D and things like that, presented to them, government officials will listen, and then after the meeting, they would turn to me or others and say but they had a really good quarter, though. Look at the record amount of revenue they're making in China or whatever. And I understand that, but it's an actual serious thing for companies. That's an actual loss, and they have to plan around it.

So when I was in Qualcomm, for example, if there was ever a national champion in like communications technologies, it's Qualcomm, at least one of them, an absolute pioneer in inventing new things that we use every day and take for granted.

When Huawei was being put on the entity list, and there were considerations of other handset makers, other smartphone makers being placed on the entities list, like Oppo, Vivo, Xiaomi, these other Chinese handset makers, with the idea that they're somehow all connected to the Chinese military, and I respect all those opinions, but the reality for the companies that are selling these chipsets was, if half the handsets being sold into the world are by Chinese smartphone makers, then that's an extremely big risk that you're facing now for the revenue that you use for your next set of inventions. I think that cannot be underestimated that these revenue loss impacts are real and should not just be dismissed. Now, sometimes when you see evasion of some of these rules, that's not what I mean by that.

So that was really interesting to observe, as to how to wrap your minds around what are the risks here. And the fact that when there is a foreign competitor that are not under those restrictions, then all of a sudden they now have market access, preferred market access in the Chinese market that you no longer have. And that's a real hit to you as well. And that's real. I wouldn't dismiss that.

Chad Bown: In October 2022, the US government expanded its export controls to cover equipment that companies in China needed to manufacture chips.

The concern was Chinese companies getting the best equipment to manufacture AI chips used by the Chinese military. This was the start of the so-called "small yard, high fence" policy.



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You were based in Washington for SK Hynix at that time, and your company operated facilities in China to make other kinds of chips. Your company also imported this equipment and needed to send workers from your suppliers in to constantly service it.

With this sudden new October export controls, your company needed a legal exception, a license. Did you meet with US policy makers? What happened?

Dan Kim: I remember being pulled into, and I was at the company at the time, and because I was located in Washington, I got pulled into this meeting, and they had assured us that this would not be impactful for us.

And then as I was playing with my daughter in the playground that weekend, I got a call from one of our suppliers saying, hey, do you realize that you need a license for us to continue operating here?

And I said, no. They told us, they assured us, this does not apply to us and that we were exempted. And they said, no, our legal guidance is, unless you show us a license, we have to walk out.

And so the company was all of a sudden facing the situation where if they walk out, we might have to shut down production. And that's potential billions of dollars of lost revenue. What do we do?

And so that led to frantic calls and, credit to the government, they got put into action and they granted us the license or the exemption right away because it was not intended as such. The license requirement was about Chinese companies operating in China, not multinationals at the time.

It is worthwhile noting that, like, there are obviously efforts to do this, and there's always, like, discussions about these loopholes and how they're exploited.

But there are also very earnest companies that are trying to do the right thing that sometimes are impacted negatively by it. You don't see them really complaining about it, and rightly so, because they are companies that are genuinely interested in being aligned to US national security positions, and they want to help, not get in the way, in a lot of cases.

But, my goodness, it was sometimes very messy to be in the middle of that from time to time, from the corporate side.



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Chad Bown: One argument that you often hear is that for every round of these export restrictions that the US government has imposed, all it's done is incentivize China to do more, to try to break the dominance that the American and the Western tech ecosystem has, especially for chips that are needed for AI. What's your sense of that?

Dan Kim: So, I buy it, but I also don't buy it to some degree.

China has made it very clear that they want to be self-sufficient in this sector, and they're plowing so much money into it, and they're putting all of its resources possible to do that towards a self-sufficiency drive, that measures that the United States or others can take to curb that, I don't think is really deterring them to not have that desire on principle.

At the same time, it is the case that they have to force themselves to innovate in ways that they otherwise would not.

So, we found, for example, in the latest Huawei smartphone, SMIC's manufacturing capacity at, say, about 6 nanometers, this is their N plus 3 node, really innovative multi-patterning of lithography that otherwise they would never have to do if they had access to EUV equipment, for example. So, it is actually forcing them to innovate in ways that they otherwise would not. So maybe they get better at some things than the US because they're forced to.

Maybe they're forced to come up with more efficient AI models because they're constrained in compute. And we're seeing that happen in real time.

But you do also see examples, though, of where if something is available in China that is not Chinese, there is actually huge preference for non-Chinese technology.

So, for example, if you crack open a Huawei phone, which is not allowed to have American technology in them, you actually find very, very little American technology there.

But if you open up a Chinese-made smartphone that is allowed to have American technology, then it ends up being mostly American technology because they also have to compete in the global market space. And Chinese goods are not as competitive, and so they would prefer to have a better one or a cheaper one.

It's important to keep in mind that the government wants to be self-sufficient, but the Chinese industry may not. And they vote with their feet as well to the degree that they're allowed to. So I think we just have to always keep that in mind.



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Chad Bown: Dan, this has been fantastic. Thank you very much.

Dan Kim: Thank you. Really appreciate it, Chad.

GOODBYE FOR NOW

Chad Bown: And that is all for *Trade Talks*. A huge thanks to Dan Kim at TechInsights and former Chief Economist at the CHIPS program office.

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Please order a copy of my new book titled, *How to Win a Trade War*. It's out in May. That is, *How to Win a Trade War*.

See you next week, everybody.