THE BROOKINGS INSTITUTION

FALK AUDITORIUM

THE FUTURE OF THE US-CHINA COMPETITION FOR HUMAN CAPITAL

WASHINGTON, D.C.

Tuesday, January 10, 2023

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Ryan Hass [00:10:15] Good morning. My name is Ryan Hass. I'm a senior fellow here at the Brookings Institution, and it's my pleasure to welcome you in person, as well as our global audience joining virtually, to this joint Brookings-CSIS event on the future of US-China competition for human capital. We are immensely pleased to be joined today by some of the world's leading experts on competition for talent between the United States and China. In a moment, you'll hear from Jude Blanchette, the Freeman chair in China studies at CSIS, as well as our panelists. But first, let me briefly try to situate today's conversation within the broader examination that Jude and I have been conducting over the past year on this subject.

When Jude and I launched the Vying for Talent Project last March, we were guided by a hypothesis that much of the competition between the United States and China would turn on technological innovation. Innovation is driven by talented individuals, and the country that best attracts and cultivates top talent will gain an edge in overall competition. To test this hypothesis, we began by conducting a survey of China's human talent landscape, both strengths as well as its shortcomings. We met with dozens of experts, we hosted four public events, and we launched a podcast series to dive deeply into discussion with some of the leading actors in this space. It's been a pretty rich learning journey for us. We've heard from a billionaire founder of the world's leading semiconductor manufacturer, the deputy secretary of defense, the deputy chief of the US Space Force, a former Nobel laureate and leading thinkers from the academy. And you can find links to all these podcast and events by searching Vying for Talent on the Internet. And today, our goal is to bring a lot of this learning together with this panel conversation to examine both countries talent profiles side by side.

I'm going to turn the floor over to Jude in a moment, but— to, to briefly introduce the panelists and moderate our conversation— but before I do so, just a few quick housekeeping notes. If you would like to submit a question online, you can email it to events at Brookings dot edu or via Twitter at hashtag vying for talent. If you're here with us in the audience, please just wait to receive a microphone before you launch into your questions to this panel. And secondly, I would like to thank Chubb Insurance for their financial backing and support for our research independence as we've gone through this, this journey. I will now pass the baton to Jude, who will lead our panel discussion.

Jude Blanchette [00:23:16] Thanks, Ryan, and thanks, everyone for joining and really excited for this conversation. Ryan and I were trying to think as a capstone, how would we create an X-Men force that could cover the full spectrum of these issues? And, and I'm really excited to say

we've done that. The point of this conversation today is just to try to, as Ryan said, synthesize by looking at developments in China, challenges, strengths, look here in the United States and try to come up with some top line conclusions about where the United States is doing well and should buttress and support where we're falling behind and really need to put our shoulder into taking more aggressive actions and more aggressive investments.

So down to my far left, Matt Turpin, I think everyone knows as one of the bomb throwers of the US-China relationship and helping to keep all of us honest here. Matt spent a couple of years at the NSC before that was at the Department of Defense, and now since leaving government is at the Hoover Institution, where he's a visiting fellow and then senior advisor at Palantir.

Yasheng in the center here is at MIT, where he's the Epoch Foundation professor of international management. And I think for anyone who's been reading about China, China's economic reform progress and just trying to think clearly about China's, the growth of the Chinese and development of the Chinese state, the trajectory of Chinese reform, Yasheng has been a necessary voice and really excited to have him here today because MIT, I think is at the cutting edge of trying to think about how higher education institutions can remain innovative bastions of critical thinking and learning and remain engaged, engaged with China. So we're going to ask him a bit about that.

And then, Amy, to my immediate left, has, as of just a few days ago, left the White House where she was working on a lot of the issues we're going to talk about today and thinking about how did the United States find authorities to increase STEM immigration, how does that buttress our national competitiveness? And she is now moving on to take up a role at Cornell University, but based here in D.C., where she'll be continuing to push forward in our, our, our thinking on STEM immigration.

So what I thought I'd do is I'm first just going to ask a general framing question of Amy immediately, but then want to open it up to Yasheng and Matt, which is coming out of your, your role, you've been in the weeds thinking about national competitiveness and where does STEM immigration play a role in that. But if I can ask you to sort of pull up a few feet in elevation, you look across U.S. national competitiveness and the role that talent plays in it. What is your top line thought having just left the administration on what are our strengths? What are we really doing well, and I think critically, what are our shortcomings and where are the areas you felt like there's for you unfinished, unfinished business?

Amy Nice [00:26:27] Well, thank you. It's very nice to be here and to talk with all of you and to have this important conversation. I think that the United States, you know, continues to have this with CSIS and others call an asymmetric advantage because, you know, we are still an open society. And the science and engineering enterprise is an international exchange of ideas. And people still want to come here and still want to contribute and us to our country, but also are looking for opportunity. We still offer opportunity. We have a strength in that we have a high number of clusters of science and technology, intense, intense science and technology activity distributed broadly across our country. It's not just in the big, major cities. And we have a, we have a, a, a innate ability across our country to still be a place that is welcoming.

I know that there's been a lot of promote versus protect challenges and there will continue to be so. But we have some tools in our toolbox that we haven't been using as much as we could with regard to talent and with regard to encouraging, attracting talent to come to our country. So I think doing a better job of explaining to industry, to academia and to individual scholars, students and experts what these tools are that are actually at our fingertips today that we have not been using to attract and retain STEM talent is a big goal of mine, as we, as I move forward and I think that's both a strength and a weakness because there are tools, but we're all kind of used to our immigration system being dysfunctional, and it's hard to imagine that we actually have tools that we could use. But there are some and we should use them, and we need to use them more aggressively and more confidently.

And, you know, I think a sort of fundamental weakness, obviously, is that when you look at numbers, I put that in quotes, just because everybody wants, that, that's a measure that we all use, our immigration system was last updated with regard to numbers in 1990, and it's not really a bright prospect that Congress is going to update those numbers any time soon. So this idea of there's, there's a translation issue of what are the tools in our toolboxes that could actually address some of these weaknesses, because the existing law actually allows more numbers in certain nooks and crannies. But it's going to be a challenge to actually, from an immigration standpoint, think that there are realistic pathways anytime in the foreseeable future where the, the strong policy arguments for why we need in— across our country, across the science and engineering ecosystem— more permission for more individuals to remain in our country is, even when those strong arguments are made and we've tried to change the conversation, to make those connected, to make the connection

between talent and our national security, that there's strong forces in play that are going to be unlikely to relent and allow those changes to be made.

And the last thing I'll say about a weakness is that I think that it's clear that across our country there's a lot more that can be done with regard to underserved and underrepresented communities in the education system, you know, throughout the K through 12 environment and tapping into the potential that our domestic workforce has. But these are complementary efforts to the fact that we also need more advanced STEM degree talent in our country, these are not mutually exclusive pursuits, they are things that have to be done together. And so a weakness is that a lot of times people see those as alternatives. And I think we need to do both at the same time.

Jude Blanchette [00:31:03] So, Amy, I want to, I'll come back around to a few follow up questions on this precise issue, but maybe Yasheng if I can move to you now from your perch at one of the world's premier STEM research institutions and you focusing on, on the US-China relationship and understanding both systems deeply from your personal professional hat looking at this issue of what is the United States doing well to develop, cultivate and keep talent in your world, what are we doing, what are we doing well, and where do you see the shortcomings?

Yasheng Huang [00:31:37] Yeah, so I agree with Amy that the U.S. has this incredible edge over any country in the world in terms of producing frontier research. There have been difficulties and policy shocks to that system. The China initiative under the Trump administration, and it is to the great credit of the Obama, Biden administration that they terminated the, actually that a lot of the some of the things going after the Chinese scientists started under Obama. So let's just be clear on that. And so the Biden administration terminated the Chinese initiative. If we can come up with a sensible solution to balance the national security imperative and the imperative and the recognition that science for one thing is open is fundamental, is about disclosure.

So the China initiative was designed to catch Chinese economic espionage and trade secrets. In academia, there's really no secret to talk about. You know, MIT has a Lincoln lab and that has a national security clearance. I cannot go there. And one of our former vice president for my team, who is a, he, he left MIT, he, he was foreign born. He was running the finance of America; he couldn't get there. So there are national security carve out. And our system has a way of separating fundamental research from classified research. There's also export controls, mechanisms in place, and there's closure. So I'm not saying that the current system is adequate in terms of addressing this balance

between national security imperative and the fact that we have so many foreign researchers working at American universities and many of them came from China. So I don't think we're there in terms of coming out with the, with, with a, with a way to address this issue. They're under, even though China initiative has been terminated, I know for a fact there are still investigations of Chinese American scientists.

At a recent overseas conference— there were many Chinese American scientists who attended this conference— they came back from this foreign country, and this is, we're talking about recent, two months ago, maybe three months ago, every single one of these Chinese American scientists were stopped by the customs for a long period of time, whereas other members of the delegation went through customs without problems. So every single, it's pure ethnicity. And professor, Charles Lieber at Harvard was found guilty for disclosure issues. You know, there are technical issues, there are legal issues. But one of the IPI agents who testified at his trial said without apology that they began to pay attention to him because every single one of his post-docs was Chinese. So that was the information on which they based their decision. So and there are other notorious cases going after Chinese American scientists.

I sometimes joke with my friends and colleagues and, because China's a very repressive country, right. But what's interesting about China is that they make a special carve out for science. In China, you can actually do scientific experiments that you cannot possibly do in the Western country. For privacy, ethical issues. CRISPR is one of the examples, right, genetic editing. A Chinese professor just went ahead, edited the genes of a, of, of twin girls, and you would never be able to do something like this in the United States. I'm not saying this is good. This is actually very bad. I'm just saying that when we say China, China's a very repressive society restricting freedom of speech. That's absolutely true. But they make a carve out for science and technology that has its own problems. But we need to recognize that fact. So that's where my joke comes in. I said, in the U.S., natural scientists get arrested. In China, social scientists get arrested. So essentially, it's a kind of a nice division of labor between the two countries, and that's just not a viable way to go.

I, apart from my day job at MIT, I'm also founding president of a organization called the Asian American Scholar Forum. We are trying to do more research on this. We did a large-scale survey research on Fear Factor and the finding there is really, really shocking. You know, even though 89% of the people that were surveyed want to contribute to America and to contribute to science, scientific

activities in the U.S., you know, some something like 60 to 70% of them fear for their career, fear for their life. Some 40 plus percent of the researchers do not want to apply for federal grants. Right. So we, and this is after the China initiative has been terminated. We got to address this issue. We're killing ourselves if we do something like this. And, you know, I don't have a solution. And I think we need to gather the minds and gather the ideas from society, from scientific community. But this is a serious, serious issue.

Amy Nice [00:38:34] Jude, if I could just add one other thing to the points that, your very important points that you're explaining. In the end of 2021, October 2021, the Science and Technology Policy Institute, STPI, did a study on just the economic costs and benefits of foreign STEM talent in America trying to figure out a way to your point to measure what is the real risk here?

Of course, there's concerns that the risks aren't just economic, but I think it's a useful report to sort of frame that when you look at the costs and benefits, the risks of, the value of looking at just the risk of there's Chinese scholars in somebody's laboratory are always outweighed by the benefits. And it's like a distraction in some ways to continue to focus our attention in that way. I think that it's the first report that I've seen where there's been an effort to try to quantify what does that really mean, but something that's worth looking at.

Jude Blanchette [00:39:49] So the, and as is the case, when you try to centrally plan how a conversation will go, I'm going to course correct here, maybe Matt, I was originally going to put the security openness tension at the back end of the conversation, but it feels like we're planting those roots now, so why don't I go with it and I'll, Matt, that's some other question I wanted to ask you, but maybe now I'll bring the security one forward. You know, you've been working in national security. You're, you know, most of your young career and you've been thinking hard about this issue, working at a technology firm now, where, of course, innovation is dependent on access to talent, but also thinking about how do we innovate, create the ecosystem for innovation, but make sure that we're protecting national security.

So if I can just lob the question over to you, either building off of your thoughts or reactions to what's been said here, or your own framework for thinking about this hard challenge of making sure you know, immigrants and everyone in the United States who's here legally feels safe, but also recognizing that we've got a tough challenge of protecting national assets from, you know, from espionage and other, other national security challenges.

Matthew Turpin [00:41:04] Yeah. So thanks, thanks, Jude. I mean, I really appreciate being here. And certainly it's good to be back and sort of face-to-face kind of events again. So, I mean, I think what we've witnessed over the last few years is an effort to sort of rebalance kind of where we had been. Right. So my hat's off to M.I.T. in the last kind of, I think last two months in publishing the guidelines, you know, after conducting a study as within the institution about what it needed to be able to do to rethink about balancing this sort of, of continued openness and ability to accept folks from around the world into the institution and to do that, but also to think very deeply about the kinds of ways in which an authoritarian regime seeks to take advantage of open societies in order to gain benefits that fundamentally undermine the interests that sort of we all share. And that that's, that requires a balance. And so, you know, my hats off to MIT for, for addressing that head on and putting out policies.

It's, I think what, what certainly, you know, going back a number of years from my time of starting to look at these issues back sort of in the late Obama administration, through the Trump administration, it was what we were asking of the academic community. And it's good to see that that's happening. Yeah, I would, I would note that the University of California system, starting in the spring of 2019, was one of the first institutions to do this across their ten campuses, five medical centers and their national lab to institute Janet Napolitano instituting a sort of a, you know, a set of policies around looking at this very deeply. And so the University of California system has been leading this and being able to do sort of audits of whether or not they thought that what was happening inside their own institution was appropriate and whether or not they were being good, you know, that they were safeguarding the interests of, of, of taxpayer grants for research and development and whether that was fulfilling their things.

And so, you know, while I, I understand sort of this, sort of look at, you know, some of the the cases that have come forward as being technicalities, I think fraud and untruthfulness in, in, in research is not a technicality. There's a trust that comes from the enormous expenditures by US taxpayers in terms of research and development inside or in educational institutions, that that was fundamentally a real problem where I think we found that there was a number of problematic behaviors going on. And it's good to see that universities are taking, are taking a real stand to sort of correct some of those internal processes. Um, I agree with Amy that attractiveness and promotion is

the thing that we should be accentuating over protect and restrictions. Right. And I think fundamentally our system still remains where that is the overarching emphasis.

I understand, you know, there are plenty of folks that see that that the other side is far more accentuated. But I don't think the evidence sort of bears that out. I still see enormous numbers of students seeking to come here, and it has to do with the opportunities that are available, even as our institutions and government and government entities seek to balance out some of the things that have kind of gotten out of whack for a, for a period of time. So I'm, I'm generally optimistic of the sort of the path that we're on. So, you know, I think, you know, weighing sort of how do you, how do you weigh security and restrictions versus the benefits of the openness, I think fundamentally our benefits come from that open access and the ability for folks to pursue their own ends, and that there isn't particular amounts of direction in how that happens, because we can't predict what's going to come out and what's going to be most important.

So I think from a— if I were to put on my sort of my, my industry hat— it, it is extremely hard for us to predict what we're going to need five, ten, 15 years down the road. Right. Which is when folks are going to enter into the, the, the sort of, the train to be able to get these vast degrees. We need as broad a system as possible with as many options as possible. And then we'll find that we've got the talent that's available to us. And so I think from that perspective, it's important for the US to kind of keep doing what it's been doing, even as it accounts for some of the things that the Chinese government, which I think, I think one of the things that we should keep in mind is that the China initiative was really around directing the resources, the Department of Justice, around the things that the Chinese government was doing to undermine U.S. interests, not solely around academic espionage, which I think is a, is a misnomer. Because in fact, many of the things that they brought forward in that initiative were about all the things that the Chinese government did operating inside the United States that violated US laws. Right. And that's, that was the, if you go back and look at how it was announced, speeches given around it, that's what it was meant to do. What got the most attention was the academic aspects of it.

Jude Blanchette [00:47:01] I feel like we could have, this is a really important issue and I want to move on, but not because we've plumbed the depths of this, because I think this is a really important, it has to be an ongoing discussion. But I just there's a few other things I want to make sure we get through in the short amount of time we have. So Matt if I can actually try to pivot off of

something you just said about, we don't know what we need ten years from now, and that's one of the advantages of the United States system, is you want to create an open platform where talented individuals can come think of the next, you know, the next Palantir, the next Google. And hopefully now if I can make a clumsy segue, the next TSMC, as we try to build out, you know, our own expand and create resiliency in the semiconductor industry.

So, so let me now use that as a thought experiment as a way to stress test how we how we develop and cultivate talent. It's been interesting in discussions with, with companies, foreign companies and U.S. companies that are trying to think about following the signals being sent by the U.S. government on, on semiconductors. You realize how you've got a whole ecosystem you need to build here, and talent is critical to that. So, you know, Amy, if I can ask you, the immigration issue is if you just read the headlines, it's pretty much a southern border issue. Right? And it's made it hard for some of these targeted discussions on, on immigration to break through. Just thinking about this from a pure national competitiveness lens, why is STEM immigration so important? If we're thinking about building out a semiconductor industry or anything else we want to do, I would have a top line sense that we're doing pretty well. People still want to come here. You know, you look at the CEOs or founders of most of our big technology companies, it would seem to affirm that we're doing fine. People are coming in. Where do you see having been in the trenches here, where's the delta between where we could be and what we need to be doing better? And if you can just articulate the case for why STEM is so critical, expansive, expanding immigration is critical from your lens in terms of national competitiveness.

Amy Nice [00:49:08] Well, over the many decades that the National Science Foundation has kept track of how research and develop, STEM research and development in America is funded, there's been quite a shift from US government funding to industry funding with regard to applied and experimental activities. So one of the fundamental reasons why we must have more STEM talent at the advanced, at the master’s and Ph.D. levels is that 90% of all STEM experimental development in our country is funded by and conducted by companies today, and 60% of all STEM applied research is funded by and conducted by companies in our country today. Those percentages are quite different as they compare to other countries in the globe, around the globe.

So we have A, a need for a lot more collaboration between industry and academia and B, a lot of critical need for advanced STEM talent in industry. And it might sound like we're doing well, or I

guess, you know, overall we like to all think that we're doing well in our you know, in our country, we're a nation of immigrants and all that, but we do not provide sufficient certainty and predictability for the very people that we want to attract and retain. That in itself, providing more certainty and predictability is a barrier.

One of the thing— getting back to my theme about we have tools in our toolbox— one of the things that's important is that if the various companies that we want to be our representatives in changing industrial policy in the United States of America, in the semiconductor world, have hundreds of jobs that need to be filled, that are these advanced STEM degree positions and thousands of jobs that are going to need to be filled at the technician level, they're not look, those companies are not looking to the immigration system with regard to the technician level jobs, some of which will be filled by people with bachelor's degrees. But they know that they have domestic American workers, whether they're recent immigrants or native born. They have domestic workers they can train to do those things.

But there's not enough, we have this whole pool of international students that our colleagues have been referring to who are here, but a lot of those in these graduate programs across the country, approximately 50% of all master’s and Ph.D. programs across STEM fields are international students, they don't know how to maneuver through this system. And they know from experience with their professors and colleagues that it seems like a random process, and we have to do a lot better job of providing that certainty of predictability, which thankfully we can do without Congress. And the executive branch can do a lot better in providing information about what these pathways are and providing information that policy guidance that makes a connection to immigration being in our national interest. And if you can show that you're doing work in a field that is a critical and emerging technology field, that you have this pathway or that pathway.

One thing that U.S. Citizenship and Immigration Services tried to do last year is set up a new, for example, official government microsite on their public facing website that says for international STEM students, here are the different categories and pathways that are available to you. Of course, it's a government agency, so they can't actually tell you, you know, the fine print and, you know, on page seven, you do this and all these other steps are available, but I think there a effort in, I think there's an effort underway to try to be more clear and to provide more consistency in adjudications.

So that, I know I know you want me to be at the top level and I'm going down to the details again, but I think that a lot of the reality is in order to, stem talent is important and critical, and international STEM talent is important and critical because industry needs it and industry needs it for their activities and also for this increasing collaboration between industry and academia that is key to applying the foundational and basic research to whatever the next event is. As Matt and his company and others are focusing on. And I think there's things that can be done that relate to these nooks and crannies in our immigration system to try to provide that sort of additional level of certainty and predictability in that area.

Jude Blanchette [00:54:19] Not only because I think it segues nicely, can I ask you as someone, you know, just coming from the policy world and now in industry, I guess kind of two questions. One, just building off of, of Amy's and you're both within the firm and as you talk to other tech companies, how are they thinking about where the workforce is now and what, what are the, you know, what are the upskillings or reskillings that a company like Palantir or others— I don't want to make you speak on behalf of Palantir— that others see as critical gaps. And then just a second one is what's the state of industry, government discussion and discourse on this? Are you happy now that you've, you know, you've, you've had your feet in both camps? Are you happy with the extent of and the maturity of the conversations, or do you still feel like there's a delta that we need to close in how industry and government are thinking about this issue of workforce and talent?

Matthew Turpin [00:55:13] Yeah, so I'm in the software industry, as a company, we're a software company and there isn't a better place in the world to be to find the best talent than other than the United States. And part of this has to do, I think, with, you know, because, you know, what you have is not a designed, centrally planned sort of system. You have a whole bunch of people that are really talented, making decisions about which path they take. Right. And so it shouldn't be surprising that when you have a strong software industry inside the United States, that you have a lot of great talent here, right? Because they sort of, it's a, it's a sort of a virtuous cycle. Right. You, and I have some familiarity with the semiconductor industry, but I'm not, I don't I don't mean to speak for it, but it's a mature industry. Okay.

So, I mean, this is, this is not, there are merging aspects to it, but the manufacturer of semiconductors is a mature industry. Right? It's an industry that the United States certainly started back in the 1960s. Right. And it has, it has gone through a period of diffusion out into the world that

it's in various other places. Right. And, and I think it is not, it has not been the area over the last few years where talent has been the most excited inside the United States, Right. Where they get to make choices about where they go into that they choose to go in that path. Right. And so there isn't, this this then becomes the sort of trade off. Right. Because your best talent has choices about it wants to go into and it goes to the things that either their friends think are the most, right or, you know, there's a, there's a series of signals that kind of go down that path. And so I think from, from my perspective or from my sort of industry's perspective, it's pretty darn good.

And we actually think that that this is actually a real competitive advantage for the United States. It's a competitive advantage that we sort of outmatch on anyone else. And while it's important to continue to have a bunch of other industries and you need to have those and we can make sort of adjustments in those areas, folks are going to respond to it based upon what they think the incentives are and what they think their future is. Right. I think it's absolutely critical, you know, Amy's points about for the semiconductor industry, I think it's— and this is what I've heard as I made trips to Taiwan and listened to semiconductor leaders— is that they saw that that their industry is really shaped by 50 people in many cases. Right. These are the folks who are going to set up fabs. They're going to put in new processes.

It's, to me, it's very similar to what I would hear from the most advanced jet engine manufacturers, Pratt and Whitney, General Electric, Rolls Royce. Right. That the real skill was about a tiny handful of individuals who are highly, highly skilled. Most of them all came out of educational institutions inside the United States. And then they essentially entered a period of apprenticeship inside the companies, and they learned the real processes of a mature industry to be able to push it forward. And then they needed talent that had some technical talent, but largely at a bachelor's degree level to essentially run the, the, the processes that they had already set up. And I think that that is a, to me is a, it's indicative of a of a mature industry, I think, in in industries that are more emerging and that that haven't yet emerged, it's much more of a sort of a free for all. And you actually need more of that talent. And there's the outcomes like the, the potential rewards for folks that enter into that are potentially much higher. Right. Because you're not necessarily entering into what is essentially an end up, you know, a long education period and then a period of apprenticeship within an established industry for ten, 15, 20 years. You're potentially moving to the top very early on.

I think those dynamics are just important for us to keep in mind about how talent sort of perceives, how individuals perceive what they want to go into, and we should kind of keep that in mind and that it's going to be incredibly hard to design that at a national level other than let's make it as wide as possible so that a variety of industries can come about.

Jude Blanchette [00:59:47] Can I ask a quick follow up on that? I'm, it seems like one of the consensus here is just the value of a market-based open system. But I think we're also realizing that market-based open systems, when you allow the market to allocate resources from a national strategic perspective, sometimes the resources don't necessarily go where you—.

Matthew Turpin [01:00:08] Or you're in a competition with a, with another that seeks to, to, to make the market not work particularly well. Right. Which I think you know, is where we're at in a semiconductor sense. Right. So the actions that the administration and Congress has taken in terms of Chips Acts and other things is to correct what is largely a failure in the market of you've got an authoritarian regime that is seeking to divert those things in ways for their own ends. And you have to step in. I mean, you know, it, it shouldn't be a surprise that we've spent and conducted industrial policy around aerospace for 70 years. Right. It's a critical national security industry that you have to intervene on. And I think the same thing is going to play out. It is a balance that you're going to have to do.

Amy Nice [01:00:51] But Jude, sorry, if I could just—.

Jude Blanchette [01:00:52] Yeah, please.

Amy Nice [01:00:53] Add to your point and also to Matt's point and bring you back to immigration. When we talk about STEM PhDs and how facilitating the ability of more internationally born and educated or international STEM PhDs, whether educated abroad or here to be able to remain in our country. Over the last ten years, if you look at the census data, there's been a 100% increase across a variety of fields in hiring of STEM PhDs in for profit industry. If we now, overlaying that, have needs that we think are tied to our national security, we don't have the ability to attract and retain more people unless we find those nooks and crannies or provide more certainty and predictability, because the baseline is already there's more of that demand and supply. Anyway, I wanted to make that.

Jude Blanchette [01:01:58] That's a great point. Yeah, there's a lot on the table, so A, just want to give you a chance to react to anything you've heard and then we'll give you that chance, and then I have a targeted question for you afterwards.

Yasheng Huang [01:02:09] Yeah. So I think this idea that the mature industry vis-a-vis frontier industry and then firms respond to the market signals, I think that in the ballpark, these are the right way to think about this. But we shouldn't forget because typically we think about firms responding to a market, we say it's market because the firms make that decision not the government makes that decision, but the government makes a decision or makes a non-decision that has shaped the market. Right. So it's not just the, in the kind of the immediate conditions that firms face, it's also how the market has been shaped and principally by a lot of other things, technology, globalization, but also by by government. So what you see, it's very interesting.

So in Cambridge, Massachusetts, 30 years ago and 40 years ago, around MIT, Kendall Square. They were textile factories, electronics factories. Lowell, Massachusetts, as you know, a textile factory and electronics factory. So these industries typically move across countries rather than across regions. And is there a necessary economic logic? Probably not, right. So obviously, the cost base considerations are a big one. But if you have comparable skill sets in other parts of the United States with, you know, streamlined regulation, permitting less complicated permitting labor issues and all of that, those industries may not go all the way to Taiwan or go all the way to China. They may go to other parts of the United States. Right. So that ultimate condition is actually shaped by the decisions that the politicians have made in terms of how to organize the labor, how to organize the regulatory regime, how to invest or not invest in education, K-12, actually not just university education.

The other thing I want to say is that Matt is absolutely right. Software is, you know, this is the, this country is the best place to be. But if you look at the data scientists in the world, the U.S. has by far the most, you know, best data science, China is the second. The difference between the two is actually pretty big. But but China is like way ahead of other countries. So it's not like China is nobody. China is somebody, is not as somebody as US, it's near, right. And the other thing about data science is that if you look, at Open AI, you know, they publish their code very, very quickly. So essentially there's, in this industry, there's not a big what is known as a valley of death vis a vis semiconductor, vis a vis aerospace and other industries. So the knowledge suffuses actually pretty quickly in this industry, and it puts a lot of pressures on the most advanced data companies to come up with, you

know, the best algorithm, the best skills. So I would not bet against China in this, in this, in this area. China, I think has issues and struggles but I will not bet totally against China.

The other thing is that if you look at you know, semiconductor, it was invented in the United States, solar it was invented in the United States, wind turbine was investing in the United States. U.S. is extremely good at the upstream. It is not very good at downstream. Right. We can say that's market. I you know, again, going back to the first point I made, market itself is shaped by the by the politicians, by the by the policy making. There's really no reason why a country like the United States can only be good at upstream. Right. I mean, there's just, just no reason. So we need to think about how you are, China is very good at applying knowledge and scaling the industry, scaling invention. And in a perfect world, without geopolitical issues, human rights and all these issues, these are actually two kind of countries that should get married together. Right. So one is very good at inventing the other is very good at application. But, you know, the world is that we want to decouple the two. Then we have to think about the ways to make US not just good at upstream, but also good at downstream. And here our education system and the incentives are not helping us. Right.

So if you look at the STEM, STEM is a very broad field. But if you look at engineering, the best students go into what math is doing, data science. Right. AI. These are the most exciting things. But if you talk to TSMC, what they need is material scientists. What they need is hard tech engineers, factory engineers, factory technicians. And we are not doing a very good job at educating both the, at the factory end, and as well as at the top end. Right. So and no, actually, let me take it back. We're, we're, we're pretty good at educating at the top end. But almost all of the supply came from country that we want to decouple with. Right. So in terms of the human capital in that, so it creates this, you know, my colleague Gang Chen was arrested by FBI. Now he's in the material science. He's in battery. He's doing energy storage. In that area, China dominates the rest of the world in terms of human capital. So. So this is actually very advanced. This is not a mature industry. It is dominated in terms of research by the U.S. and within the U.S. is dominated by the Chinese American human capital and now has the security issue. So.

So those are the kind of struggles that, that we are faced with. And it is it is it is a, it requires, I think, the biggest mistake for us to think about why China has succeeded in solar and wind turbine is purely because of subsidy. There, there, there's a human capital base there. There's organizational architecture. There's a lot of other things that are in place that enable those industries to take off.

Jude Blanchette [01:09:14] But one quick interjection. I mean, I would, I mean, I, I concede to you that solar and wind has certainly been something that that that the PRC has succeeded in downstream. But I mean, in terms of manufacturing, those are kind of microscopic compared to an automobile industry, compared to a broader agricultural industry, compared to an aerospace industry where the United States still maintains a significant lead. So if we look at sort of other sectors, right, the United States still maintains quite a bit of lead, like we have a broad economy that conducts a number of those things. It is not as if we have essentially offloaded all of our manufacturing to the PRC. Right. I just, I want to put a little bit up, you know, a little caution around that. You know, solar and wind are certainly important and may be really important to us in the future, but it isn't as if those are the, the largest sort of shares of what we're doing.

Yasheng Huang [01:10:09] But, but what you just said is actually very important. They may be important for the future. Right. So where you're talking about climate change, we're talking about energy independence and things like that. So automobile industry, it's a great industry, I have a car, it's not going to solve the climate change problem. Right. So it is actually those industries that we care about in terms of energy independence, in terms of climate change, that we do not have a competitive edge in the downstream sector. They may be small in terms of a kind of employment and all of that, but in terms of the global share of the energy, solar is rising, another is nuclear. And the wind turbine hydro, those are small relative, but they are rising in terms of their energy production, right. So I you know, I think that's, that's, that's important for us to think about.

The other thing I want, sort of adjacent to that is about the government policy. If you look at the federal funding of R&D, so this is top tier research, US is very good at true areas in terms of concentration of funding, life science and data. All right. So US funding, historically speaking, has been very bimodal. Life science, I understand, because politicians want to live a long, long life and they don't want life science to be starved. Data, obviously very exciting. Other countries are more distributed in terms of their funding priorities. They also fund material science. They also fund electronics. This is actually the logic why, before the Trump administration, many American universities collaborated with Chinese universities, because American universities were not being funded in those areas outside of these two sectors, and they had to get funding from somewhere. It just so happened that China funds those industries, Singapore funds those industries, and Russia, Saudi Arabia. Right.

Amy Nice [01:12:23] I know you want to get to some questions, but I just want to say regarding to don't count China out and the United States is still leading in a variety of critical areas. Don't forget that data is very clear, the United States by far imports the most innovators. And China by far is the only, is the largest exporter, loser of innovators. And it may be true that, you know, cars aren't going to solve climate issues, but my son is working on his engineering Ph.D. that's all about how do you use assisted cruise control to better to, to a limit, to smooth out traffic so that we can reduce carbon emissions in cars by 10% globally. So I don't know if that's, there's no cutting edge there, but I think there's a lot of things that are related to innovation that, you know, aren't captured by specific industries.

Jude Blanchette [01:13:21] We've got 10 minutes left, and no this is great, I just initially, of course, in my head I had it with 50% talk about the US, 50% on China, and now we will do 90% or 50%— I can't do the math— we'll do most of it on the US and, and the remaining 10 minutes on China. But maybe, Matt, I want to go to you because the picture in my head of, of China's human capital strengths and weaknesses is pretty muddled right now. I think about the aggregate size of the human capital potential that China has. And there are these pocket stories of China, you know, showing as much innovative capacity and inventiveness as the world has ever seen. And as Yasheng indicated, you know, the applied component, the speed, the time to market is a, is a blink of an eye traditionally.

I wonder from your perch looking at this both within the US government now outside of it, what's your, what's your sort of elevator description of China's human capital position right now? They, they have the plans, we can see made in China 2025, I now question how they're utilizing and deploying human capital with a political system that seems to trip itself up as often as it succeeds. Loren Brandt had this really memorable line in a long paper he did about, you know, China is going to have the occasional Sputnik within a you know, within a galaxy of mediocrity. What's your, what's your assessment on the talent front in China and how it's doing and how it's utilizing it?

Matthew Turpin [01:14:54] Yeah, I share your, your muddled sort of outlook of, of where does this look? I guess, you know, my, my, my top line would be I wouldn't trade our position for theirs. You know, I, you know, I suspect they're going to be extremely motivated to, to make it look like everything is great and, and we're going to hear nothing but positive sort of outcomes. But I think we will continue to see that, that the system that the Chinese Communist Party has chose to

reimpose upon the PRC over the last decade does not produce the kinds of outcomes that I think we were all fairly amazed to see starting to emerge, you know, a decade, 15 years ago, right, in which the party allowed the Chinese people to achieve the kinds of outcomes that are very natural for the Chinese people to be able to achieve. Right. Like because they have enormous talents, drive, and just like people do across the world. And that that has been constrained and re-imposed and, and, and folks are forced to sort of move in the directions of what the party has laid out as being the objectives to achieve that that will continue to have harmful effects over the, over the long term.

And from our perspective, we should probably remain humble about our ability to protect the future. Right. Confident in the ability for us to be able to sort of keep an open society that that can organize and attract people to achieve outcomes, even if we can't predict what exactly those will be. Right. And that that's, that's, that's maybe our best sort of way to approach this. With the full knowledge that we actually do have to, you know, that when we see things that are, you know, that are in violation of, of kind of rules that we've set, that we take action to do those, but we be very mindful about our, our own biases and, and those sorts of things and allow for a justice system to be able to do that and, and correct when we, when we maybe take things too far. Right. So I think it's far more likely that we're going to be able to do that.

The other thing that kind of keeps me optimistic because I, I suspect that, that Beijing remains more concerned about the kinds of ideas that, that, that, that their innovators get infected with here being transplanted back into their system, than we are concerned about our system being undermined. Right. I think as long as that, that situation remains the same, that's a positive sort of outcome for us in terms of a long-term competition.

Jude Blanchette [01:17:46] Just something I was going to say earlier is thinking about China's talent programs, which of course, is one of the one of the concerns we have here. I've always thought of China's talent programs as an admission of failure on Beijing's part, and that's one of the reasons it needs to go out with its wallet to bring people back is the gravitational forces is—.

Matthew Turpin [01:18:04] In the opposite direction. Yeah.

Jude Blanchette [01:18:06] Yasheng, I want to turn to you. Stick with China for a moment. When we had a discussion recently around your, your forthcoming book, you had some pretty bracing comments on the outlook you have for China's innovative capacity given some of the political

constraints. I wonder if I can basically ask you to regurgitate that, because I thought it was quite cogent and bracing.

Yasheng Huang [01:18:24] Hopefully I'll remember what I said.

Jude Blanchette [01:18:27] It was good, it was good.

Yasheng Huang [01:18:28] On that note, I think that I agree with Matt. I wouldn't trade the United States for China, but I do believe that the country that can hurt China the most is China itself. So if you look at the data science, what is amazing about the U.S. is that traditionally it is universities that come up with the most advanced knowledge. But in data science, it is the companies, you know, open AI now, but also Google and others. In China, we have just witnessed the crackdown on some of the potential sources of data science advances such as Alibaba and Tencent, Alipay, those were the companies that came up with health codes very, very quickly in February of 2020 to deal with the outbreak of the virus. They came up with these codes in record time, in one week and two weeks, and now the government has, has cracked down on them. I mean, so if they had the potential to make advances in AI, I think that's the end of it. Right.

So and, and this is the problem with that system. The centralized nature of the system is such that it is the top leader who decides what is important, what is not important to him. He probably doesn't understand data science. He understands semiconductor. Right. So let's do some semiconductor. But, you know, in the future, AI may help the design of semiconductor.

In terms of your larger question, I'll be very quick. If you look at where China has got it right, it has got it right where the collaborations are the most advanced, right. So Huawei before 2018 had 130 American suppliers. They work with British companies; they were working with American companies. They made a lot of advances in 5G and other areas. Chinese universities, the best researchers are the collaborators with American researchers, with European researchers, with Japanese researchers. Now, Xi Jinping has cut or has undercut a lot of these ties, right, science is collaborative. Innovations are collaborative. You are, you say exactly the same thing about the U.S., right? So but China has gone way beyond what the equivalent of the China initiative did in the United States in terms of a requirement that you have to disclose information to the government in terms of examining the details of the collaboration, in terms of training abroad, in terms of funding the research activities abroad. They have done a lot of damage to that system.

And so I, I'm not optimistic. And, and by the way, I also think that if we don't get our act together, science as a whole also suffers by the fact that China has not, has gotten so many things wrong because so many human capital talents are being wasted in that country. So I would argue that we have an open science. When scientists go back to China, they enter into an area of dark science. So the disclosure is less, therefore, science as a whole benefits less.

Jude Blanchette [01:22:12] Amy, final thoughts? Benediction, closing remarks. We got a few minutes left. Anything I didn't ask you which you want to get on the record or any reactions to anything today? No problem if not, just want to give you, the let you do the mic drop.

Amy Nice [01:22:27] Oh, okay. I think that overall, we have a lot of, we continue to have a lot of opportunity in the United States to attract and retain international STEM talent. And I'm looking forward to being part of that world and continue to work on it.

Jude Blanchette [01:22:47] I mismanaged the clock, which means I didn't leave any time for human Q&A. But everyone here is findable if you had a burning question, and you could also tackle them before they are able to exit the room. So thanks to everyone for joining us virtually and here in person. And please join me in thanking our guests for a great discussion.