Peterson Institute for International Economics
Labor markets and structural transformation in times of change: AI and demographic shifts
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[00:05:22.37] - Adam S. Posen

Hello everyone, and welcome back to the Peterson Institute for International Economics. I'm Adam Posen, president of the institute, and it's my distinct pleasure on behalf of the combined very rich resources of the International Monetary Fund, the Organization for Economic Cooperation and Development, the World Bank, and the Peterson Institute to have you at the Annual Labor Markets Conference. We are particularly blessed with a rich set of speakers and papers today. We are confronting what are arguably the most important political, economic, and social issues facing us today. Which is how to manage labor markets and structural transformation taking place at the same time in a world of very steep demographic shifts. And while this is not the focus of the conference, obviously a world in which political legitimacy for technocrats and for migration flows are somewhat at risk. And so it is useful for us to bring together experts from around the world, from the 4 aforementioned institutions, but also academics and practitioners to this day-and-a-half, 2-day conference. Over the course of the conference, we're going to have sessions on demographics and labor market frictions, on AI and labor markets, a policy panel later today featuring Jason Furman of Harvard, Nikki Yarmouz of the Government of Greece and Signe Krogstrup of the Danish National Bank.

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But additionally, tomorrow we'll be having a session with chief economists and even better than chief economists at the— on the broad economic trends, including Stefano Scarpetta of the OECD, Bo Li of the IMF, and the newly appointed World Bank Chief Economist, my grad school classmate, Michael Kramer. So there is a lot of deep substance, a lot of policy talk informed by deep substance, and no shortage of issues to discuss. Again, I am grateful to my colleagues, Jacob Kirkegaard and Jed Kolko, who worked with colleagues from the OECD, the World Bank, and the IMF to put this event together. Later, we will be getting into research papers, but to start, we're fortunate to have with us today Gordon Hanson of Harvard University to give the opening keynote. And for that, I call upon one of the conference co-organizers, PIE Senior Fellow Jed Kolko, to give the introduction.

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Thank you.

[00:08:56.37] - Jed Kolko

Thanks, Adam. Let me add my welcome to everyone in the room and joining us virtually. It's a thrill to be here, and I'm delighted to introduce Gordon Hanson, who is going to be giving our keynote speech today and setting the stage for the rest of the next 2 days. So Gordon Hanson is the Peter Wertheim Professor in Urban Policy at the Harvard Kennedy School and Academic Dean for Strategy and Engagement at the Kennedy School. He's best known for research on the labor market consequences of globalization, including pioneering work on the China trade shock. His current research addresses the causes and consequences of regional job loss, the effectiveness of place-based policies, and the effect of— and how energy transition will affect local labor markets. His related work touches on immigration, globalization of production, and economic geography. As you have a sense from that description, his work covers a wide range of topics, particularly well suited for this conference that is bringing together multiple critical topics around AI, demographics, labor markets, and structural transformation. He will deliver his keynote, and then I will come back and join him up on the stage for discussion and to answer your questions.

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So think about what you would like to ask Gordon as you enjoy his keynote on place-based versus people-based policies.

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Thanks very much.

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Welcome, Gordon.

[00:10:41.30] - Gordon Hanson

Thank you, Jed, and thank you, Adam. And thanks to folks at the IMF, the OECD, and Peterson for having me. It's been a few years since I've been here. We had a little thing called COVID that got in the way of my DC travel. Delighted to be back. So what I'd like to talk to you about today is understanding what mechanisms do we have in place to deal with job loss. And this is going to be a descriptive analysis of how the US has dealt with major shocks. I'm going to focus

just on one, and that's the impacts of the Great Recession. And it's relevant for the topic of this conference because AI, as we're all very aware, is a potentially massive shock for the US economy, the global economy, for people everywhere. We don't know what the contours of that shock will look like. Will it be electrification? And so it plays out over decades. And so the impacts at a 50-year horizon are profound, but the impacts at an annual horizon are less so. Or will it operate like the forces that were behind manufacturing decline, in which what we had was massive job loss operating in the space of half a decade.

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If it's the latter, if AI hits hard and fast, then that disruption means we want to have the right policies in place to deal with the fallout from job loss and the need for folks to make transitions. The research I'm going to present to you today is work that's joint with Dani Rodrik and a team at Harvard Kennedy School, in which we spent the last 5 years just amassing as much data as we could on every type of policy that is relevant for dealing with local economic distress. The basic message I'm going to give you is we're not very prepared. The sets of policies we have, one group are what I'll call people-based policies. And that is entitlement programs, social insurance programs. Some of that is about dealing with insured risks. Some of it is about poverty alleviation. And then the other bucket is this grab bag of policies that I'll call place-based policies that are really about economic distress. That latter group targets distress very poorly. So what do we have in place to deal with AI? Essentially policies to deal with poverty alleviation. And we now need to be moving quickly if we want to be better positioned to deal with potentially massive shocks in the labor market.

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But that's the punchline. Getting ahead of myself. Let me show you how we get there. So I've spent a good chunk of my career thinking about regional adjustment to job loss. What we've learned from the impacts of globalization, automation, the global financial crisis, and energy transitions is that places and people that are exposed to those shocks experience scarring effects, experience massive disruption. Places that have been more exposed to large negative labor demand shocks experience reductions in wages and employment rates that lasted for at least a decade. The fallout from those adverse labor market consequences was a lingering spatial misallocation of resources as we had elevated joblessness, social dislocation, breakdown in family function, more children growing up in poverty, increased opioid use and deaths of despair, and then political polarization. And that's true in the US. It's true in Europe. Here's a map showing you the change in the employment-to-population ratio for prime-age men, age 25 to 54, without a university degree over the last quarter century. These are for US

commuting zones, which is kind of a now standard measure of local labor markets. And this is— the employment-to-population ratio is different than the unemployment rate.

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which we all know. The unemployment rate moves around and then settles back down to something like its natural rate. And that natural rate in the US today is shockingly low. We're at 4.1% unemployment right now. The employment-to-population ratio does its own thing because it also incorporates people who've exited the labor force. Over the last 25 years, this group, prime-age men without a BA degree, have seen their employment rate fall by 5.5%age points. 5.5%age points is a big deal. It's the same metric as the change in the unemployment rate. These are people who have pulled themselves out of the labor force. What you see on this map is this checkerboard pattern. There are places where the increase in joblessness— we've got about 25% of the US population living in places where the increase in non-college joblessness is above 10%age points, and about 15% of the population living in places where it's above 15 or 20%. What has also happened over the last 25 years is that the geography of joblessness for men is now replicated by the geography of joblessness for women. Now, that's a switch. Since the early 1960s, female labor force participation was increasing dramatically.

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That overall increase stagnated sometime in the 1990s and now has bifurcated. It continues to rise for women with a university degree, but it has fallen for women without a university degree, such that over the last 25 years, matching that 5.5%age point decline in the employment rate for non-college men, we've seen about a 3.5%age point decline in the employment rate for non-college women. Now, that non-college group was very exposed to the shocks of the last quarter century. They're exposed to the China shock. They're exposed to automation. They were also exposed to the Great Recession because the Great Recession hit manufacturing and construction very hard. What will AI do? If I talk to my labor economist friends, there seems to be a fair amount of unanimity in the sense that we don't know what AI is going to mean for the economy. So there you read the press on a weekly basis. One week we're obsessed about recent college grads not being able to find jobs. Then we're obsessed with lawyers and we're obsessed with accountants. And the focus of our concern keeps migrating. The issue for policy that's relevant to what I'll talk about today is that if there is a strong spatial dimension to that shock, what the past 25 years have taught us is that that joblessness can get locked in and lead to the adverse consequences that I've discussed.

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OK. So what do we do about that sort of concentrated joblessness? One option is don't do anything. Just let markets equilibrate on their own. How do markets do that? You do it through migration. People leave areas that are in decline. What experience has taught us is that mobility is much weaker than we thought it was in high-income countries. The US is a lot more like Europe than we were willing to admit, something that's been hard for US policymakers to come to terms with. The US is dynamic, we move, we're responsive. Not so much. We are if you think about college-educated young people, but if you're over 40 in general, and if you're over 40 without a college degree, you don't move in response to adverse shocks. So this mechanism works, but it can take a generation to play out. The second is to target distressed people with social insurance programs and mean-tested entitlements. Those go directly to people whose incomes have declined. We have concerns about moral hazard. They might prolong adjustment. And they also don't kind of get at the root problems of joblessness. If a shock creates joblessness, it's not like It's not like expanding the supply of food stamps or income to low-income families is necessarily going to address the issue.

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Third option is to target distressed places, subsidizing jobs, training, and investment. Economists were long dismissive of place-based policy because of concerns about bidding wars, about windfalls for landowners. the incidence of the benefits falling on unintended folks, and just policy mistakes, policymakers not knowing enough about what it means to implement place-based policy correctly. We kind of are taking a second look at place-based policy because of the map I just showed you, because that job loss has become entrenched and we're looking at additional tools. So what I'll walk you through very briefly is just what we know about what these different, the second 2 mechanisms do. What does, where do policy benefits go and how does it relate to metrics of economic distress? So in this project, what we've done is catalog every policy that we can identify. And we've got a, in the paper, which I'm happy to send folks, we've got a 20-page appendix that lists the enabling legislation, for each bit of policy, amendments to that legislation, the intended beneficiaries, and that varies as legislation gets updated over time. And then also our best take on what the theory of change is. What was the logic when these initial policies were put in place?

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For the place-based policies, it really is about dealing with distress in some way. It could be about credit constraints. It could be about dealing directly with the absence of investment in low-income communities. It could be about trying to activate spillovers in places where good jobs are scarce. What I'm going to show you today is not information on what policy says it should do. I'm going to just show you what does policy actually do and then give you our sense of why

that's the case. So we'll talk about 4 buckets of policy. One is social insurance. So unemployment insurance, Social Security, Social Security Disability Insurance, and Medicare. These policies are there to address insured risks related to age, health, and job loss. Now, why might they be triggered by negative labor demand shocks? Well, unemployment insurance, there's no surprise there. You have job loss, uptake of unemployment insurance goes up, not for very long. That lasts for less than 2 years. Social Security, pensions, and subsidized healthcare for the elderly is also activated by job loss because there's flexibility about when people retire. And so what happens is you get more selection into retirement as jobs disappear.

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And that means that Social Security, in effect, acts a little bit like a policy to deal with increases in economic distress. Here's this other kind of weird feature of what Social Security does. Going back to what I mentioned earlier about older folks being less likely to move. In places that have experienced job loss, over time, what happens? They get older. 18- to 39-year-olds are the ones who are likely to leave. And the populations don't change. The net population of places that are hit by job loss, shocking as it might seem, experiences zero change. But the composition changes. You have fewer young people of young working age and more people who are aged 65 and older. This then creates this weird thing. So if you're over 65, you then have a guaranteed source of income. You have Social Security, you have Medicare, then you have your pensions and so forth. So these places end up being specialized in a weird form of tourism, in which you're providing services to an entrenched elderly population via income that's coming from somewhere else. That is what a tourist economy does. These are just— these are tourists who never leave.

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However, but what that means is you've got then a changing pattern of specialization. When we think about demographic shifts, this is then going to become more important. Means-tested entitlements. Now, these we expect to go to places in distress because these programs are about targeting low-income households, especially households with children. This includes the Earned Income Tax Credit, That's a negative income tax. You get that if you're a low-income worker. You mostly get it if you're a low-income worker with kids. That means that most of the benefits for the EITC go to single moms because those are the primary low-income workers with kids in the household. SNAP is food stamps. SSI is Supplemental Security Income. That's income support for low-income elderly and disabled. And then Medicaid, I won't talk about because it's so blindingly complex. Then we have 2 categories of place-based policy. The first is about business development. So this is subsidizing investment in a place. So this can include tax incentive deals that mayors and governors negotiate with companies that are coming to

locate. Amazon choosing to establish itself in Northern Virginia is an example of this. There are— and what I'll show you data on is not all of these deals, but the bigger ones, the ones that are more than $1 million in benefits in a given year that have become very controversial recently because these tax benefits also go to data centers.

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Prior to going to data centers, tax benefits to companies that are coming to locate in your place were actually politically popular. Governors— research by Eddie Maleski shows that governors who cut the ribbon on a big plant coming to your location enjoy an electoral boost in an upcoming election. Data centers has upended this, and we'll see if those impacts last. There's also a subsidized credit for investing in low-income communities. So these are like The enterprise zone programs that were pioneered in the UK under Margaret Thatcher and now are present in many countries. The US has 2 versions of this, the New Market Tax Credit, which grew out of a Clinton administration program, and the Opportunity Zones program, which was created by President Trump. Even though they were implemented in very different ways, the geography of their benefits looks very similar. They go to low-income neighborhoods by statute, but they go into low-income neighborhoods in rich regions. And I'll tell you why that's the case. A 4th category for policy are place-based policies tied to workforce development. Now, economists have also been skeptical about workforce development. Subsidized training, it has zero returns, correct? Yes, but it has Zero returns when we look at actually small set of programs that are funded by the Department of Labor.

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So that's— Department of Labor spends about $3 billion a year in giving subsidies for worker training, these individual training accounts. You get vouchers to go to get training at approved vendors. There's 75,000 approved vendors in the United States. Quality is low. That's not where most of the money goes. Most of the money goes to career and technical education in US community colleges. And recent research has shown that returns to longer-term programs, career and technical programs in community colleges, pay off well. Not all of them, but on average, the returns are clearly positive. And for programs like nursing and welding and HVAC and the portion of IT that doesn't require a BA degree, you see increases in annual earnings between 5 and 10%age points. Of place-based policies, it's the subsidies to community colleges and the work that community colleges do is the only program that ends up going to low-income regions. Okay, I will jump ahead. One fact on Entitlement transfers. So the sum of Social Security, the sum of social insurance and means-tested entitlements. Even in the US, which is known— we're known for our stinginess, the median commuting zone, the median local labor

market has seen government transfers rise as a share of personal income from 17% to 25% over the last quarter century.

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So if we think about distressed areas, income support from the government is a very big deal in terms of where people are getting income from. And I want to say just one thing about funding of place-based programs. In total, my sense before looking into the data is that just not that much money at stake. So, you know, So there's not that much money there. If it's misspent, it's not that big of a deal. If you were to spend it wisely, it's not that big of a deal. Turns out that that's not true. We spend about $25 billion a year on these incentive deals for big companies. We provide about $30 billion a year of loan guarantees to small business. We spend $60 billion a year in public subsidies to community colleges. And we spend about at least $20 billion a year in tax incentives for investing in low-income neighborhoods. You add that up and some other programs I haven't mentioned, that you're kind of, you're in $140, $150 billion. Or in a modern metric, 3 FAA renovations. So how does that compare, $150 billion? Just the means-tested entitlements part, throw out Social Security, Medicare, and so forth, means-tested entitlements, those are about $450 billion.

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So place-based policy in sum is at least 1/3 of what we're spending on means-tested entitlements. So I mentioned that for the following reason. The evidence, as we can tell it, is that we're just not spending the money very wisely at all. But there's a lot of money there. We don't need new authorizations. There's a lot of money sitting on the table if we were to reallocate in sensible ways. Okay, so I've told you that much of place-based policy says it's about helping places in distress, although that is defined in different ways across different programs. Why might, in practice, that not happen? Well, one is that it might be what policy says it's supposed to do, but policymakers, they actually have a different theory of change in their head. And maybe they're about trying to activate spillovers, or maybe what they really care about is not generic distress, but distress caused by manufacturing decline. And I'm not going to show you results on this today, but we go looking for evidence of alternative theories of change, we don't find it. So a second possibility of why place-based policy might not go to distressed areas. It's funded in a very different way than social insurance and entitlement programs.

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State and local governments play a much bigger role in the tax incentives for business investment and a very big role in workforce development. The funny thing about state and local

governments in the US is they operate on a pay-as-you-go budgeting scheme. So what does that mean? That means you can spend what you bring in in terms of tax receipts. Now, you can borrow for certain types of stuff, but you borrow for capital projects. You don't borrow for operating expenses. And tax incentives and worker training subsidies are operating expenses. What does that mean? That means that you get negative hits to appropriations because tax receipts have fallen precisely at the moment when demand for those subsidies goes up. So revenues are procyclical because that's how revenues work. Demand for those funds is countercyclical. And that's just a basic mismatch. And I'll show you evidence of that in just a second. But there's another reason, which was just really surprising to us. This is a little bit specific to the US, although in conversations I've had with Michael Stolper and Peter Berkowitz about the way the European Union works, the issue I'm going to raise right now is present in Europe, though in a quite different way.

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In the US, A lot of the money that we give out starts in the federal government, starts in a federal agency. But different than, say, Social Security, which you just go and you sign up for online and then you get it, so it's individual application, this money is given out through intermediaries of some kind. It could be an approved bank that you go to for a subsidized— for a loan guarantee, or an approved bank that is a vehicle for getting tax credits for investing in a particular place. Or if you want training subsidies, you go to a commuting zone. If you want a community development block grant to revitalize kind of a blighted downtown, you need to have the right municipal agencies that can then go get in line for those funds. So what we've done is to create a supply chain in which access to that money depends on having the right type of local organizational capacity. That local organizational capacity is not funded by the federal government. It is funded locally. As it so happens, richer regions are a lot better at creating those intermediary organizations. And that's a key part of why funding that by statute has to go to low-income neighborhoods ends up getting captured disproportionately by high-income places.

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Okay, I've totally given away the punchline. So I'm going to— the plots I'm going to show you in a second are just going to characterize these patterns. So what I will show you then is where money flows, so resource flows per capita. And I'm going to plot this against a measure of labor market strength. And that measure of labor market strength has 3 components. It has a measure of earnings. And so this is commuting zone fixed effect from a Mincer wage regression. So just capturing what are average earnings in your place, controlling for educational and demographic composition, the employment rate in your place, again, controlling

for labor force composition, and then the poverty rate. So a higher value of this index means that you're in a stronger place. And what should we expect to see if policies target distress? A negative correlation, a downward sloping line, indicating that weaker places get more money. So we'll start with entitlements and social insurance programs, focus on the bottom row first. The lower left corner, the Earned Income Tax Credit. This is the negative income tax. More of this goes to low-income places. No surprise there. How do you get this money?

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By being a low-income person, a low-income person with kids. So what is this telling us? In that in weaker labor markets, there's more uptake of the Earned Income Tax Credit by design. Then lower right-hand corner, the Supplemental Nutritional Assistance Program, food stamps, also by design goes to low-income households. It has work requirements. It's about funding issues. It's been in the news this week. But again, no shock there that there's a negative correlation. And the upper 2 panels, it's a little more surprising. So with Social Security, there's a negative correlation. You get more uptake of Social Security benefits in places that are weaker. What's going on here? More old people and more old people selecting into retirement.

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Veterans benefits.

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definitely something that's, uh, distinct to the United States. We have a lot of veterans again as a consequence of Iraq and Afghanistan. It turns out that veterans come disproportionately from places that aren't doing very well, and when they came back to the U.S., they go to those places. The veterans, uh, programs today, the centerpiece of it is a disability program in which you can obtain disability benefits while still working. Veterans benefits, all told, are now 1% of personal income. That is bigger than any individual means-tested entitlement program. So what happens is that the veterans benefits are working like a subsidized a help for low-income people because veterans are in places where distress is more common. Okay, so I'm going to summarize this then in this plot, which I'm very excited about, but it takes a little bit to understand. So what I've done is this is for one time period. This is around the Great Recession, 2008 to 2012. I'm going to then calculate the same correlations in 10 years earlier, previous recession, 20 years earlier, the previous recession, and so forth, and then in future, and then around COVID. For these programs, these correlations are quite stable.

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I'm then going to just pick 2 time periods, 2000 and 2010. And I'm going to plot the correlations for those 2 time periods such that if you're in the bottom left quadrant, that you get a negative correlation in pretty much every time period. Here are 2 time periods we're looking at here. So what does that mean? You get higher benefits where labor market conditions are weaker. So now what we're going to do is we're going to fill out this map by then adding in the correlations for place-based policies, which we'll do in 2 batches. The first are subsidies to business investment. I'm showing you just 4 here. We have more in the paper. The SBA loan guarantees— this is Small Business Administration guarantees for loans that you get if you can prove that you can't get credit from anywhere else. They're meant to relax credit constraints. In its inception, the Small Business Administration had an emphasis on dealing with places in distress. Today, that's been rolled back to be about credit constraints, but credit constraints tend to bind more when the availability of collateral diminishes, as it happens when places are hit by adverse shocks.

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So what do we see? The take-up of these loan guarantees is greater not in weaker labor markets, but in stronger labor markets. So what's going on? Well, over time, what Congress has done is it has transferred authority over the allocation of these loan guarantees to approved private lenders, which serve as the intermediaries. And it gives them pretty much— as long as you guarantee that a firm is can't get credit from somewhere else, then you have authorization to give out those guarantees. You get some oversight from the SBA, and you have to be one of these approved lenders. For the top program, there's about 230 of them in the United States. Guess what? Given autonomy, what do private lenders do? They act like private lenders. And the authorization of credit just is strongly procyclical in space and time. On the right, are 2 programs that go to low-income census tracts by statute. It has to go to low-income census tracts. But that money has to go through intermediaries. As I mentioned earlier, those intermediaries are better and more prevalent in richer places. So what happens? That money flows to stronger, not weaker, labor markets. So where does business place-based policy go?

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It goes in the upper right quadrant. So you get a positive correlation between policy flows and economic conditions in all the time periods in which we can document. Finally, we'll look at workforce development. And so this is— the vast majority of this happens through US community colleges. So these are public 2-year institutions that charge low tuition by US standards, $4,000 a year. I realize by European standards and other countries' standards, that's a lot. For the US, that's a bargain. It has pretty open enrollment. If you have a high school degree and you live in a place, then you can enroll. They're one of the few institutions of higher

education that actively bring in low-income students and working-age adults. In the upper left, what do you see? You see spending per enrollee in community colleges. And that spending has a positive correlation to it. So what are states doing? They're giving more money to places that are better off. And this has to do in part because about 20% of the money for community colleges comes from local governments, and those local governments and state governments are bound by the same procyclicality of revenues that I talked about earlier.

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But then, Federal revenue counteracts that. It has a negative correlation. How does that happen? It happens almost entirely through one program, the Pell Grant program, which gives you up to $7,500 a year to low-income students. And this ends up being hugely important for access to higher education, not just community college, but 4-year degrees. And so that— the countercyclicality of Pell Grants helps partially offset the procyclicality of state and local funding. such that enrollments and degree completions are greater in weaker labor markets. When do people want to get training? When the opportunity cost of getting education is lower. That's when unemployment is higher. That means we want more supply. We want elastic supply during economic downturns. Overall, we aren't doing it, upper left quadrant. Federal money is helping. And what are people doing? They're doing what economically they should be doing. And that means our community colleges, our red triangles, they end up in the lower quadrant. 4-year universities are not like that. 4-year universities do not respond to distress. So community colleges are unique in that way. Community colleges, you think, oh, this is this US thing. No, it's not. You look across European countries and there are equivalent institutions.

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that do vocational and technical training that come in their own guises. Some of them are attached to 4-year institutions. Some of them are independent. And now what we have in middle-income countries is mandatory upper secondary schooling. And that mandatory upper secondary schooling has vocational tracks in it. Take-up tends to be low. But we have created, without really realizing it, institutions for the delivery of career and technical education in nearly all middle and high-income countries. We're not— haven't designed those institutions to deliver the benefits in a way that we would like. I've got some other stuff that I'm going to— I'm not going to show you so that Jed and I can go to conversation. I want to highlight that this is just correlational. There's nothing causal here. So how do we show that this happens then? There's a causal— that these relationships then have a causal counterpart. When unemployment goes up, we then see perverse reactions of place-based policy, and we see expected reactions with mean-tested entitlements. What we do in the paper is then use the the Great Recession as

something of a laboratory here. And we've used other recessions. You can use the China shock.

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I really want to use the China shock for this because the China shock happened. And if we think about AI, do I think the AI is going to be like the China shock?

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I don't.

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It's not. It's going to hit very different sets of places. Do I think it's going to be like the Great Recession? I don't know. But the Great Recession was big and it hit a lot of places. So if I had to choose, just as for a comparison, I'm happier with the Great recession comparison. What do we find in this exercise? What we find is that places that are harder hit by the Great Recession see this long-lasting decline in per capita income. The government transfers are not making up for it, but government transfers increase a lot. If I look at commuting zones at the 25th and 75th percentile, of exposure to the increase in unemployment from the Great Recession, there's a 10%age point larger increase in government transfers in the more adversely affected place. What do we see with place-based policies that subsidize business investment? No reaction to the Great Recession. What do we see with workforce development? funding falls. So overall funding for community colleges goes down because tax revenues have gone down. But federal funding comes in and responds positively. And what we get are increases in enrollment and increases in completion of career and technical degrees in places that were more hit by the Great Recession.

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So what is this telling us? Despite the supply constraints that are in place, people are voting with their feet and doing the right thing, policy could accommodate that in a more serious way. So, what do we take away from this? Entitlement programs broadly defined are operating as automatic stabilizers. Some of those, that was the intention. Some of them not. We don't think of Social Security as an automatic stabilizer. Turns out it's a better automatic stabilizer than any business investment place-based policy. What are place-based policies doing? We've got issues of how they're funded and how you get access to funding that are creating a disconnect between intent and delivery. And who are the stellar performers in all of this? It's community colleges, in spite of the fact that they're subject to supply constraints. according to how they're

funded. So the good news here is that we've got a lot of money in the system, and we have institutions in place that are kind of set up to do what we would like them to do. The problem is, is that we've created a set of artificial constraints that makes them much less effective than they could be.

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And in the new spirit of bipartisanship that has gripped Washington, I anticipate that we will be taking up this challenge finding a way to make community colleges more effective as we confront what AI is going to mean. Thank you very much.

[00:48:53.29] - Jed Kolko

Thank you, Gordon. That was terrific.

[00:48:55.40]

And sparks lots of questions, certainly for me, and I'm expecting from participants here as well. I would like to go back to maybe a couple minutes into your presentation where you deftly said, if there is a strong spatial dimension to the AI shock, to the economy. Now, as you explained very clearly, shocks are often geographically uneven. That's often justification for thinking about place-based policies. And when we think about either historical shocks, mechanization of agriculture, impacts on manufacturing, or other more recent shocks— the Great Recession involved foreclosure crisis. Climate change, for sure, also spatially uneven. How likely is it, do you think, understanding all the uncertainty surrounding AI, nevertheless, how likely is it that AI could be thought of or might become a spatial shock? And if so, what are the places likely to be hardest hit? if there's a strong AI shock to the labor market?

[00:50:18.04] - Gordon Hanson

Well, I think the safest bets in terms of the spatial dimensions of the AI shock are tech and tech-adjacent activities, which we've already seen. Google is not hiring as many young programmers anymore because Claude is so wonderful to work with. Although Google is going to use Gemini, although I imagine lots of people in Google use Claude.

[00:50:44.58]

The—

[00:50:45.11]

if that's— and then we have tech adjacent. So in order to deal with the fact that tech is located in very expensive places with inelastic housing supplies, that has created opportunity for Denver and Austin and Salt Lake City and Nashville to become important parts of the tech ecosystem. So if it's the case that the incidence of the shock hits disproportionately on Boston, San Diego, Silicon Valley, and New York, it's not that big of a deal. And it's not that big of a deal because these are places with quite inelastic housing. So what are you going to do? You're going to reduce housing demand. That reduction in housing demand is going to lower housing costs. And what does that mean for the real income of workers in those places? It may not change by that— by very much. It matters a lot for property owners. But because we've had this utter weirdness of concentrating tech in places where it's so hard to build new housing, then the unwinding of that shock means a redistribution of wealth that's taking a windfall away from people who we never expected to get in the first place. Now, the tech-adjacent places are different.

[00:52:00.43]

Those are places where the impacts could potentially be more painful. That's a rosy take on the spatial incidence of the shock. What are the things that concern me? What concerns me is that if this really loads onto people who are thinking about going to college, in college thinking about completing, or trying to find jobs immediately after college, the disruption effects we could have on that generation could be painful and very long-lasting. There's been excellent work by labor and macroeconomists about what it means to get hired during a recession. But it means that you're on a slower earnings profile for the rest of your career.

[00:52:47.13] - Jed Kolko

So continuing with that, you argue quite clearly that if AI's spatial shock is concentrated in tech hubs that have inelastic housing supply, in a sense that is sort of less a cause for concern than spatial shocks that affect places with more elastic housing supply. But are there other kinds of places that could also disproportionately suffer from an inelastic housing supply? spatial AI shock to labor markets that don't have inelastic housing supply and could have severe localized effects in a longer-term sense?

[00:53:36.24] - Gordon Hanson

Yes, there are. And that has to do with logistics hubs. So you think about all the places that saw manufacturing decline. They lost a traded activity. You now need to find a new traded activity to replace those jobs. Even if you downsize substantially, you're going to need to produce something else that people outside your region want. What have regions moved into? Some

fortunate ones that had good universities— and this is work by Enrico Moretti has shown this quite powerfully— were able to transition into tech stuff. Columbus, Ohio. was a manufacturing center. It also has The Ohio State University. So not surprising that Columbus has managed manufacturing decline pretty well. But places in southern Ohio, so you think Middletown, Ohio, where J.D. Vance is from, which doesn't have The Ohio State, what have they done? Well, those places have either just kind of gone off the map, suffered substantial decline. They become logistics hubs. places that intermediate the shipment of goods, or they've expanded as regional healthcare hubs. So you're providing healthcare to a wider region. So Scranton, Pennsylvania is one of those places. Scranton, major manufacturing center close to Lake Erie. It was kind of the center of the US industrial belt.

[00:55:04.09]

And today, Scranton is exporting medical services to a wider area. For logistics hubs, the impact of AI is just obvious, right? Because there's, you know, Amazon is progressively automating what Amazon does. And that means that those jobs, they're not great jobs, but they are jobs. And that means that the proliferation of those logistics centers, which were kind of located in the middle of the Rust Belt because they're at the intersection of travel between the heart of the US population, they could be adversely hit. On the healthcare side, not clear to me. You can tell a story about how AI is going to be really good for healthcare. Now, here's the— because of all the innovations and all the new treatments that we come up with. Here's the funny thing about healthcare. Healthcare employment has risen in lockstep with healthcare spending for the last 25 years. That could be a consequence of the fact that the US is really inefficient at how we produce healthcare, and we have regulated ourselves into being very labor-intensive. It's not been a bad thing as an employment program because healthcare is one of these funny industries that supplies jobs throughout the entire earnings distribution, from being a home health aide to being a neurosurgeon, and then before being a neurosurgeon to being a physician's assistant.

[00:56:37.39]

There are lots of good jobs in healthcare. So if healthcare expands overall throughout the earnings distribution as a consequence of AI, that's an offsetting effect. If healthcare then gets rendered much less labor-intensive, that can have consequences that would be similar to what the logistics impacts might be.

[00:56:59.04] - Jed Kolko

Great.

[00:56:59.31]

Thank you.

[00:57:00.38]

So the conference has 2 themes as they relate to labor markets— AI, which we have talked about, and the other is demographics. So I'd like to dig a bit deeper into how the aging population affects the relative arguments for place versus people-place.

[00:57:22.35]

People-based policies.

[00:57:25.06]

Many examples that you gave and showed evidence for of place-based policies seem to be geared toward younger people, certainly the investment in community colleges. And other place-based policies work in part by trying to attract new residents to encourage mobility. Now, in a world where the population is older, And therefore, there is less mobility and increasingly fewer people of community college age. How do we think about the aging population changing the relative merits of place-based and people-based policies?

[00:58:03.58] - Gordon Hanson

I think it matters a great deal, precisely for the reasons that you were insinuating. So I presented to you— I showed you, I don't know, a dozen different policies. There are another 2 dozen I didn't show you. So think of this as this portfolio that policymakers that in our fictional world of a social planner deciding how you help regions, a policymaker, that social planner then has access, is going to balance that portfolio according to the needs of a place. There are going to be places that get substantially older in which opportunities for generating new job growth are going to be weak, where that portfolio is going to be much more about poverty alleviation than it is about employment creation. And then you need to think about how you do that poverty alleviation or that income support in a way that doesn't have the adverse consequences we know that support can have. You don't want to suppress employment rates. Employment confers a dignity that matters for the social fabric of a place, even if the jobs aren't all that great. So we, at that end of the spectrum, we're not thinking about then Pittsburgh going from its era as a steel manufacturer to its current era as in software and robotics and high-end medical services.

[00:59:29.07]

We're thinking about places that are managing decline. Then there are the future Pittsburghs. Suppose Salt Lake City gets really whacked by the AI shock. Well, Salt Lake City, we're there. You would want place-based policy to be very active in terms of helping workers redirect towards the new export industry that Salt Lake City will pick up. Then you have the in-between places. And there, it's harder to know. We don't have models that tell us how to manage a policy portfolio. It's not what we study. We study individual interventions. We certainly do this empirically because our professional returns as economists is to go out and find causal evidence of the impact of some specific intervention. We don't care about how that intervention is implemented and the 4 other policies that often go along with it. When it comes to theory, it's hard to think about managing a portfolio of 4 policies let alone 14. And so there's where I don't know what to say. It's a hard problem, and we don't know a lot about it.

[01:00:41.23] - Jed Kolko

So the last feature of this conference, in addition to it being about AI and demographics, is that it's a global conference. And most of the examples and programs—

[01:00:53.06]

I think all the programs we talked about are US-based.

[01:00:59.04]

expand a bit to thinking about how the relative merits and trade-offs between people-based and place-based policies may be different in other countries, particularly lower-income countries, compared to what we see in the US.

[01:01:14.49] - Gordon Hanson

So first, on the things that transfer, results on what works investing in low-income communities We've seen in a bunch of different countries. What we've also seen that works primarily in middle-income countries and low-income countries is that when it comes to assistance to small business, the credit support— it's hard to find good evidence that subsidized credit is transformative. But subsidized management training has been really, really effective. And it's cheap. And so that evidence actually comes primarily from low-income countries, the first work done in India, and then the more recent work out of the World Bank on Colombia. And that work is— the World Bank has nicely replicated in other contexts. So those policies aren't described

as place-based, because what you're doing is you're dealing with the fact that we've got a lot of low-productivity small and medium-sized firms inside developing countries. But as those countries mature, And as you see manufacturing declines start to settle in in middle-income countries, you're going to have that same issue of needing to make transitions. Now, what we don't know in those contexts is what works in terms of workforce development. There is a lot of depressing evidence about payoffs to worker training in developing countries.

[01:02:44.16]

Now, one— and so what we see is they fail in their most basic mission, of increasing employment rates of people who take up that training. What we also know is that many of those programs are too short. Many of those programs do not target specific sectors. Many of the programs are not delivered by high-quality training providers. So there is evidence from a small but growing number of middle-income countries. And this is— the best work on this has been done by Eliana Carranza and David McKenzie at the World Bank. in terms of summarizing and amassing that evidence, which shows us what can work. I don't know how much that translates. External validity is a really important issue. And the issue we're trying to deal with in developing country context is not job loss, it's informality. It's that— and so if you increase the supply of human capital, there's no guarantee you're going to increase the demand for that human capital. And so that gets us back to just a classic challenge of how do we generate better jobs in developing country contexts? In which case, the place-based stuff I'm talking about is secondary to raising productivity and productivity growth.

[01:03:59.41] - Jed Kolko

And should we think of physical or digital infrastructure as another form of place-based policy that could be especially valuable Unusually high return, particularly in the age of AI?

[01:04:15.18]

Or is that—

[01:04:16.15]

or are the lessons about place-based policies not as applicable to thinking about physical or digital infrastructure?

[01:04:24.33] - Gordon Hanson

So we have all this great micro evidence on what access to digital services means. And it could be mobile money. It could be access to broadband. And it matters. For people who have weak attachment to the labor market, it gives you an incentive to start a new business. And it gives you the means to doing so at a much lower cost. In terms of finding markets for your goods, the impacts are evidently there. So what we don't know is what it means in terms of more aggregate productivity growth. And I, 'cause we don't, we have lots of either RCTs, randomized controlled trials, or we have good quasi-experimental evidence that access to digital services has strong productivity impacts. Aggregating that into what it means for TFP growth, we don't know yet. My inclination would be it should matter, but we don't know. In the, you know, the amazing thing about what we've seen with AI thus far is that the boom in entrepreneurship that started in the US under COVID seems to be continuing with what AI represents. There's no reason that should not translate to developing country contexts as well. But that's a question about the relationship between digital services and business dynamism.

[01:05:55.31]

Which I think is immensely important. And I would like to see more analysis in the large, understanding how that aggregates into rising productivity, rather than saying, we know that access to— when I get a cell phone, there are things I can do without a cell phone.

[01:06:11.41] - Jed Kolko

Great.

[01:06:12.26]

So let's open this up to questions from others in the room. There is a microphone toward the back of the room. If you are close to that, feel free to step up or line up behind that. If you are not so close to that microphone, um, uh, Jessica can bring a microphone to you. So folks, either please line up or raise a hand. Um, great, please.

[01:06:39.47] - Audience

Oh, hi, Howard Schneider with Reuters.

[01:06:41.19]

All started off really interesting.

[01:06:42.56]

I'm wondering if you've begun to think about or update your data for this sort of post-COVID era.

[01:06:49.08]

And specifically around what seems to have been a return of population growth to small towns and even some rural areas. And that's including, in some cases, net growth in prime-age workers, which has been surprising in the couple areas I've spoken to about that. Does it matter? Is it a new trend? Is it a turn in what we saw as a decline, sort of endemic decline in those areas prior to COVID?

[01:07:18.10] - Gordon Hanson

So post-COVID— so during COVID we had this moment where we thought work from home is going to change everything. We can all go live in a cabin in the woods and do yoga in the morning and commune with nature while we sell our services to people in Silicon Valley. Didn't quite turn out like that, but some of that did happen. And so the experimentation with living in places places which have high amenities but low population, there was some stickiness to that. The stickiness was least in places that were close to major population centers because those major population centers just pulled people back. And so it's a real phenomenon. It's on the small side. I would think that the impacts of AI on that would be more profound than what COVID taught us about work from home.

[01:08:17.27] - Jed Kolko

A question over here.

[01:08:25.23] - Audience

First, very interesting. Now, 2 things coming from the European experience. The first one has to do with lessons from the national recovery and resilience plans.

[01:08:39.14]

Concerning the misallocation of place-based policies.

[01:08:43.43]

And it's not only a problem of administrative, local administrative capacity. It has to do also with the fact that some of these place-based policies are capital-funded and also they are lump sum.

So local governments are all— are not so much prone to take up these funds because then they have to continue funding current spending.

[01:09:09.29]

So for this reason, we were not able to create in areas with serious problems childcare centers and many other facilities. So there was a resistance of local governments to do that.

[01:09:23.25]

So that's a different type of issues, but perhaps something like that also happens in the States. And secondly, this, uh, this employment, very strong disemployment effect to Social Security. I've a lot to do with program substitution.

[01:09:38.17]

So people flowing out of unemployment benefits and employment insurance or schemes that in principle do have also a proactive component to disabilities and various other things.

[01:09:51.35]

And that is instead something related to segmentation in Social Security. Perhaps AI in that respect could help if it is properly used by Social Security Administration in tracking these flows and preventing that they take place at a massive scale because otherwise they clearly would create large unemployment flows.

[01:10:15.38] - Gordon Hanson

Yeah, I would entirely agree with that last point. We're in a situation where we have lots of variation in how old-age pension systems work and the variation in the employment incentives that they create and lots of good research going on this. I know that folks are going to talk about this a this conference. On the first thing that Tito said on funding, we think really hard about the nature of financial systems for economic development. And we need capital deepening. You need financial deepening. We don't think about the financing of the public sector side of it. But the financing of public sector operations is really, really important. And we think you just put the money there and you say it should do X, that X will happen. And structures and incentives and coordination between government agencies are enormously important, just like they are in the private sector.

[01:11:16.00] - Jed Kolko

Great.

[01:11:16.24]

At the microphone.

[01:11:17.56] - Audience

Thank you. Super interesting talk. I'm thinking about the political implication. Our Western system is based on local politics. You vote locally.

[01:11:32.07]

It didn't work in the past.

[01:11:34.17]

the past, it was different. Italian kids were organized by profession. So, but now we work with local representation. And at the same time, shocks have some, uh, not local, as you argue, not only local dimension, but sectoral or professional representation dimension. So there is a kind of disconnect between their political representation, which is based locally. At the same time, you have lobbies which are based according to profession or interest, industry level. So you have this mixed system and the nature of the shock. What are the implications? And could it be that basically this this affection for politics is due to the fact that the current political setting doesn't represent faithfully the nature of the shocks and the solution to the shocks. It's a little bit strange.

[01:12:41.00]

So coming back, you are—

[01:12:44.10]

you have this contrast between local policies and people policy, but the current political system is geared just toward local representation.

[01:12:58.16] - Gordon Hanson

Um, so, uh, thanks for that question, Antonio. Um, so you think about— there are voters who want some things done. We have national political actors that could be representing companies, it could be representing industries, it could be representing occupations, uh, and What could be

missing are people who characterize the— who internalize the civic needs for investment in local activity. And so this means there's a role for civil society to translate those local needs into demands on the political system so that resource allocation doesn't get dominated by these interests. who may not align with local needs at all. So this might be a very US-specific thing, but part of the variation we see in who gets access to funding is in the strength of civil society. And the data we put together on all of these policy flows, it leaves a data trail in terms of the organizations that that money goes through. And that reveals the presence of having different types of entities that help you get in line for different types of funding. We're creating an institutional database that will then give us a measure of organizational capital when it comes to local economic development.

[01:14:30.33]

That includes things like specialized financial institutions and 2-year and 4-year institutions. It also includes public-private partnerships. That work in favor of local economic development and local community foundations. I don't— we're just on the verge of releasing these data, so I can't give you further insights. But to the extent that civil society is organized and there are a set of actors through which civil society can represent itself, then you do have another force. If those civil society actors are controlled by national entities, national unions, national occupational associations, as might be true in the Italian context, then that can be interrupted.

[01:15:16.59] - Jed Kolko

That sounds like an incredibly exciting project. One of the, perhaps the most important input into successive place-based policies that we don't have a good measure of is this local and civil society institutional capacity. So hearing that, we are going to all be much wiser about what that actually looks like is great to look forward to.

[01:15:40.05] - Gordon Hanson

I'm really excited about this project. And I don't know how US-specific this is, because nonprofit actors are present in many different contexts. But you go back to de Tocqueville wandering around the US in the early 1800s, and what did he find? He found people joining stuff. And they joined stuff to build barns. to create roads, to build bridges. Those actors are still present today. They are highly unevenly distributed across regions in the US. And what that means is, just like we've come to terms with the fact that their public infrastructure affects productivity, this is a form of public infrastructure. But it's a form of infrastructure that then gives you access to financing from other, from other places. Great.

[01:16:32.01] - Jed Kolko

Again, at the microphone.

[01:16:33.43] - Audience

Thank you. Lori Kletzer, University of California, Santa Cruz.

[01:16:37.14]

Gordon, it's good to see you. I think it's been longer than a while.

[01:16:40.36]

I have 2 policy questions that may actually ask you to speculate.

[01:16:45.34]

You can choose one or the other or answer the question that you wished I had asked.

[01:16:50.05]

The first is, you mentioned that we know from labor market research, from labor economists, that early career entrants are scarred for their career when they enter the labor market during a recession.

[01:17:07.43]

And, you know, and the mechanism, right, is likely that they're not getting placed into the right job, so they can't go from job to job to job, right, and get that kind of career and wage growth that comes from shifting across jobs. One of the things we know now, right, while we keep looking for widespread job loss from AI, we find it in pockets and it's probably not widespread, but we know the job finding rate is low and falling, right?

[01:17:37.12]

That there's—we're in a low-fire, low-hire labor market. And we worry greatly about college graduates and other early career entrants.

[01:17:48.04]

The speculation I'm asking you about is what if a low job finding rate actually turns out to be a characteristic of the diffusion of AI into the workforce, right?Particularly for the period of time where boomers are retiring, so you can manage your workforce, right, by letting the boomers retire. You don't hire a lot to replace. You use the AI. You're not hiring early career workers. They're not getting the experience. We haven't thought of a low job finding rate as a policy variable, right?

[01:18:22.34]

Something we can address policy-wise because you just wait for the recession to be over, right?

[01:18:27.03]

And then the job finding rate for early career entrants somehow recovers. Do we think that that characteristic, like a low job finding rate, is going to be with us for a while?

[01:18:38.03]

And the speculation is, do we think there's any policy that we might have national or place-based to address it?

[01:18:46.40]

And my second question, different, is you mentioned, and I love that we should applaud what community colleges do, but do we actually think that the career and technical training in community colleges that we historically have, which is nursing and HVAC and trades, is really going to be up to the task for the workers who need to be retrained when they are displaced by AI, who may be principally women without a college degree? They haven't been as well served, except for nursing—

[01:19:18.32]

except not for nursing, because they need college degrees, right? So there are the 2 speculatory questions I'd love you to choose to address.

[01:19:28.40] - Gordon Hanson

If AI permanently lowers the job finding rate, we're in trouble.

[01:19:33.02]

Yeah.

[01:19:33.11]

I don't have anything more to say than that. We know it's a mess. We're in— we've got a lot of issues to deal with. I think what we've learned about community colleges, in particular with regards to creating opportunities for women, is a very positive one. Because you don't need a BA degree to be a nurse. You can be a nurse with— a nurse's assistant with a certificate, not even a 2-year AA degree. And then you can be a nurse with an AA degree, and then a BA degree, and then a master's degree. So nursing, which— healthcare, which accounts for 1/3 of the career and technical education that community colleges provide, has been this ladder for career advancement for women. If we could replicate that to other sectors, that would be incredible.

[01:20:24.06] - Jed Kolko

Gordon, thank you so much. set the tone perfectly for the day and for today and tomorrow. We're going to see lots of research with both detailed empirical evidence as well as grappling with some of these very large and broad questions about structural factors affecting the labor market. So I think we are well set up for that. Thank you so much. Thank you for your questions. We are now going into a 15-minute break and back here at 11:00.

[01:20:52.31]

Thanks.

[01:20:56.55] - Gordon Hanson

Thank you.

[01:35:39.02] - Sandeep Mahajan

Good morning. Good morning.

[01:35:42.28]

So we'll get started with— we'll get started with the next session. We'll get started with the next session on structural transformations, demographics, and labor market frictions. I'm very pleased to be chairing this session. My name is Sandeep Mahajan. I'm Regional Practice Director in the World Bank. cover the Middle East, North Africa, and Pakistan and Afghanistan

region at the World Bank. Very pleased to be part of this. I want to begin by thanking the Peterson Institute and of course OECD, IMF, and of course my colleagues at the World Bank for organizing this very important days of discussion, but especially this session. I'm really looking forward to it because it really goes to the heart of much of what we are thinking and more importantly discussing at the World Bank with our client countries, which is about jobs, job creation. But at the heart of the job creation is the question of structural transformation. We have an excellent set of presenters. Marta Dominguez Jimenez from SEMFI, Martí Mascheri from the Universitat Autònoma de Barcelona, and Nicholas Engbom from NYU. And also very pleased to have Meghana Iyagari from the George Washington University as the discussant. So again, very important discussion on structural transformation in the age of demographics, AI, labor market frictions.

[01:37:32.17]

I grew up in times of much simpler narratives of structural transformation. Things have gotten much more nuanced now, and really pleased to see that nuance coming out in the research that will be presented now. I mean, when we used to talk about structural transformation some time back, it used to be much more simple narrative of resources, workers moving from agriculture to industry, maybe low-end services, That's about it. And then the industry picks up and everybody moves to services. But now the narrative obviously has changed. Narrative had always changed, but our understanding has become more nuanced. And it is now, we are in a world where the structural transformation itself was never very simple and never conforming to textbooks. But we've seen that structural transformation happen in a simpler form. I was in Vietnam and we saw it happen there. We saw it happen in other parts of East Asia as well, but some other parts of the world missed it. But now the structural transformation obviously has taken different forms where you have countries moving from agriculture to services to some extent bypassing manufacturing, or you have structural transformation happening in the context of complicated demographics, which is, you know, we are seeing in binary forms where either you have the region where I am, which is growing very rapidly in terms of population and labor force, but not with sufficient job creation, or you have demographics, which is what you're seeing in much of East Asia, which is happening in the context of getting older before you're getting richer.

[01:39:21.15]

You also have a situation now where you have enterprises which have opportunities to grow their output rapidly, but not necessarily seeing job creation happening at the same pace. So, and not to mention the challenges that AI and technology are presenting. So look, a lot of

nuances to be brought into the discussion. I'm very pleased that the researchers are going into these very nuances. Look forward to that.

[01:39:52.49]

and look forward to the conversation that's going to happen after it and what it means for our policy work. Without further ado, let me pass the floor to our presenters. And I think Marta is going to be first. And the floor is yours.

[01:40:16.06] - Marta Domínguez-Jiménez

Right. Hello, everyone. I'm just gonna set a little timer. Um, so hello everyone, uh, thank you so much to the organizers for having me here today and for a wonderful conference in general. And I'm going to present my job market paper, which is called The Demographic Origins of Prematurity Industrialization. Now, the first idea I want you to leave with today is that the demographic conditions under which countries are going through industrialization have changed quite drastically. Now, in order to illustrate this, this graph just plots 3 countries. And what I'm showing is the share of 20 to 34, so the young adult share over the working age population. Now, these countries are not anchored by a single moment in time, but they're anchored by a point in structural transformation. In this case, the last year in which their employment in agriculture was over 60% of employment. And from that point onwards, I'm showing the population in the subsequent 50 years of industrialization. And what you can see is that for the US, they were very young throughout the entire period. Thailand began to age very rapidly, so almost from the very beginning, and Indonesia was somewhere in the middle.

[01:41:32.30]

Now, with that in mind, what is the object this paper is trying to explain? And it was mentioned briefly a second ago, But this is the idea of prematurity industrialization. So we've long known that manufacturing was hump-shaped in development, meaning as countries got richer, manufacturing sector employment grew, but then eventually it gave way to services. But in a pretty influential paper about a decade ago, Dani Rodrik introduced this new fact. And his idea was that if you allow the coefficients to differ before and after 1990, so this is sort of a regression of manufacturing employment over total employment, on a quadratic of GDP per capita. And if you allow the coefficients to differ before and after 1990, we see that that hump has really moved down and to the left, right? That peak in manufacturing employment is both getting to a lower level and it's happening earlier. Now, what do I have on the right-hand side? This is just sort of to motivate my research question. I have the exact same specification from

the Rodrik paper, but in this case, The independent— the dependent variable, sorry, is the share of young adults over the total population.

[01:42:38.54]

And the parallelism between the 2 graphs is what motivates my research question, which is whether workforce aging, early workforce aging specifically, can give rise to prematurity industrialization. Now, the literature has identified many other drivers, for example, trade, different rates of sector productivity growth, et cetera. But hopefully by the end of today, I'll be able to convince you that the right-hand side graph is actually a core driver of the left-hand side graph. Now before we get to the details of the paper, just a brief note about why we should care. And this is a very simple graph which for the Groningen Panel of Countries, which is a country that covers high, low, middle income, different regions, it simply plots value added per worker. And what I'm just trying to highlight is that skipping out on the manufacturing phase just from a compositional standpoint means that you're losing out on many workers being in a sector of high productivity growth. And this is especially so when you compare it to low-skill services, which is the service— the sector, sorry, that typically absorbs most of the employment in countries that go through premature industrialization. Okay, so perhaps you're wondering, what does age actually have to do with structural transformation?

[01:43:53.01]

And I realize I haven't said it yet. But the first thing this paper does is it documents a new fact empirically. And this fact is that within birth cohorts, the probability of working in manufacturing is much, much higher when you're young than when you're older. And this I document across many countries within birth cohorts, but also for a panel of countries in Indonesia. I can see individuals actually transitioning from one sector to the other as they get older. Now, what is driving this? Well, the main mechanism relies on the fact that we have some abilities that peak early in life. For example, physical abilities, but also certain fluid cognitive abilities, so things such as inductive reasoning, processing speed, and so on. And then there's other abilities that peak later, right? Things like vocabulary, written-oral comprehension, interpersonal skills. And it turns out that manufacturing relies quite a bit on abilities that peak early, while services rely much more on abilities that peak late. And so this creates a sort of lifecycle comparative advantage. That shifts from manufacturing to services as the worker gets older. Now, this is an individual-level fact that I just mentioned, but the next thing I do is to try to understand how that matters in the aggregate and in general equilibrium.

[01:45:09.44]

And in order to do that, I develop a theory of lifecycle worker sourcing to rationalize the empirics, and I embed it in a quantitative model of structural transformation in the open economy. And what do I do with the model? So the model is calibrated to Indonesia. That's my baseline economy between 1975 and 2025. Now, during this period, Indonesia went through structural transformation. We start at a point where their agricultural employment was over 60% and we end past their peak, which was 21%. And then what I ask is, right, under this process of structural transformation that they lived, there was an underlying population age structure that evolved throughout the 50 years. How much did that population age structure matter for the trajectory that Indonesia saw? And this is the population age structure from the very first graph. I don't know if you remember, but Indonesia was sort of in the middle. It wasn't as young as the US, but it wasn't as rapidly aging as Thailand. And so what I do is literally that. I hold everything else fixed. So it's very much the baseline Indonesian economy facing a given global environment and certain paths of productivity growth.

[01:46:17.19]

And I ask, what would this country have looked like, what would it have fared like if it had had the structure of the US in that 50-year period after 60% agricultural employment, or if it had had the structure of Thailand? And what I find is that it makes quite a big difference for structural transformation. Specifically, I said the Indonesian peak was 21%. Under US demographics, changing nothing else, it's 23.3%. And under Thai demographics, again, changing nothing else, 18.4%. Now, as I was mentioning, this matters for output, right? And we're not just describing some positive profiles. And indeed, output per capita grows much more over the 50-year period in the younger economy, but that is driven by more forces. But output per worker also grows much more in the younger economy. So there's a difference in cumulative growth over the 50-year period of 20%age points. Now, the final thing to mention in this introduction is that export opportunities really lie at the heart of this, right? This is very much an open economy mechanism. Because it is the open economy that allows, you know, an economy that's suited to manufacturing, so a young economy, to specialize in that sector beyond sort of what domestic demand allows.

[01:47:32.10]

Right. So I'm going to skip through the contribution if you'll allow me because in terms of— in the interest of time, although I cite quite a few people sitting in this room. And let me just move to the first fact that really underlies the paper. This is the idea that there is a real relationship between the age of a worker and the sector that they choose to work in. Now, how do I explore this? Well, I have worker-level data for 88 economies. This comes from IPUMS, so it's country-level censuses and surveys that cover between 5% and 10% of the population at any given

point in time. For those 88 economies, I have different numbers of waves and so on, but the data goes somewhere between 1960 and and today. Now, my main dependent variable of interest is simply the share of employment in a sector in a given country at a given point in time, but for people of a certain age. And that is the main independent variable of interest. It's these delta coefficients on age-fixed effects. And I have one for every single year of age. Now, I also control sort of— so the patterns that we see are within cohorts.

[01:48:41.08]

I control for period effects with with GDP per capita, so in as far as they're explained by development, as well as many demographic observables. And what do I find? To me, this pattern is quite striking. And it is the fact that the propensity to work in manufacturing within cohort is far, far higher when you're 20 than when you're nearing retirement. Indeed, the gap between 20 and 64 is 21%age points. And we see the opposite pattern for low and high skill services. Now, I'm not going to discuss it today, But in a panel of Indonesian workers, we see similar individual transitions, right? So this is not something going on in the background. It really is many people switching from manufacturing to services as they get older. And it's a pattern that holds for mostly for middle and low-income countries, but it also holds for periods where manufacturing is expanding and for periods where manufacturing is contracting. So it's not sort of structural transformation going on in the background.

[01:49:33.50]

Okay.

[01:49:36.26]

So then my question becomes, what is driving this? Why are workers sourcing based on their age? And to do that, I turned to external evidence from the sort of medicine, psychology, physiology literature on how abilities evolve as we get older. And I have 3 bundles of abilities: physical ability, fluid cognitive ability, and crystallized and interpersonal ability. And I used this literature to construct sort of ability profiles as people age. Using a series of proxies I don't think I have much time to discuss, but for example, for physical, it's flexibility and grip strength. For fluid cognitive, it's things such as episodic memory, processing speed, and so on. And then I ask, OK, how does this relate to sectors? Well, it turns out that O*NET has some measures of how abilities are required in the different occupations. And this can be aggregated to sectors. And the main message here is that manufacturing really doesn't require much of crystallized and interpersonal abilities. And those happens to— happen to be the ones that actually get better as we get older. Now, what do I do with this? Well, I have this evidence from medicine

and I can use the ONET weights to construct some sectoral productivity profiles over the lifecycle.

[01:50:47.46]

And then I sort of divide by the 3-sector average to get some normalized profiles. And what I'm trying to see is whether there's any relationship between these profiles and the sorting that we see. So the sectors that workers choose. And what I see is that there's quite a bit. Now, these are different axes. So we're talking about shape and direction. But I think still that the pattern is quite remarkable because the sources of data it comes from are entirely different. The dots that I'm showing are the workers sourcing age-fixed effects that I showed earlier. So literally, you know, the propensity to work, it's normalized by people age 50, but the propensity to work in a sector given your age. While the lines are the probability productivity profiles I've constructed. So one of them comes from worker-level data and censuses, and the other comes from medical estimates of abilities. And yet the shape and direction have a very good, a very close match. Right. So now we move to the model. So, so far I've established hopefully a credible relationship between sector, Sorry, a worker's age and the sector they choose to work in. And I've traced that to how abilities evolve over the life cycle.

[01:52:00.20]

But then the important question is, right, does that matter in general equilibrium? Does having different population by age structures actually affect general equilibrium outcomes, both for employment and for output? And in order to do this, I develop a theory of worker sourcing across sectors over the life cycle. And I embed it in a quantitative model of structural transformation. Which has sort of all the traditional sources. So certainly trade, and as I said, it's important to these results, but also known homothetic CES preferences, different paths of productivity growth, et cetera. And I use this to quantify how much workforce aging affects the pattern that we see. So how much does it affect the extent to which countries industrialize and the output consequences of that? So in terms of environment, the model has 4 sectors. agriculture, manufacturing, low and high skill services. Cohorts enter age 20, they supply labor inelastically until they're 64, and then they consume until they're 89, but they are retired. Now, the actual structure of the population of the different ages is taken directly from the data. So how many people are 20 versus 21, et cetera, et cetera. And there is a representative household and perfect foresight.

[01:53:13.23]

And let me talk in a little bit more detail about the worker block, at least in terms of intuitions because that's sort of the novel side of the model. Now, workers have 3 abilities, the same ones I showed earlier. And the idea is that, you know, we can use this O*NET weights to construct sectoral productivity profiles with just Cobb-Douglas aggregation, which means that the same worker at a given point in time will be, you know, will be more or less productive in a sector versus one another. Now, where do these abilities come from? So what makes up these abilities? And the way I have it is that there's 3 components. One is schooling. So when you enter the model, you get a schooling draw that is permanent. And schooling matters for some abilities more than others. And that's governed by the parameter alpha. Specifically, it matters for fluid cognitive ability. For the others, it makes a small difference. Then there is a residual draw in each of the 3 permanent abilities that the worker does. to get to a permanent component that is the combination of schooling and the residual draws. Now, this permanent vector you should think of basically as an intercept in each of the 3 abilities that the worker has, and it's heterogeneous across workers.

[01:54:23.25]

And then there is a 3rd component, which is the life evolution of those abilities, which is common to all workers, and it's the one from the graph we saw before. And so the idea here is not only is a given worker more or less productive in a sector versus another, but as they get older, that changes. Therefore, it might induce switching at some point during their lifetime, both because of the aging effects and then also general equilibrium wage effects. Now, I'm skipping a lot of math, but I just want to give you hopefully a little bit of intuition of how this works in practice. First, the one thing you should know is that the overall level of ability doesn't matter for the sectoral choice. Why is that? Well, because it raises wages by the same proportion in every sector. So what matters is your ability mix. Are you relatively physical? Are you relatively crystallized? And because the deviations from the overall add to zero, this can be represented in a 2-dimensional coordinate. So that's literally what I plot here. So on the y-axis, we have relatively high fluid cognitive ability. On the x-axis, we have relatively high physical ability.

[01:55:31.56]

And the points are the same workers when they're age 20 and they enter the model and when they're about to retire. Now, the points are static because this is the permanent ability bundle. What aging does is it moves the boundaries, both aging and general equilibrium. So at any given point, a worker will choose a sector that, you know, results in the highest earnings. And that will change as they get older. And notice manufacturing has the sort of high fluid and high physical corner. But at age 20, that has quite a few points, gray points inside it. By age 64, everyone's become less suited to manufacturing. And only those who are sort of innately, so in

terms of permanent abilities, very physical and very fluid cognitive will still be there. OK, so how does this aggregate? So first of all, we care about headcount employment. And for a given cohort, headcount employment was the cloud of gray points that I just showed. But to get the aggregate for the economy, you have to aggregate across all the cohorts. And sort of very naturally, you can see that if you have a higher weight on younger cohorts, because they have a bigger cloud in manufacturing, then sort of naturally it will mean that headcount employment in manufacturing will be higher.

[01:56:47.46]

Now, naturally there's general equilibrium effects, but sort of that direct effect carries quite nicely. And then the other thing we care about is effective labor. And I just mentioned that to say that overall ability did not matter for the sectoral choice, but it will matter for the productive units that you supply. Right. So this is the last model slide, I promise. And I'm just going to sort of mention it quickly since, I mean, there's no time for details. But I have non-homothetic CES preferences in the style of Kamil Lashkari and Mestieri, who are in the audience, with an extra, which is that I allow for the taste parameters to vary with age. This is not new. This has been done before. The reason for that is that the literature has discussed it. Now, it turns out not to be very relevant in my model at all quantitatively. So the idea that, say, young people consume more manufacturing, older people consume more services, But I allow for it in the model. Production is very standard. It's linear and effective labor. And just to mention that there is trade. I'll discuss a little bit how trade is modeled in the counterfactual, so I'm going to leave it at that for now.

[01:57:55.35]

Okay. So how do I calibrate the model? So baseline calibration, as I mentioned, is Indonesia from 1976 to 2025. And the data that I used is mainly the Indonesia Family Life Survey, which is the panel that I mentioned, both household and worker panel. But I supplemented with IPUMS censuses for Indonesia that allow me to go back further. And then I also use some aggregate sources of data like the World Population Prospects from the UN, et cetera. Now, the main thing you should know about calibration, since I don't have that much time to get into the details, is that I use the abilities with age profiles that I showed before, so from the medicine literature and the, and the O*NET thetas, meaning that sort of those 2 very key drivers of what's going on in the model are, are taken externally. So I'm tying my hands in that regard. But I do calibrate some parameters like the schooling alphas, for example, um, and a ton of, you know, consumption level parameters, etc. And just very briefly, model fit is quite good in what we care about most. Since it's the main driver of results, which is employment by age by sector in Indonesia during that period.

[01:59:06.56]

This is the average over the period. It's also very good also in consumption moments and does reasonably well in some untargeted moments. What do I do with the model? Hopefully you remember a little from the intro, but the idea is to ask, okay, we have Indonesia, They had this industrialization that happened and underlying it there was a population structure. Now this is not quite the same graph from before because I had, in this case I have 20 to 34 over the model population. And so what I do is I use this lab that is Indonesia to measure how much demographics play a role in the path of industrialization. So I'm holding everything else fixed, the same global environment, the same exogenous path of productivity, growth. I just want to see how much does just changing the structure of the population, how much can it affect how Indonesia industrializes? And in my mind at least, this is quite a lot. So if you look at the far away graph, which is manufacturing, we can see that manufacturing sector employment follows very different paths. Now the gray is Indonesia, blue is US demographics, and orange is Thai demographics.

[02:00:24.31]

And the idea is that Indonesia and the US were similar for a while because if you remember, Indonesia stayed quite young for a while. But then eventually they decouple as they start to age. And Thailand, which was rapidly aging from the beginning, does far worse from the beginning. And at the peak, that is an almost 5%age point gap difference in the degree of industrialization. Now most of that is going to low-skilled services. The axis is longer, so it's not as obvious, but most of that employment that is not in manufacturing for the younger economy is going to low-skill services, which is, let's say, precisely the sector that we generally consider less productive.

[02:01:04.29]

Right.

[02:01:05.55]

So then the question becomes, how much of this is actually about sorting on abilities that age versus other things, right? Because this is a model with many details. In order to isolate that, I solve a version of the economy that I call no ability aging. What does that mean? I neutralize the ability by age profiles. So I set all of them to one coefficient for the 3 abilities. And I solve the 3 economies to see the extent to which you still get more industrialization under the younger economy. And what I find is that you still get a little bit more. For example, the younger economy has more schooling, et cetera. But the vast majority of the gap really disappears, right? We're

talking about sort of 3/4 of the gap disappears once you get rid of these ability aging mechanism. So it really does seem to be that it's the sectoral sorting that's driving these aggregate results. Now output. So as I was saying, this is not just an interesting pattern but it's something that matters. Now output per capita, and this is cumulative growth over 50 years, is very different in both economies. But that is not primarily an industrialization story.

[02:02:14.17]

That has a lot to do with the fact that the younger economy has more workers and fewer retirees, and having more people producing is generally good for output per capita. But output per worker, I think, is more interesting. And you see that cumulative growth in output per worker is still substantially different between the 2 economies. Not just that, again, I solved the no-ability aging economy, and once again, output per worker is higher under the young economy, but it doesn't explain the majority. The majority has to do with the fact that workers are sorting on own abilities and that causes greater industrialization, which is positive for output. Right, so 2 more quick exercises. The first is about trade. So I mentioned at the beginning, and hopefully this was in your minds, that export opportunities are at the heart of this. Now, in the baseline, I have that Indonesia can export both agriculture and manufacturing goods at prevailing world prices. Right? It functions like a small open economy. This made empirical sense to me because Indonesia is a fairly small share of global markets for these goods during the 50-year period. However, I now instead try downward sloping demand.

[02:03:22.15]

And I find that the industrialization gap is still there between having a young and old economy, but it shrinks by about a third. So restricting export opportunities really reduce the extent to which having a young workforce is conducive to industrialization. And that is because that's a workforce that is allowed to specialize even more. OK, so one final exercise and then I'll wrap up. And that is schooling. Because schooling is a big part of this literature, right? And there is this idea that people who have fewer children give them more education. And so there might be some offsetting effects in that regard. And so I look at an estimate that's done for Indonesia specifically, but it's sort of in line with the literature. And I think, okay, how much would you have to adjust US— sorry, Thai schooling relative to, you know, the Thai population path versus the US population path to account for that elasticity in terms of greater schooling when you have fewer children? And you have to give the last cohorts in Thailand something like 0.4 more years of schooling in order to account for that. In contrast, in order to offset the output effects, you would have to give every single cohort 3.8— 3.2, sorry, more years of schooling.

[02:04:35.28]

So schooling for sure can offset some of these output effects, but not in a way that, you know, would rise in any way organically just by people having fewer children. And with that, I'm going to wrap up. So just what the paper shows is that, you know, there's some real age-driven sorting among workers and at the individual level and that in the aggregate in a in a quantitative model that explains quite a bit of the differences between manufacturing parts that we've seen. Thank you very much.

[02:05:49.29] - Martí Mestieri

All right. Well, Hello, everyone. Thank you very much for inviting us to present here. I'll be presenting Jobless Modernity, which is joint work with Laura Alfaro, who's sitting here as well, Marcela Eslava, and Felipe Sainz. So Jobless Modernity is a term that we have come up to denote a feature that is pervasive in many emerging economies and has to do with the fact that modern firms contribute a lot in terms of value added in emerging economies. However, they create few jobs in these economies, far fewer when you compare to the US or to the EU. Okay, what I want to convince you of today is that policy in fact has quite a bit to do with this. Not only that, but different types of policies, they will have different types of bite. The policies that really matter for jobless modernity are not going to be the ones that really matter for output maximization. Perhaps not surprisingly, at the end of the day, the ones that will matter for jobless modernity will have to do more with basically distorting the cost of of labor. So the plan for my, I guess, 23 minutes that I have— first, I'll show you a few motivating facts.

[02:07:18.17]

Then, so we will use a model to kind of uncover the mechanisms in general equilibrium. So I'll just outline the model. And finally, I'll show you some of the main exercises that we do. And I'd like to discuss some of the policy implications that we take from that. Let me start first with one fact. Throughout the presentation, when I talk about modern firms, I want to think about firms that have 10 or more workers. Here I want to capture this notion that modern firms can scale up production, they can hire workers, expand capital, and so on and so forth. Below that, I want to think about basically small firms, self-employment, and I will call these traditional firms. So what I have here is data for Colombia in 2019. One thing that you see is that the share of jobs that are accounted for by modern firms is a third of the entire labor force in Colombia. Here, getting back to Gordon's response in this Q&A, so here we have the formal and informal sector.

[02:08:29.41]

Okay.

[02:08:29.43]

Now, if you look at the share of labor income, they account for half. But if you look at value added, they're over 80%. Okay. Is this something that you should expect everywhere? And the answer is no. If you were to look at the US or EU, here I have the EU. What you have is a completely different picture. So the share of jobs that are basically generated by modern firms is around 74%. They account for a commensurable amount for the share of labor income and also for value added. The gap in fact between share of jobs and value added is 7%age points for the top 12 EU countries, the most advanced ones, where it is like 56%age points for Colombia. This is exactly this phenomenon that we call jobless modernity. Why do we care? Well, here I'm piggybacking on Marcela's, one of the co-authors in the paper, other work where I'm basically going to show you that really modern jobs is the ticket to the middle class in emerging economies. What you have on the left-hand side, you have the average of Latin American countries. On the right-hand side, you have high-income countries.

[02:09:50.01]

Here we have put like the population of each country in deciles, okay? And the light blue bars are the fraction of the population in modern employment, okay, in that decile, okay? And so what you see is a striking difference. So for in Latin America, right? So most jobs that are modern sit at the top of the distribution, right? If you were to look at the first or second decile, there's just like 4 or 8% of people in the 1st and 2nd decile are working in the modern sector. And then you have like a steep gradient, right? And if you were to look at the top decile, it's like 56%, right? So this is in stark contrast to high-income economies. There, even like at the bottom decile, you have 55% of the population working in modern firms. And after that, if you look between the 3rd and the 10th decile, it's essentially flat. You have very little gradient. That's why, like I say, in high-income economies, really you have that these middle— these modern jobs really expand the income distribution. I guess that was present in Martha's presentation as well. But one thing that comes out very clearly from the data is that modern jobs, they pay more, and that's why we care about those.

[02:11:10.32]

One reaction that we've had when we've presented this paper, They say, well, that's a matter of development. You just wait. It's this transition. So one great thing about Colombia is that it has very detailed data that spans 50 years. So what I'm plotting here is basically in dark red are the numbers that I've just shown you. So Colombia in 2019, share of jobs that are modern, 33%. Share of value added, almost 90%. If you go back in time to 1971, the share of jobs that were accounted for by modern firms is 23% and the value added is 74%. It's true that the modern sector expanded. Granted, you have that income per capita almost tripled over this time period.

[02:12:03.40]

Schooling expanded.

[02:12:05.13]

There were substantial labor reforms. Colombia liberalized, opened to trade in the '90s. But what is really surprising is that these 2 bars have moved in parallel, such that if you look at the difference at what we call the jobless modernity, if anything, has increased rather than being reduced. Therefore, it's what we call growing Latin America. I don't know if that's the right way to sell it, but really the way the model is going to interpret this is that there are structural barriers to creation of jobs in these modern firms that have nothing to do with basically transitional dynamics. It's not like this view that, okay, the emerging economies, really what they need is just to create more modern firms and everything is going to get solved. It's really on top of that, that modern firms are not absorbing a substantial share of the population.

[02:13:04.31]

Right.

[02:13:05.08]

So, okay, so these are the facts that motivate our exercise. And so what we've done is we have developed a general equilibrium model that is pretty rich, and I will not get into the details. So I'll just spend some time on this slide telling you about the main ingredients, and I'm happy to entertain questions later on if you're interested. Okay, so I guess what really underpins this whole exercise is the fact that for Colombia, We have this exceptional data that allows us to basically look at formal and informal workers. So we have digitized these household surveys that start in 1971. And so that gives us a glimpse on how formal and informal work is. And on top of that, there's this Census of Manufacturing Producers data that actually we have gone to the historic archive and pushed back to the '70s. That is extremely rich. So we have sufficient data to actually estimate production functions in a serious way. So there's prices for inputs, prices for outputs, so you can separate prices and quantities and so forth. And on top of that, this data contains measures of not only wage payments but also like this non-salary labor cost that each firm incurs.

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That's going to be important. I'll come back to that. With this data, we really devised a static model that basically we will apply in the '70s for Colombia and in the 2020s, if you want, 2019. It has 2 key ingredients. First, it will have these 2 technologies, the modern and traditional that I was emphasizing. Then similar to Martha's presentation, there's going to be like this occupational choice margin. Workers or agents in this economy can self-select into traditional self-employment or can go to work in a mother firm or they can become mother entrepreneurs. This is going to be a model that is quite rigid. We have heterogeneous firms, agents with different levels of ability selecting into the occupation that maximizes their return in a— it's somewhat similar to what Marta presented, in fact. Once we have this model calibrated to 2019 and to 1971, we want to conduct basically 2 key counterfactors that I want to talk about. We will remove different distortions that firms face and that the economy faces, and we want to assess to which extent they contribute to jobless modernity. And second, and that's going to be this growing, like Latin America type of exercise, will be what happens if I swap the 1971 and 2019 fundamentals while keeping distortions constant.

[02:16:03.12]

All right. And so the main outcomes I want to think about is jobless modernity, this gap between value added and employment shares, And then these relative earnings by group. Just getting back, getting into the nitty-gritty of the data, I mentioned that there are some distortions we measure directly. Those pertain to labor costs. We have this, for each firm, they report not only the wage payment, but these non-salary labor costs. We also have a very important feature of Colombia, but also that also is present in Mexico and other Latin American countries, which is you have this minimum earnings floor, which turns out to be quantitatively important that we observe in the data. In the model, we also will have revenue and capital wedges that we will estimate as part of the production function estimation. This will build on the work that Marcela Slava has done with John Haltiwanger and co-authors. We will also recover not only like these wedges, but also key parameters of the production function. In particular, this labor elasticity, the output labor elasticity, which let me mention in passing that since 1971 until 2019, it has fallen. Production has become less labor-intensive. Also, we will estimate the price elasticity of demand.

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We will, from this estimation, you recover also kind of like the so-called, well, you know, you can recover, you recover the productivity of each firm, right? And the cap—

[02:17:50.20]

and yeah.

[02:17:53.14]

And so we kind of like nonparametrically fit that. Okay. On top of that, the model will have like some, some nesting where you have modern production and traditional production that will be nested. And people will have some taste for traditional goods and some taste for more modern goods. And that will also be true for self-employment. So in the model, it's simple. And the baseline model will just have one sector, even though we have a 3-sector model extension. But there's going to be also some shocks that, for example, are going to make people want to go into self-employment despite having a very high productivity. And that in the data, for example, we do see, I don't know, like architects or doctors in that upper tail for self-employment, for example. But so kind of like at the heart of the results that we're going to get, it's going to be really like these distortions to labor. So let me just talk about these 2 in detail before showing you the results. So the first one is this— minimum earnings floor, which as crazy as it sounds, nowadays in Colombia, basically the minimum earnings floor is equal to the median earnings of a Colombian worker.

[02:19:04.11]

So just mind-blowing, but it's like this. So as you can— and that in the past, it was not as binding, but we estimate it to be around a third. So what does such a— So what earnings floor do? Well, so what we're going to have— let me just explain this plot in a second. So what I have on the x-axis, I have workers' productivity. So workers will differ in their productivity. And the way you want to think about it is that they can supply efficiency units. And there's going to be some workers that will have more efficiency units than others. There's going to be a price per efficiency unit. So this blue line tells me the potential earnings per worker. The thing that this minimum earnings floor does is basically prevent people that are below this minimum earnings floor to actually select into this wage work. It forces them into self-employment. That is going to have a substantial bite. Now, another important margin, as I said, is that we observe these labor costs reported by firms. Which you add as a— it's a drag on the marginal product from the point of labor, from the point of view of the firm.

[02:20:26.17]

What this is going to do, it's basically that when you look at the return net of these payroll costs, the effective return is pushed to the right. Now, it's not only these workers that are low productivity workers or low efficiency units workers that are pushed out of these modern jobs, but also these additional workers that are pushed into self-employment. Okay? So that is— that

is going to have substantial bite in our results. Okay. So with this being said, so let me just show you what happens once we calibrate the model to Colombia in 2019. And we conduct some counterfactuals. So the first thing that I want to draw your attention on is a comparison of what happens in the baseline economy and an economy in which there are no distortions whatsoever. So I basically turn off labor distortions, revenue distortions, and capital distortions. And so perhaps, well, one thing that I forgot to mention is that, in fact, because we can invest with this method of production function estimation, you can back out nonparametrically these distortions. So the distortions that we have are correlated with the productivity of the firm and something else that we call product appeal.

[02:21:55.41]

Okay.

[02:21:56.13]

So in fact, it turns out that overall, they bite hardest in the most productive firms. What you have here on the first column is the baseline economy where you see this 50%age point of jobless modernity between where it would be the difference between the modern share of income and this modern share of jobs. In the baseline, you have income per capita, well, We could have normalized this to 1, but it's now 0.77, and the average establishment size is 1.5. When you remove distortions altogether, what you have is an increase in the modern share of income. So basically, the modern share of the economy expands. That's not surprising. And also, the modern share of jobs expands. However, what is interesting is that this effect is substantially asymmetric. So you have an increase in this modern share of income that is about 7%age points, but you have something like 27%age points movement for the modern share of jobs. So as a result, you have that this jobless modernity measure falls from 50% to some 30%. So that's kind of like the first headline number that I'd like you to remember. Which is that distortions account for 40% of this jobless modernity.

[02:23:26.41]

And of course, when you remove the distortions, income per capita increases by around 23%. And this average establishment size increases by 60% or 70%. So that's the first thing. The second thing I want to talk about is which distortions matter.

[02:23:45.24]

Okay.

[02:23:46.07]

And so what I'm putting here is basically Colombia in 2019 still. And the first column is the baseline, so that we have already discussed. In the top right column also is what I showed you already, which is what happens when you remove all distortions. What is interesting is to have like the— to look at the columns in between. So the first column is what happens when I just remove revenue and capital wedges. And what you see is that what you get when you remove these distortions, you get a boost or an increase in the modern share of income. Basically, output produced by modern firms expands by around 6%age points. There's a more modest increase in modern shares. It increases a little bit more than one for one, but It's around 12%age points. By contrast, once you remove these labor distortions, which is this labor floor and payroll costs, what you have is a more modest increase of modern output. It goes from 84% to 86%. And yet the modern share of jobs increases more substantially. You have this asymmetric effect of these revenue and capital wedges relative to labor distortions. That's the second important conclusion or policy conclusion that we draw, which is that it is these payroll and labor floor distortions that it's really preventing or really accounting for most of the of this jobless modernity that is generated by distortions.

[02:25:36.00]

The 3rd result that I want to show you is that, of course, everyone loses from distortion. So when you compare the economy with and without distortions, you see that— so the blue bars are the economy with distortions, and in gray are without distortions. You see that the total earnings generated by traditional producers and the one that is accrued to modern workers and entrepreneurs, it's much higher. That's not that surprising. But then again, you see that there's a disproportional effect on modern workers. That's in the total volume. In fact, it's a compounded effect between price effects and selection, which I don't have time to get into it, but I'd be happy to do that. But one consequence of that is that Basically, once you remove the distortions, if you look at the average earnings of a modern worker relative to traditional worker, you have that it falls from 2.5 to 2. What it means is even though the part of total output that is accrued or the value added that goes to modern workers expands per worker, It's reduced a bit and just because you have not so great workers now are able to get into modern work.

[02:27:00.11]

But still, you have that the average wage goes from 2.5 to 2, meaning that even without distortions, modern worker earns twice as much as a self-employed worker. Last but not least, this is, I guess, my favorite result of the paper. Which is this what I like to call growing like Latin America. Okay, so let me show you what this is. So on the, on the, like the far right column, you have the baseline results that I showed you. So this is basically the result of calibrating the

economy to 2019. So we can redo exactly the same thing to the economy in the '70s. Okay, and that would be like the first column.

[02:27:44.56]

Okay.

[02:27:46.08]

So one thing to notice is that, as I said, basically jobless modernity was a feature in 1971 as well. So what I do now is I take the 1971 economy and I keep the distortions to the level of 1971. And then what I do is I change the fundamentals to those of 2019. Okay, so it is the economy of 2019 with the distortions of 1971. One thing to notice, as I change the fundamentals, the modern share of the economy expands, both for income and for jobs, but the gap between the two actually widens. Of course, income per capita expands substantially more than doubles. Once then I can do one, then you can also compare what happens these 2019 fundamentals with 1971 distortions to 2019 baseline. What you see is that basically, to first order, nothing changes. Distortions improved a little bit. Distortions are less— they have less bite. The modern share of income and modern share of jobs expands if you look from the second to the third column. But basically, the gap remains. So what this means for policy in the— I have 1 minute left. So I think one thing that I've learned from this exercise is that growth alone does not eliminate jobless modernity, that growth reforms may not necessarily be like job reforms in the sense that if you were to improve these revenue or capital distortions, you would get not substantial mileage for labor.

[02:29:40.13]

The design of labor cost is first order for jobs. I guess it's perhaps obvious once you see it, but really thinking about reforms that affect payroll costs or the earnings floor seem to be really first order for having this ticket to the middle class for a substantial substantial part of the population in Colombia. And really, opening access to modern jobs is really redistribution without transfers because you don't have to do anything. You just, if you, for example, could shift part of social protection financing away from the payroll, you could get like this, you could get like an expansion of these modern jobs at basically like— At zero cost.

[02:30:25.37]

for free.

[02:30:26.20]

OK, so I had something to say about AI, but I'll stop here. And thank you very much.

[02:30:42.33]

There you go.

[02:30:48.56] - Niklas Engbom

OK, thanks so much for having me. It's great to be here. This is aging, labor market dynamics, and economic growth. It's motivated by the pattern you're seeing already on the first slide— a rapid and quite dramatic aging of the workforce, uh, in 2 selected countries, in Sweden and the US, for reasons that will become clear. I have good data for Sweden, but the patterns that you're seeing here, they're representative of a broader set of countries. We see these patterns across all advanced countries, very dramatic aging. So in the US, the share of the labor force that's older than 45 has risen by almost 15%age points since the 1980s. So I'm interested in understanding what that aging does to the functioning of the labor market and ultimately economic growth. I'm motivated by 2 facts that I document using Swedish administrative data that I have access to. First, I find in these data that older workers, they tend to be less likely to move across employers. They're less mobile in the labor market, and they're also less likely to start new firms. And so aggregate aging, then you would expect mechanically to reduce labor market dynamics and reduce firm creation because you just have more of these workers that are just generally less dynamic.

[02:32:12.40]

But on top of that, my second finding in these data is exploiting spatial variation in Sweden. I find that when a local labor market ages, it also sees declines in the age-specific rate at which a worker switches employer and starts a firm. To understand those empirical patterns, I'm going to proceed to develop a model of embodied technical change with labor market frictions. It features the entry of new firms that over time introduce new technologies into the economy and workers that over time relocate across existing firms so as to become better matched to them. This model will then predict that older workers will tend to be better matched to existing firms because they've had more time to relocate in the labor market to find a good match. Aggregate aging will increase the employment share of these well-matched workers, and so it will then improve the economy's— the economy-wide match to existing firms or existing technologies. It's as though the economy is going to be better able to produce using the technologies currently in existence. But that has a positive level effect. It boosts the level of output in the older economy, but it also serves to discourage the introduction of new technologies into the economy.

[02:33:33.07]

You now have an economy that is well-matched to existing technologies. It raises the opportunity cost of switching to new ways of producing. So, it discourages the introduction of new technologies. That's a negative growth effect. So, there are these opposing positive level effects of aging and negative growth effects. Now, how do they trade off? To assess that, I'm going to conduct transition experiments. Feed in baby boom into the economy, and I find in that experiment that even though the economy has monotonically aged since the 1980s, and and the what I call a growth effect—the introduction rate of new technologies has declined monotonically since the 1980s—the measured growth rate of output per worker booms through the 2000s because of this positive level effect. You're just becoming better at using the technologies we already have. That matches broadly the pattern we see both in. In Sweden and in the US of high economic growth through the— at least the early 2000s. But going forward, it paints a pretty dismal picture. So I estimate that growth will continue to be low for another 30 or so years. So with that, let me jump straight into the analysis. So I'm using Swedish administrative data.

[02:34:49.01]

They're very rich and they allow me to link workers as they move between employers. Employers and also into entrepreneurship. This is first— my first motivating fact. In the cross-section, older workers tend to be less likely to switch employers. They're less mobile in the labor market. And the right-hand side panel shows that older workers or individuals are also less likely to start new firms, even though you're seeing a little bit of an increase early in careers in the probability of starting a new firm. Now, what has happened in Sweden and many advanced countries over this period is you went from having a large share of the workforce being aged 25 to 40 to having a large share of workers older than 45. So just staring at these graphs, they would— you would predict that that aging will generate some aggregate declines in worker mobility as well as firm creation just through the composition effect. My second finding is that there is more than just that mechanical composition effect. So exploiting now variation, spatial variation in Sweden in both the timing and magnitude of aging across local labor markets and using lagged fertility as a predictor of that, it's a very good predictor of the current age composition.

[02:36:04.31]

I find that there is more than just that. So partly the first column shows you without direct age controls, aging will generate— predicts declines in worker mobility. Predicts declines in firm

creation. You would again expect part of that because of those profiles I saw you before. The second column shows that there is more than just that. So even once I control for an individual's own age, when people around her are older, she's just less likely to switch employer and less likely to start a new firm. It's as though in an older economy, those entire profiles that you saw on the previous slide, they shift down. So that's suggestive of some kind of equilibrium force that discourages worker flows and firm creation. When people age. That's the remainder of my talk, trying to understand why those equilibrium forces, you know, what they are. So I'm going to propose an endogenous growth model. It's set in continuous time, risk-neutral individuals. I'm going to focus on a balanced growth path in my exposition, and then I'll come back and talk about a transition path. It's populated by workers that make an occupational choice that I'll describe in some more detail on the next slide, and firms that produce homogeneous final good using an idiosyncratic blueprint of the firm that I denote by Z, the productivity of the firm.

[02:37:26.20]

The firm hires some workers and produces this final good using a linear technology and labor. The firm incurs some costs to be in operation. There are some costs of intermediaries. There's vacancy costs. Think about that as there's an employment adjustment cost just like in Hopenheim, and there's an operating cost to stay in business, again, just like in Hopenheim. So nothing kind of really novel there. And to close the market, there's a standard cryptoglass matching technology that brings together the vacancies created by firms and the searching workers to generate a job-finding rate for workers. Finally, bargaining is over marginal surplus, is following a protocol that I developed in work together with Adrian Bilal, Simon Monge, and Gianluca Violante. Let me describe a little bit more the occupational choice that people make. So some new workers come in at any point in time. They enter the labor market and they make an initial occupational choice. They exert some effort to start— either get a business idea and enter the labor market as an entrepreneur. In that case, I assume that they get to imitate an incumbent firm that follows Per Lantonetti's So they draw productivity from the incumbent distribution.

[02:38:40.00]

If they're unsuccessful, they're going to start— enter labor market as unemployed. When you're unemployed, you either at some— with some rate, you get a chance to enter wage employment or you might also get the opportunity to start a new firm, in which case, again, the productivity of that new firm is a random draw from the incumbent distribution. Again, just like in Perla-Turnetti's famous 2000 paper. 2014 paper. When you're wage employed, you sometimes become unemployed for some idiosyncratic reasons or because your firm shuts down. You sometimes get offers to work for a better firm. So you can make job-to-job flows. Or finally, you

sometimes get the chance to move into entrepreneurship. Here's one important assumption. I'm going to assume that— so it's going to be a model of spinoffs. So my assumption is if you start a new firm when you're currently employed, you might potentially build on top of the productivity of your current employer. So it's a model of spinoffs, and it's captured by this parameter beta that I'm going to estimate. Spillovers from productivity of the current employer you have into the new firm that you create. Finally, when you're an entrepreneur, you produce, you hire workers, until at some point you're going to find it optimal to exit again.

[02:39:53.11]

Okay, so that's the model in a nutshell. I'm going to show you now a scary-looking thing, but then I'll show you how to greatly simplify it. So, this is the joint scaled value of a firm, a collection of a bunch of workers that work for the firm, and that firm has some relative productivity C and hires some workers N. In the interest of time, I'm not going to talk you through all the components of this. It's partly to just show you the beauty of how much progress we can make in a second. So, in particular, under some fairly innocuous assumptions, we can greatly simplify. This problem. So in particular, we can show that we can reduce that beast that we just looked at, the joint surplus of a firm, into something much simpler. It's just going to be the sum of values of matches that are in the firm plus some additional value to the entrepreneur. The beauty of this is in particular that it reduces the state space. Instead of having to keep track of both the size of the firm and its productivity, we can only focus on the relative productivity when solving the model.

[02:40:55.06]

So Instead of solving PDEs, we can solve ODEs. It greatly simplifies things. We can make a lot of progress analytically. Okay. So the next thing I'm going to do is I'm going to make some further analytical progress. I'm going to impose some additional assumptions. They are going to be— these assumptions will be relaxed in my quantitative work later. So in particular, assume first that all entry into entrepreneurship takes place at that point of labor market entry when you make that initial entrepreneurial choice.

[02:41:23.06]

choice.

[02:41:23.50]

And second, that recruiting is inelastic for firms. Under those assumptions, we can show that the expected return to entry into entrepreneurship takes the following form, and it highlights 2 key

forces that govern how growth affects the incentives to start a new firm. An interior equilibrium has to satisfy the following free entry condition, that expected return has to equal the cost of entry. Now, I want to zero in on these 2 opposing forces that the framework highlights. So one is a well-known force. If you think about this, the growth rate is really a key equilibrium object, but let's think for a second about this exogenously varying and think about what that does to incentives to create new firms. If the growth rate is high, then new firms are not expected to remain in business for as long. The rate of obsolescence is really quick, And so you're not going to stay in business for that for as long. That's going to discourage entry of new firms. That's a standard obsolescence force that Aghion and Howitt emphasized in their seminal 1994 paper. But on top of that, there is in this framework a new force which I term mismatch channels.

[02:42:38.32]

In particular, when the growth rate is really high, it means that technologies turn over at a rapid pace. That gives workers little time to relocate across those technologies, become well-matched to them before they're displaced, before new technologies come in. So in a fast-growing economy, it's going to be as though labor mismatch is really high. These technologies churn all the time and workers don't have much time to find a good match to them before they're gone and replaced with new ones. That's illustrated in the left-hand side panel here. In a fast-growing economy, there's just a lot of mismatch at any point in time. That force per se is a force that tends to encourage the creation of new firms. New entrepreneurs come in and they can hire workers cheaply because they haven't already found a good match with incumbent technologies. In principle, if these forces, that mismatch channel, is strong enough, you can even generate multiple stationary equilibria. There could be an equilibrium where the growth rate is fast, the labor market is mismatched, and that encourages the introduction of new technologies. You can also have a slow-growing economy, technologies stay around forever, workers are really well matched to those technologies and that discourages the introduction of new technologies.

[02:43:47.06]

So, that's very much possible. Under some conditions, there exists an equilibrium and it's unique. I'm not going to talk more about the details of that. They're in the paper. I'm going to proceed now assuming that those conditions hold. So, we have a unique balanced growth path equilibrium. Before I turn to the effects of aging on that equilibrium, I want to pause for a second and tell you about worker and firm dynamics, lifecycle dynamics in that equilibrium. So in particular, this is first for workers. So workers come into the labor market, they're poorly matched, they're unemployed, and they gradually find a good match in the labor market. So older workers, that's the left-hand side panel, will tend to be better matched. They will tend to

work for relatively more productive firms. They've had more time to find that good match. As you become better matched, left-hand side panel, you're less likely to move to another employer because you've already found a cushy, good job that you enjoy. That will then— the model will then naturally predict that decline in worker mobility that you saw in the data before. Workers become better matched over time. The second lifecycle dynamics I want to pause to talk about for a second is firm lifecycle dynamics.

[02:44:58.08]

So this is how it looks in this model. Young firms come in with some random productivity, say that is z naught. Initially, they have no workers and they're relatively productive. And so they're going to hire workers for a bit. But over time, they're going to— technological obsolescence is going to hit and they're going to become relatively less productive. At some point, they're going to stop growing and start shrinking again as more and more of their workers leave for other more productive employers, until at some point they find it optimal to exit. When you integrate this against surviving firms, you can show this formally. Mean size rises monotonically in firm age and net poaching, which John Haltewanger emphasizes a lot, declines with firm age. you get that naturally in the model. The final pattern I want to tell you about is entry over the lifecycle. So here you need some additional assumptions on the strength of the spinoff externality, that parameter beta. But you can show there exists a range of values for that spinoff parameter such that you get the inverse U-shaped entry profile that we see in the data. The intuition for that is if initially those spinoff effects are large, so you kind of move to a more productive job and that makes you much better at coming up with new ideas, that's going to encourage for a bit entry into entrepreneurship because you're just creating much better ideas.

[02:46:15.58]

But at some point, the opportunity cost of pursuing that idea will be really high. You'll already have a cushy, well-paid job, and so you're going to be less inclined to then pursue entrepreneurship. You have to give up that job to do it. So for the right parameter values, you're going to get the inverse U-shaped pattern of entry that we also see. Now, let me tell you about the effects of aging on this economy. So, I'm going to model aging as a decline in the growth rate of labor supply. That's going to shift the aggregate age composition toward older workers. The way this model is set up, it doesn't feature either strong or weak scale effects. So, there is no effect directly of labor supply growth holding fixed the composition of the workforce. The way it's set up. But it does affect that composition of the workforce, and that's what I'm going to refer to as aging decline, and that is going to increase the share of old in the workforce. What does that do? Well, it's going to increase the employment share of these well-matched workers in the labor market. That's going to serve to then discourage the introduction of new technologies, of

entry of new firms into the economy, because everyone is already well-matched to incumbent technologies.

[02:47:24.31]

There's a higher— it's going to be harder to recruit workers to work for new technologies. As the growth rate declines, that makes individuals even better matched to incumbent technologies. They stay around now for longer, so even conditional on their age, workers are better matched in the older economy. This we can show then formally. The growth rate declines with aging, but the level of output actually rises. You have more of these well-matched individuals in the older economy. So there are these opposing level and growth effects. I'll tell you just very briefly about also the welfare consequences of aging. It's interesting. So what it does is unambiguously it reduces welfare of labor market entrants. When you're a young worker, you look forward to your career. You want a fast growth rate, a fast arrival rate of new technologies into the future. That's lower in the older economy, so you're unambiguously worse off. But there are actually some older workers who are already well-matched to incumbent technologies that benefit in the older economy. Their values go up because it just means that those technologies are going to stay around for longer. They're going to get to keep their cushy job for longer.

[02:48:33.57]

So they're better off. Now, finally, let me turn back to my original, my second motivating fact. The model then, again, we can show formally, will replicate the empirical pattern that you saw. that aggregate aging will reduce the age-specific rate at which you switch employer and the age-specific rate at which you start a new firm. The intuition for the left-hand side panel is that in the older economy, fewer new technologies are introduced at any point in time. That means for workers, fewer new, better opportunities to move to. And so they're going to kind of be less likely to switch employer. For the right-hand side panel, it's the intuition we talked about before. In the older economy, it's just people are just better matched to incumbent firms and technologies. Entrepreneurs realize that, new entrepreneurs realize that it's going to be harder to introduce a new technology and hire workers to work, to operate that new firm. They get discouraged, and so you're getting kind of also these declines in entry conditional on age. In the last few minutes I have available, I'll just put briefly some numbers to this. I'm going to focus on just one key outcome, which is growth in GDP per worker.

[02:49:47.40]

So, tell you just briefly what I'm doing here. I'm estimating the model to hit Sweden, a range of moments in Sweden. And then I'm going to consider a perfect foresight experiment where I start

aging the economy as we've observed it in the data starting in 1945 and as we expect it for the next 25 years. and then let it eventually settle down to balanced growth path again. Feeding in that change in the age composition and looking at what it does to GDP growth and GDP per worker. So, the left-hand side panel is for Sweden, which the model is estimated to fit. The right-hand side panel is for the US, which the model is not estimated to fit. I don't have all the moments I need to estimate it separately for the US, so you'll have to take that with some grains of salt. It's just a Swedish calibration and now feeding in the US demographic trend. So what you find— what I find is that aging generates a boom, high economic growth through the 2000s, at least the early 2000s, which is broadly what we've seen also in the data, both in Sweden and in the US.

[02:50:55.12]

And it's happening even though the workforce, as you saw on my very first slide, has monotonically aged since the 1980s. That means that shows up if you decompose this as a negative growth effect. So by growth effect, I mean the rate at which new technologies are introduced has declined monotonically since the early 1990s, the late 1970s, '80s, as the workforce has aged. But over on top of that is this very strong level effect. So older workers move in the labor market, become better matched, in the labor market. And that level effect temporarily is so strong that you actually get a boom in economic growth. But of course, these level effects are exhausted eventually. And so going forward, the growth effect becomes relatively more important. And I estimate that, you know, for at least the next 30 years, growth will continue to be suppressed.

[02:51:52.14]

Good.

[02:51:53.02]

So I will wrap up. So I used Swedish administrative data to document 2 facts on aging and labor market dynamics. First, older workers are less likely to move across employers, and they're less likely to start new firms. Second, when an entire labor market ages, also the age-specific rate at which you move across employers and start new firms declines. I proposed a theory to to rationalize that pattern and use that theory to think about the aggregate implications of aging. So the theory highlights that older workers, they tend to be better matched with existing firms because they've just had more time to find a good match in the labor market. That means that workforce aging will improve the aggregate match, the economy-wide match in the labor market, just put more weight on subpopulations that are better matched. That better match with

incumbent technologies in turn serves to discourage the introduction of new technologies into the economy. Quantitatively, because of these opposing level and growth effects, I estimate that aging generates a boom in economic growth through the 2000s, even though the workforce has aged over that period and the rate at which new technologies are introduced declines monotonically.

[02:53:10.53]

But it's offset by the fact that we relocate across incumbent existing technologies. We become better at using those existing technologies to such an extent that for a bit you have high economic growth. But going forward, you know, at some point you exhaust these level effects, and so we're going to start to see sort of the growth effect become relatively more important. Growth is going to continue to be suppressed for, you know, decades to come. Thanks so much for listening in.

[02:54:20.37] - Meghana Ayyagari

Thank you to the organizers for having me to discuss these papers. So we have 3 papers, 10, 12 minutes for me to discuss, and one of those papers is over 100 pages. So I think the binding constraint that we should be talking about here is the discussant's time constraint. Straight. But the nice surprise of reading these papers together was that I think it made me draw some interesting connections between the 3 that I probably wouldn't have done if I'd read them on my own. Okay, so I'm going to give some very high-level comments on each of these papers. So in the interest of time, you know, highlight their main findings, but in each case I'm trying to think about what these findings really imply for policy. So please take my comments in that spirit of maybe expansion for work, maybe even new papers rather than sort of criticisms of existing models or empirics and so on. Let me start with the big picture. Here are some 3 facts that we have seen according to latest statistics. In the next 10, 15 years, we expect to see see 1.2 billion young people reach working age in developing economies.

[02:55:41.28]

And at the same time, if you look at current trends, the jobs for these young people tend to be around 400 million. So, you know, there's a big shortfall there. Meanwhile, you see that about a quarter of people are living in a country where population has already peaked. Right, so 3 very, you know, interrelated but also different challenges. And so the world is really facing 2 types of demographic pressures. In some countries, you see a lot of young workers coming in, maybe not enough productive jobs to employ them. And on the other hand, you see an aging workforce with few jobs, and the jobs that exist, you know, may not really be the most productive jobs,

right? So I think these 3 papers really are very timely in the sense that they're asking how does How can you trans— how can structural transformation lead to better jobs, more productive jobs, and really sustain growth? So I see these 3 papers as 3 links in a chain. So Marsha's paper is really about who's available to work in manufacturing. So that's your demographic constraint. The paper by Marty and his co-authors are really about these modern productive firms.

[02:56:57.01]

Even when these firms are productive, why are they not hiring more workers? And then of course Nicholas's paper is about, you know, what prevents movement. So who's available, who's hired, and, you know, who really moves. And the common thread across all of this is, you know, what does it mean for policy? What do these 3 things mean for policy? And sometimes it's very different policy implications. So let me start with Marta's paper, right? So she starts with this very striking patterns that she documents. So if you look at the left figure, we find that earlier developed countries sort of hit, you know, sort of the fertility decline in these developed countries was happening at much later incomes. So that's the, you know, the navy blue line that you see. The developing countries, on the other hand, see that fertility declines are happening at much lower income levels, right? So that's a very steep decline that you You see that. So then she relates this to manufacturing peaks being lower. So if you look at the green bar on the right figure, you see that the manufacturing peak is much lower and it's also happening at a much lower income.

[02:58:08.49]

And she has a very nice story behind this, which is that if you think about young workers, so this is the 25 to 34 age group, they mostly work in manufacturing. So when you have a declining fertility rate, this faster demographic transition, supply is affected because these workers are the ones who really are in manufacturing. But you also see demand being affected because it's the younger workers who are also consuming more durables, right? So those 2 forces together give you a lower manufacturing peak and a peak that's occurring at, you know, much lower incomes. So what I really like about this is, you know, we've talked about trade, we've talked about automation, globalization, and here is a new sort of explanation explanation for why we might be having this premature deindustrialization, which is this timing of the demographic transition. And it's a super relevant issue, right? Because if you look at developing countries, you look at the BRICS, even the— we are below replacement fertility rate in many of these economies, right? So very nice paper. And what is really interesting is she shows that there's almost a 1-to-1 estimate. So a 1%age point increase in young adult share leads to a 1%age point increase in industry share of non-agricultural employment.

[02:59:32.17]

And this is almost at the cost of services, okay? So I have 2 comments on this. First is really about this age or the, this whole, you know, is it just age or is it the whole fertility transition that's accompanying this? What the paper does is it looks at births 25 to 34 years ago as an instrument, as a prediction of current population structure. And that makes sense, right? You would think that past births influence the age profile today. And it's a very commonly used instrument in a lot of things. So my comment is not really about IV violation, but really about aging and these fertility declines affect a lot of other things, right? I mean, they affect, sort of the nature of work for women. It affects schooling. It affects technology adoption. And all of this we are bundling into this age effect. I mean, there's this very— I've done some work on payments in India where we show that it's more the young people who are adopting UPI or this Unified Payment Interface. Nico Krause has this really nice paper where they use a similar instrument and say that these past births actually also influence technology adoption.

[03:00:47.05]

So the question that I had was, you already have a decomposition in the paper, but I would like to see how much of this one-to-one effect is coming entirely from aid, from, you know, the forces in your model, which is young people working in factories and buying durables, and, you know, how much is actually left over. So if, you know, if there's a large portion that's left over, then maybe we want to think about these other channels like technology or how sort of nature of work has actually transformed. And this is not really, I worry about the channel here because you always think about like this one-child policy in China and these other countries that have these policies, whether these past institutional changes or policy changes are affecting both fertility and industrial transformation. Right? So, and that's something that affects a lot of other papers. Second broader comment is about this earlier deindustrialization. And I'm trying to think about, is this really a loss? Because if you see some of these papers that document manufacturing having coming back, but that coming back of manufacturing is happening in smaller firms, more informal firms, Is that really what we want?

[03:02:07.04]

We also know that services can carry productivity growth. So, and in the paper's own model, you'll see that most of this output loss is coming from having fewer workers. It's less about this transition between manufacturing and services, right? So what I would like to see is, I think you're able to separate wage work from self-employment in the paper. So are these large young cohorts, are they actually raising formal wage jobs and productivity in manufacturing or are they

actually doing more of self-employment? And since Samuel asked me to explicitly relate some of this to my work, so you'll have to deal with some self-promotion along the way, but we have some work where we show that small firms are the ones that generate most of the employment share, the large firms are the ones that are the most productive, jobs. And so it's really which firm the young firm decides is joining is really going to determine whether this is really a big loss or not.

[03:03:07.22]

Yeah.

[03:03:09.11]

So the second paper is, you know, they have a very striking finding. So as you can see in the picture there, middle-income economies have these productive jobs. So they modernize in output. So 43% of labor income is generated by these, what they call as these modern firms or 10+ workers, but it's only 26% of the employment share. That same sort of ratio you see in high-income countries is like 69 to 63%. So the big question is, why is it that you are modernizing in output that you have these jobs but really not contributing in You have these productive jobs, but you don't really have the workers in these jobs. So they look at Colombia at its 1970s industrial peak. They have a really nice model where you can either run a modern firm or you could be working in one or you could be self-employed. Headline finding is that different types of distortions are cutting modern jobs from 73 to 24% and income by 31%. What's cool about this paper is really the policy implications because it's telling you that the policies to create modern jobs are very different from the policies that you need to raise output, right?

[03:04:27.43]

So, and that's what I find really, you know, very attractive in the model and the sort of findings. And they show that this technology could raise output, but at the same time, not really, you know, sort of give you modern jobs. And the floor here, the wage floor that they're looking at is pretty important. So my 2 comments on this, one is there is entrepreneurship in the model, but it's largely a static occupational choice model, right? So what would happen if you add firm lifecycle dynamics? You already have a really nice model. So this is the one where, you know, it's probably a second paper that, you know, we are talking about. And this again comes from some of the work that I've done. If you take 2 promising young entrepreneurs who are sort of equal in all dimensions, one has access to credit, buys new investment, buys new equipment, and is able to employ, say, 20 workers. A same similar type of entrepreneur doesn't have

access to credit, doesn't invest in CapEx, and employs 2 workers. Both of them have very different implications on how sort of, you know, how the employment structure would look like.

[03:05:34.29]

So the question is, if we added an entry cost or a collateral constraint to this model and you recalibrate to firm size at birth, would we still get the same ordering of this wage floor explaining most of the action in the model? And the second thing is payroll costs, you know, sort of are a big factor in this model in terms of how much the firms can scale. And I'd done some work on minimum wages and that's why I'm familiar with this Kugler paper wherein they look at this 2012 reform on payroll taxes in Colombia. And it occurred to me that maybe you can calibrate to this pre-reform Colombia and see whether your model can actually explain the real numbers in the reform itself, right? So that would be a very compelling finding to me. And there's already some evidence that this correlation of payroll wedge with productivity is reducing over time, right, from the '80s '70s and '80s to more recently, you know, that's a pretty big drop in those— in that correlation. So maybe there's this reform and you can actually bring in some hard numbers to it. Third paper is, you know, so the first 2 papers were about young workers in these countries.

[03:06:46.33]

Nicholas's paper is sort of the rich country equivalent where we are looking at what is the role of aging and how it transforms the workforce. So he's looking at local markets in Sweden and, you know, very cool sort of matched worker firm founder Founder data. And the simple story is this, right? So if you have an aging workforce, what he sees in Sweden is that there are fewer startups and there's less job movement. There's less movement mobility of these workers. And what is striking is that it's not just a composition effect. So it's not just the older workers, workers of all ages, people of all ages in these older markets are starting fewer firms and they're switching jobs less. Why does this happen? Well, in an older labor market, people have had more time to find a job that matches their skill set. So there's that better matching that happens between workers and their skills. So that leads to an increase in output. That is the level effect that we see. But then if you're already in a job that, you know, matches your skill set, the opportunity cost of leaving is going to be much higher.

[03:07:51.49]

So what does that mean? You're less likely to switch. You're less likely to be bringing in new technologies, and that's where you see the growth effect going down, right? So, you know, it's very elegantly modeled that there can be increase in output and at the same time there's an increase in growth. So my first comment is, if I take 2 30-year-olds who are equal and one is in

a younger labor market and one is in an older labor market, why does the 30-year-old in the older labor market stay put? The paper story is that there's a better matching, right? My skills are better matched to the job that I'm in. So, you know, there's no incentive for me to move. But I wonder if a part of that is also coming because you have fewer outside opportunities, right? Or as in the case of Sweden, there may be some institutional lock-in. So if you think about this tenure-based protection that you see in many countries and including in Sweden, The tendency for a person who's in a job for a long time to leave is going to be— the incentive to leave is going to be much lower given these lock-in programs, right?

[03:08:59.19]

And I think you can do some empirical tests. So if it's the ruling out the fewer options, you might want to look at whether older markets have fewer low-quality entrants, maybe even look at the unemployed and see if they're finding jobs more slowly. Or for the institutional lock-in, again, there are reforms and natural experiments which you could probably use, you know, and that would make sort of a nice follow-on paper. Why do I emphasize this? Because I think the policy implications are going to be very different. In the first case, if you're staying because you have a genuinely good match, then I think we should be careful about subsidizing job switching. Instead, you want to focus on, you know, on young firms hiring the better workers, on getting technology to the best firms. On the other hand, if it's fewer outside options, then maybe you want to lower entry and finance barriers. If it's more institutional lock-in, then maybe you want to have more portable worker protection. So like protect the worker and not the job, right? In the interest of time, I'm going to skip ahead. But I want to leave you with this, that these 3 papers come in at a very timely point wherein we're thinking about how demographic dividends can be converted into growth dividends.

[03:10:11.37]

And the answer seems to be that it's the ability of productive firms to absorb workers, to hire, and to actually grow. And so these papers come in telling you that, you know, maybe you should be paying a little bit more attention to this firm dimension. And the key question is which firms can enter, which firms can obtain financing, hire, and scale up, right? So that's all I have for today.

[03:11:06.45] - Sandeep Mahajan

Fantastic presentations. Please give a round of applause to the presenters.

[03:11:15.11]

This applause is unconditioned by their responses, so we will come back and give them another round.

[03:11:19.26]

But really good stuff, and also they did really good on time. I think they were just 1 minute over.

[03:11:26.05]

collectivity.

[03:11:26.59]

Okay, let's open it up. You've been very disciplined with your questions and you're holding it up, so unleash it.

[03:11:47.12] - Audience

Hello, great set of papers.

[03:11:50.22]

Thank you.

[03:11:50.50]

I actually had a question for Dominguez. Marta, thank you. So I found your paper to be—

[03:11:59.29] - Sandeep Mahajan

Sorry, can you introduce yourself and then—

[03:12:01.14] - Audience

Ah, sorry.

[03:12:03.34]

Laura Alfaro, I'm a co-author of Martín, chief economist right now of the IDB and also HBS. So I found your paper to be interesting. Latin America, I don't know if this is a well-known fact, but most of our countries went through the demographic transition a while ago, and it has this particularity, as you mentioned, that it starts later, although as I said, there's countries like Chile

and Costa Rica that did it a while ago, but once it happens, it happens very quick, it's very fast. That's why I was a little bit skeptical of finding this age transition to be the reason why manufacturing in Latin America peaked early, because it has happened. But hearing about your explanations, there's like, when you start your sample, the expected lifespan of those people were like 50. So no one was really going at the end of your, like 65, 70. And I also find it weird that people were like, I am not that smart, let me go into manufacturing. I think a lot of it is like, that's the job that you see and that's the opportunity that you have. But also, when you take this medical— this reasoning of the cognitive— like, of being services requires more knowledge, so on and so forth, it seems to be for certain type of services, not for a lot of services that a lot of these people tend to do.

[03:13:31.47]

For lack of a better example, cleaning. Cleaning doesn't really require a lot of—

[03:13:35.35]

and a lot are these.

[03:13:37.00]

So perhaps if you go deeper into— I know you have high-skill and low-skill services, but services is a sector that has really, really a lot of heterogeneity. I think it will help me convince myself a little bit more of the story, although I did see your evidence. The other thing is all of these things are very slow moving, and so I don't know how you— and they all have a trend, and it was not clear to me how you're doing the econometrics for that. Very interesting paper.

[03:14:03.53]

Hi. So should I? Okay, so I have a question for Marty regarding your paper and the—

[03:14:18.01] - Sandeep Mahajan

Please introduce yourself.

[03:14:19.37] - Audience

Hi, I'm Marina Mendes Tavares with the IMF. So first question is, how widespread do you think it is, this effect that the labor costs are— the minimum wage, let's put easily, is too high and is creating problem for some workers to have access to good jobs. And second is, we know that

these minimum wages also affect even the return of workers in the informal sector, right? So it's affecting many workers on these economies. So is the problem really that there is a minimum wage, or is the problem that the minimum wage became too high? And in that context, what is the optimal minimum wage for economy that actually has high level of informalities and many workers really work in subsistence jobs. Thanks.

[03:15:16.25] - Sandeep Mahajan

Thank you. We have one question here at the table and then we come to the queue after that.

[03:15:41.44] - Audience

Now, first, solidarity to the discussion, because, you know, discussing 3 different papers in, in 15 minutes is really a big achievement. A point on Egmont paper, which I like very much, and I think it's very, very, very useful. What I find a bit difficult to swallow is this initial positive productivity effect of aging, which seems to me to go against much of the facts I'm aware of. It seems to me to be rather counterfactual. I wonder whether you really need it, because the key mechanism there is a declining reallocation, which is cumulative. And to get that, you may not need that these are better matches in terms of higher productivity.

[03:16:26.50]

Maybe for instance, that you get better matches from the welfare standpoint.

[03:16:31.35]

Suppose that, you know, jobs are a sort of experience goods, uh, so older workers in a way get, you know, better matches in that respect. In, in, uh, or there are many other possible reasons, family-related and so on, why you get less reallocation. And that accumulates if you have other coworkers. You know, coworkers are a key amenity, for instance, in jobs. So there are other mechanisms there that could be at play, and that your story would hold perhaps still in this case.

[03:17:11.24]

Um, hi, my name is Mark Levinson. I'm a historian and economist here. I had a question regarding Nicholas Engbom's paper. And that is that just about all the OECD countries saw a decline in productivity growth starting in the early 1970s.

[03:17:32.24]

And this slow productivity growth went on for at least 20 years and in some cases more.

[03:17:38.49] - Gordon Hanson

This happened at a time when record numbers of young people were coming into the workforce due to the post-World War War II baby boom in all of these countries. How does that fit with your findings here?

[03:17:58.45] - Marta Domínguez-Jiménez

Sure.

[03:17:59.56]

So thank you very much for your question. So in terms of Latin America, I must admit, so I haven't specifically focused on Latin American economies, so I can't really tell you, you know, zooming into Latin America, the extent to which it captures the trends. What I can tell you is that in the cross-country level, and this is something I didn't have time to present, but luckily it was mentioned in this discussion, in the cross-country level, there is sort of, you know, in a country panel, quite a strong relationship between young adult shares and manufacturing employment shares. And that holds true not just for sort of manufacturing employment in general, but also the 2 objects of prematurity industrialization. So sort of the peak and the GDP at which that peaks. peaks happens is fairly related to the young adult share leading up to that peak. And yeah, I guess my sort of point is that this is all relative, right? So it's not like low-income countries are necessarily very old. It's just relative to how young high-income countries were. And you're right, much of that was about mortality. They still have a workforce that's much younger.

[03:19:00.56]

So sort of that composition of the workforce is much younger. And then what you said within sectors, so I agree that's very important, sort of sectors are broad categories and they're very heterogeneous. And I haven't delved into manufacturing— sorry, services that much, but I have looked quite a bit. And in the paper appendix, there's a bit of work done on sort of within manufacturing, what is the sourcing across the different occupations and sub-industries. And you find again that there's quite a trend in how physical these different sub-occupations are and, you know, sorting by age. And for example, there are some occupations in manufacturing that actually you know, go up with age. So it's not sort of— it doesn't hold across the board, but this is just sort of the aggregate pattern. And I imagine in services it's very similar. I haven't done a full breakdown, but I certainly could. But the other thing I wanted to point out is that this is about

relative abilities, right? So you're saying some services don't require that much accumulated knowledge. That's for sure true. It's not quite just accumulated knowledge. It's other types of skills, so communication, interpersonal.

[03:20:01.31]

But I agree with you. Cleaning doesn't require any of them, but it's about relative— relative to other sectors, right? But anyway, but again, it's sort of broad sectoral categories that captures heterogeneity within them. So it doesn't necessarily have to hold for every subcategory.

[03:20:18.52] - Martí Mestieri

So first of all, thank you, Marina, for these 2 excellent questions. So in my heart, I'd like to say that these labor costs being a very important element to take in consideration, hold widely in Latin America. Of course, the precise reason why the exercise is only in Colombia is where we are actually more or less confident that we can estimate these wedges in a reliable way. This being said, and also that's part of the discussion, we do observe this jobless modernity basically across the board in Latin America and other emerging economies. Being able to pinpoint more requires being able to estimate the production function and the wages in a careful way. I think that's for future work and that's very interesting. Relating to the minimum wage question, of course, there's a selection margin and here workers in our model select according to comparative advantage. But also then there's this distortion, which is basically some workers may actually would like to work in the modern sector, but they can't. So the optimal thing to do in our setting would be to get rid of this minimum wage and just allow everything in terms of comparative advantage to play out.

[03:21:45.13]

I mean, this being said, probably we'd like to make this point more forcefully. You want to have a rich richer model to think about that. But yeah, happy to talk more.

[03:21:54.14]

Thank you.

[03:21:59.29] - Niklas Engbom

Thanks so much. I think Tito asked the first question. I agree with the spirit that if older workers are just less likely to move for whatever reason, there might not be a better match. But anything, the mechanism in some sense would work still. I agree with that. I do want to say though that

that I find in the data that workers do move quite a lot towards more productive firms as they get older. So that gap is about 20 log points. You move towards higher, more productive firms. So that's clearly kind of— it is there in the data. And we also see that partly reflected in life cycle wage growth, et cetera. So I do think there's some truth to that mechanism, but there might be other factors there too, in fact. had some decomposition suggesting that there is something on top of the matching, some true age effect that also accounts for some of the patterns you see. Now, the second question I want to emphasize there that the model is very much consistent with slow growth in the 1970s that you saw that flash by really quickly. And it happens even though the— you're right that there's a lot of young workers in the 1970s, so the rate at which new technologies are introduced is high then, but you have this very strong level effect then again in the background.

[03:23:15.45]

These young workers come in poorly matched and that drives down the level of output and that effect is so strong that you're actually getting low economic growth in the 1970s just like we saw in the data because of that level effect. These young workers are just flooding the market and they enter initially pretty poorly matched.

[03:23:37.01] - Sandeep Mahajan

Thank you.

[03:23:37.51]

Meghana, do you want to come in on any of the questions? Anything to add?

[03:23:46.30] - Meghana Ayyagari

Going back to what Nicholas said, I'm sure there are other mechanisms that can contribute to this, but there's pretty strong evidence in the paper that aging is a significant part of some of the relationships that he establishes. So, there may be other channels, but I think these demographic changes

[03:24:06.07] - Sandeep Mahajan

Okay, much food for thought, but I think we also have real food now after this.

[03:24:10.12]

So thank you very much.

[04:24:51.46] - Laura Alfaro

Welcome back. Good afternoon. Welcome back. I hope you enjoyed your lunch. We're heading into a new great session. My name is Laura Alfaro. I am the Chief Economist of the Inter-American Development Bank, on leave from Harvard Business School. Our next session is on AI and labor markets. And so let me just advertise that the IDB just put out their flagship report on AI and digitalization for the region. We're a region, as people have mentioned, that has productivity problems, a demographic transition. And so AI does offer some hope. But as we all know, this is a technology that we all need to put effort to use in a responsible way and also to help everyone learn all the ways in which we can use AI in productive ways. And with that introduction, we have a great number of presenters. Marina Mendes Tavares from the IMF, Faizéh Khosrowabi from Georgia State University, And Daniel Angelini from the University of Vienna. And we're going to have as discussant Prasanna Tambay from the University of Pennsylvania. So this is an amazing session. And let's start with Marina, Bridging Skill Gaps for the Future, New Jobs Creation in the Age of AI, in the AI Age.

[04:26:46.46] - Marina Mendes Tavares

So, thank you very much for the invitation to present this work. This work is— was done with many of my colleagues that are here in the room, and I'm super happy to be the one to deliver for you today. The motivation of this work really comes from our previous work that we look at the impact of AI on the labor market. And we really felt that that work was a little bit to show— a lot of the emphasis was on the exposure and the potential of AI to impact workers negatively. So we came back and we thought about, but what are the new opportunities that are there? What are the new skills that are going to be demanded? And we decided to delve a little bit of this challenging of look at the data and found where AI can also help us and how workers can better prepare for that future. So just to give a little bit of the key messages since it is such a short presentation. Looking at our previous work, we found that globally 40% of workers are exposed to AI. Of course, this doesn't tell about whether AI is gonna displace workers or complement workers.

[04:28:23.51]

We find that in general, half of these workers are gonna benefit, and half of them are going to be displaced. But what I'm going to show is that the labor market is changing, and it's changing quite fast. Already, 1 in 10 job postings in advanced economies, they require a skill that we call new, a skill that was not present 10 years ago, and it is requiring workers to learn new things,

and fast. And we find that skills that are related to AI, they carry a wage premium. So the workers that do have the skills, they benefit from it. But at the local labor market, we find that the impact of the introductions of AI skills can be, at least at this point, for workers that are in occupations that we call high and low complementarity, I will elaborate on that, this impact on employment can be negative. So the bottom line is that there is a mixed picture here with AI bringing gains for certain workers, but also loss for other workers. So just to put the stage, we found that 40% of workers were exposed to AI, and most of these workers are in advanced economies.

[04:29:50.40]

And that's driven really because of the structure of these economies that have a much larger share of workers in cognitive occupations that are tasks that AI tools can already perform. And this work here was done even before agentic AI. So we can think about how this picture is changing. And how fast it's changing. So now we're going to delve in our new work. So what we want to understand is how the labor market is changing right now. And we did this by leveraging job post data. And why job post data is so useful is because job post data first is very dynamic. You can go to the data and see what job posts are being posted now. And also because we have very granular information about the job titles, a complete description of the skills required, the geographical location of those jobs, the company name, and for certain countries, even the wage. So, we can look at that to really look at the skills that different firms are requiring for workers and look at how these skills are changing over time, across countries, and also the type of technologies that are being required. And we look at that across 6 economies because that was the dataset that we have on that time.

[04:31:22.40]

Now we have a global dataset. And we find that new skills, for example, they were already posted in 10% of jobs in the US, in the UK, Denmark, and Germany, around 14%. And we see that there is a much lower share in developing economies, the 2 that we have, Brazil and South Africa. And we look as well about AI skills. So, we want to make here, and you're going to see in my presentation, There is a key distinction about new skills that were before AI. So new skills that didn't exist in 2010, and then the focus on AI skills. And we can see as well that these AI skills are diffusing fast. In US, 5% of job postings already require AI skills. Some of them are using skills like knowing Copilot, ChatGPT. Other ones are more developed skills related to large language models and Python. But there are even countries that require much more AI skills, for example, from Ireland. And what is interesting when we look at the global— at the general new skills is that most of these skills are IT skills, also business analysis, but there are also a lot of new skills in sectors, for example, that are healthcare and services.

[04:32:56.51]

And we can see that these new skills are also concentrated in occupations like managerial, professionals, and technical occupations. And now we start looking at how these new skills diffuse across countries. And within countries in the US, because the US in Lightcast data is a country that we have the largest, the longest panel series. And I think this chart on the left is a very interesting chart because it's a chart that shows that skills are diffusing fast and it connects very well from the first session where we discussed that how the fact that these new skills accelerate over time put more pressure of workers on the labor market. So, what we look at here is that we look at 3 cohorts of new skills. So, new skills are skills that become important in 2010 and 2014. To be precise, they pass a threshold of 2% on the dataset. This is a— And we look at those vintages in 2010, those vintages, new skills of 2015, 2019, and new skills in 2020 and 2024. And we can focus here, for example, in Wyoming. We see that in 2010, it would take around 25 months for new skills that start in California.

[04:34:35.19]

So it appeared first in a job post in California to start to appear in another job post in Iguana. When we go back to 2015 and 2019, instead of 25 months, it became 20 months. And when we go to very recent new skills, for example, 2020, we are already talking about 16 months. If you go to Texas, that of course is much more connected to California, we see the same pattern, that all the new skills would take around 10 months to arrive. But now the recent renew skills is particularly instantaneous. So, the new skills are diffusing and are diffusing faster within the US. But they also diffuse across countries. As we can see, it takes around 2 months for a new skill that starts in the US to be demanded in the UK, and similar in Germany, but to arrive in a developing economy like Brazil or South Africa, it takes around 8 months. And also, I want to show also in the paper, we find that many new skills, they also diffuse back. Of course, they start in Germany, and go to the US, or they start in Denmark and move to Germany, and even from Brazil and South Africa and move to the advanced economy.

[04:35:59.44]

But most of them start in the US. US is a really large provider of new skills. And what is interesting is that these new skills for the workers, they carry a wage premium. One thing that is fascinating about job postings is that we have millions of job postings. And we are able to calculate the wage premium in a very simple mean serial regression, but at a very granular level, even controlling by firm, location, occupation at the 4-digit level. And what we do is that we compare the job postings when the post requires just one AI skill, particularly with a job

posting that is almost identical without this AI skill. And we find in general that new skills, they associate wage returns for workers around 2%. And of course, this new AI skill in particular, they are related with a wage of around 8% in the UK, 2% in the US. But this development skills that are skills that are really needed to drive this AI adoption, they have a higher wage premium. But on the right, I show you that not all new skills, they carry with a wage premium. And we know that a little bit from the work as well of David Autor and Neil Thompson, that some new skills of these techno skills, they are related to a decline of expertise.

[04:37:34.32]

So, what it does is that decline the barrier of workers to enter these occupations, and lower the wages. So, some of these new technological skills, yes, they are related with higher expertise and higher wages, but also with a negative— but some of that with a lower wage. So, we cannot paint a broad picture. So, now that we have discussed the new skills, how they diffuse, in our next part of the paper, we try to understand what is the impact of these new skills on the local labor market. And that's really connected with the panelist speaking. And we look at the change on wages and employment at the commuting zones in the left. And we look at for different type of workers, high-skilled, white-collar, and blue-collar workers. And what we look is the change in the employment and commuting zone of the impact of arriving of a new skill, of a demand of a new skill at the job post. We instrument that with early adoptions of new skills in California and the UK. And we usually standard controls on the literature, like education, like the education, manufacturing, employment. And in second part, we also look at the impact of interact this with a couple of policies.

[04:39:15.10]

And what we find that is very interesting is that at the commuting zone level, we can see here at the left that in a commuting zone that firms start demanding new skills, these new skills are associated with wage gains around 2.3%age points. And when we adjust for the amount of new skills that are actually demanded during this period between 2010 and '11, 2023, it's around 7.6%age points. And we also find the impact on employment, but not significant and smaller. But what is interesting is that when we go over and disentangle about the type of workers that benefit from the demand of these new skills, we find that these new skills are really associated with wage gains of high-skilled workers. that are the— because these new skills are mostly concentrated in IT and more professional managerial occupations that these workers are. And we feel also low-skilled workers, but we don't find a wage gain on white-collar and blue-collar. So what do we see here, like as well drawing the work of David Autor and Dorn, is that it's driven an increasing job polarization. Because workers at the top and workers at the bottom benefit, but not much the middle.

[04:40:50.37]

And we find similar effects for employment. But on the employment effect, the effect is really strong for low-skilled workers, because these new skills are associated with higher demand that generate demand for services, jobs of low-skilled workers. And low-skilled workers skilled workers, they benefit more through employment, but also through the wage effects. And then we try to disentangle that and looking at the interaction of these effects with policies. And in general, here, many of the results are not, as we can see, significant, but they're indicative. But the ones that are interesting and significant is that we find that these wage effects are strong from places— here it's not showing, but places that have non-compete agreements. So it seems that workers, they benefit more when places that non-compete are in place. Also, we find that the benefits in general are more for places that have higher education and also lower land which touches as well on what we spoke this morning. Then now, so at this point, I just talked about the long impact of new skills. Now, I'm going to move and talk about the impact of AI skills. For that, we're going to use a different empirical method.

[04:42:28.50]

We're going to use an event study that is going to allow— as well today, look at the impact on employment, the commuting zone. And it's going to allow to multiple treatments through the increase in the demand of AI schools and that AI skills in the commuting zone. We are also having similar controls as the one before. But here, instead of looking at high low-skilled, blue-collar jobs, we are going to look at these 3 degrees of job complementarities. And what is interesting, and I think it's a key result for us, is that we can see in the blue, light blue, that even in the— very reassuring, even in the advanced studies setting up, New skills in general, they associate with higher employment, the commuting zone. So both the shift share and the event studies, they give the same result. But now when we move to these AI skills, at least to this wave of AI skills that we are observing right now, we find that on average the effect is negative. And for the workers that are in these occupations, that we call high exposure, low complementarity, is significant negative. And these workers are workers that have many of the tasks that they're doing, that they perform, that AI can already perform.

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And they're workers that we call low complementarity because they do not make critical decisions. They usually do not have many responsibilities. So, in some sense, they are not shielded from the AI adoption. And what type of workers are these? So, we did this in our previous work, and we find that in general, many of the workers that are in high exposure, low

complementarity occupations, they are in general young workers. Workers that just graduate. And that we can see this in this blue, in dark blue. And this pattern is similar for both advanced economies and emerging markets. And that connects with the work of Brinkhoff that also finds that at least at this stage, the employment impact of AI, it has been concentrated rate in workers that are young, just graduated, and they're less responsible, having less responsibilities in their decision. So our work, I think, it also speaks about that. We now move to try to understand the supply and the demand of new skills. So we find that new skills in general, they carry a higher wage. They also carry higher employment. But the AI skills are different. So we want to look at which type of workers are offering these new skills.

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One nice thing about the Lightcast job posts is that they also have a profile of workers, around 18 million workers. So we took all the CVs of these workers. And we scan for the skills of these workers listed in their CVs. And we look at the field of studies that these workers have. And these are for AI skills. But the picture here is similar by new skills and AI new skills. And we find that most of the workers that list these new skills, they are workers that have tertiary education, and workers that have education in ICT, science, engineering, and manufacturing. And this we have done for the US. We now try to look at to see, okay, so what are the share of those workers across countries? To make this graph, of course, we need to make a strong assumption. Which is that across these other countries, workers that have a degree in a similar field of work at the US, they also have the same new skills. We could not verify that because we didn't have the CV of workers across countries. But in general, what we find is that, for example, Ireland, Poland, Austria, and Finland have a much higher share of workers that have potentially those new skills, while the share is much smaller in countries like Colombia, Mexico, and Brazil.

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And then we try to put these 2 things together to understand. We have the job posts. The job posts tell us about the demand of new skills. And we also have the supply of new skills that are given by by the graduation of workers across field of studies. So to do that, we calculated this skill imbalance index. And we do this calculation, to be very clear, relative to the United States. And you can see here, the United States is at 0, because all the countries are relative to the United States. We use the United States because the United States is really on the frontier of AI skills. skills, and it's going to help us to project and to understand what are the future constraints that other countries can face. So, we can see at the left that, for example, Luxembourg, Sweden, Netherlands, and Brazil, these countries have a much higher demand for new skills than supply relative to the United States. While the countries at the right, for example, Ireland,

Poland, they have a much higher supply of new skills relative to the demand. For the countries that have a higher demand for new skills than supply.

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Our policy recommendation is more to, of course, expand the demand. So expand lifelong training, integrate IT skills into all fields of study, and strengthen the STEM education to really support the supply. While many of the countries that have a larger supply here, Poland and Ireland, they should really boost more the demand, which would be going through support innovation, easier business creation, and maybe better access to the firms. And then there are some countries that are similar to the US that they should keep both the skill supply and the demand, and they need to make sure that they keep themselves close to the frontier, whether other countries maybe need to work on both margins of helping the demand and helping the supply. So with this, I conclude. So really what we found is that these new skills are meaningful. It's 1 in 10 jobs in advanced economies are already requiring new skills. The share is almost half for emerging markets. And what is key is that these new skills, they are diffusing faster within the United States. And that can really create tension for both workers and also for policymakers and education people in the education sphere to really be able to provide the skills for the workers that are needed to the labor market.

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The new skills, they diffuse within countries and across countries. And in general, the workers that have the new skills, both AI new skills but all the new skills, they do generate, they do experience wage gains, can be almost 8% for those workers on AI skills. But what is key here, and I think it's something that we policymakers need to grasp with it, is that we find that the new skills from the, let's go from the past, they were very beneficial, at least at the local labor market, for both wage and employment, although they did generate increasing job polarization. But at least right now, we found that AI skills, particularly for workers in high-exposing, low-complementarity occupations, are having a negative impact on employment. And of course, the policy priority is going to really depend on the balance between the supply and the demand of new skills across countries. But also, it's always important to support the workers that are negatively affected. by this skill transformation that we are living right now. With that, I conclude, and that's the title of our report. Thank you.

[04:52:52.44] - Laura Alfaro

Thank you, Marina. Now we have Paise presenting Generative AI and Firm Hiring Demand: Evidence from Developed and Developing Economies.

[04:53:36.04] - Faezeh Khosravi

Hi everyone, thank you for having me. I'm Faezeh Khosravi, a PhD student from Georgia State University, and this is a joint work with my supervisor, Dr. Elaine Liu, and Dr. Alex Bell. And for this paper, we study how firms' recruiting patterns have changed across both advanced and developing economies around the release of ChatGPT. So generative AI can affect labor demand through 2 opposing forces. First is substitution, which means AI can replace some tasks previously done by workers, potentially reducing the labor demand for those specific tasks. For example, a software company may use generative AI to write or test the code. So if the company produces the same amount of software, it may need fewer hours of programming work. And the second force is productivity and expansion, which means AI can work with humans and these two complement each other. So in our example, if AI helps the company develop products faster, serve more customers, or expand into new activities, it may need additional workers in other roles. So the key question here is that which force is stronger, and does the balance differ between advanced and developing economies? We know that firms may have access to similar AI technologies.

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But their ability to benefit from them may differ across countries. For example, differences in workforce skills, managerial expertise, or digital infrastructure that may affect how easily firms integrate AI into their operations. So this motivates our analysis of how firms' recruiting patterns differ across both advanced and developing economies. So here the broad question is, how is recruiting demand evolving in the age of generative AI? And then we break it into 3 different questions. The first question is, do firms shift their recruiting away from occupations with greater AI substitution exposure, which means the kind of occupations that AI can easily replace? And the second question is, how does total posting volume change, and do these these patterns differ between advanced and developing economies? And then the third question is, does workforce education help explain these cross-country differences? So for the first question, we use the composition outcome, and for the second question, we use the volume outcome. Most of the literature focused on AI and labor market use focus on big countries like United States and United Kingdom. So this is the first paper focused on both advanced and developing economies using 200 countries. The second contribution of our work is separating which jobs firms advertise, which is the composition of jobs, from how many ads they post, which is the volume of jobs.

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And our findings shows that similar shifts in the mix of jobs can coexist with very different pattern for the total number of postings. And the third contribution of our work is that we consider ChatGPT as a general-purpose technology, which means when firms can use AI across different activities, the productivity gains can reach beyond the tasks, beyond the tasks that AI can perform directly. So we ask whether the recruiting pattern are consistent with that kind of expansion. The data that we use, we use LinkUp data accessed through Doovi platform. And they collect job postings directly from employers' career websites. And the datasets provide— so we can observe employer, country, the date for each posting, and then we merge job postings with their ONET code, which tells us about the kind of tasks that they do for each job. And then these occupation codes allow us to link job postings to AI exposure score. That is a different external dataset built from Peter Nalean, co-authored from International Monetary Fund. Also, we know that job postings measure firms' recruiting demand. So those does not show the actual hiring or realized employment. And we do not observe whether vacancy was eventually filled or not.

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Overall, the sample, we use 160 million postings across 43,000 firm-country pairs and 200 countries focusing on both Advanced and developing economy. The estimation window runs from the 2nd quarter of 2021 to the 1st quarter of 2026. So, this is the summary statistic table. Over the analysis window, the average firm country pair hosts about 167 in advanced economy and on average 42 in developing economy. So the posting per firm, country, quarter is the total number of postings. And the second is the probability of any posting. So first and second row are our volume outcomes. And then the share of high-substitution postings and average of AI exposure postings are our composition outcome. So I will explain in next slide that how we build them. So the difference here that I want to flag is who we observe in this data. About 94% of our data are in developing economies are multinational firms. However, this is like 30% in advanced economy. So covering 200 economies and countries doesn't mean that we represent all employers in those economies. And now here I will explain that how we measure firm exposure to AI. And how we categorize firms if they are more AI-exposed firms or less AI-exposed firms.

[05:00:11.41]

So for each firm in each country, we go back to the jobs back in 2019 and 2018 because those are the most stable years before ChatGPT. And then we match those occupations to a score from Pisaneli and co-authors. The score that they built adjusts overall AI exposure for how much AI could complement workers. So somehow they— the score shows the substitution risk, and a higher score means more potential for substitution. We average those occupation scores, giving more weight to the jobs the firm advertises more often. So think about 2 firms that both recruited

for some occupations with high substitution scores. If those occupations made up most of the first firm's ad and very few of the second firm's, then the first firm gets a higher baseline exposure score. This allows us to compare recruiting pattern between the firms with higher and lower baseline AI exposure. So here, I will explain that how we did this analysis using continuous difference-in-differences. So the coefficient of interest here is beta, and we ask whether firms with higher baseline AI exposure change the recruiting pattern more after the release of public release of ChatGPT in November of 2024. And we compare firms with lower exposure, so high exposure.

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firms compared to lower exposure firms. And the post-period begins in the first quarter of 2023. We use different outcomes, both volume outcome and composition outcome. For volume outcome, we use total number of postings and the probability of any posting. And for the composition outcome, we use 2 other measures. The first measure is the share of job ads for occupations in the top 25% by the AI substitution scores, which means the kind of occupations that AI can easily replace. Our second measure, however, is the average AI substitution score across all postings and ads. We also use different kinds of fixed effects, like firm-country fixed effects that take out persistent differences between pairs. And then country by quarter and industry by quarter that absorb change common to a country or an industry. So we estimate responses separately for both advanced and developing economies, and then we use pool model to test the difference between these 2 groups, and we cluster standard errors by both And finally, this is one of our main tables. So the first panel shows advanced economy and the second panel shows developing economies. And then we also use p-value to see how these 2 groups are— to see if they respond similarly for each outcome or differently.

[05:03:33.17]

So, So let's first focus on whether a firm posts any ads in a quarter, which is any posting. Following ChatGPT's release, the estimated change in this probability is 0.7%age points lower for more exposed firms in advanced economies and 0.9 points lower in developing economies. And if you look at the p-value, it's 0.75. It is not significant. significant, which means both of the— both of those groups, advanced and developing economies, similar— respond similarly for this outcome. However, if you look at the number of total postings, it is -0.02 for advanced economy and -0.24 for developing economy. And these are— for this one, we use PPML. If you compare this coefficient with the pre-period outcome mean, it's like 2% reduction in advanced economy and 21% in developing economy. So in advanced economies, we say firms with higher AI exposure experience a 2.2% larger relative decline in expected posting after ChatGPT's release compared with less exposed firms. In developing economies, the

corresponding estimates is 21.5%. And if you look at the p-value, it is significant, which means advanced economy and developing economy respond differently. And we can see that the adjustment is stronger in developing economies, but we don't know why this is the case.

[05:05:15.28]

So that's something that we want to explore in the upcoming slides. But before that, let's focus on the composition of jobs and which jobs firms advertise. So the estimated change in the share of high-substitution occupations is 1.2%age points lower in advanced economy and 1.1 points lower in developing economies. And if you look at the pre-period means, it's about 3.6% reduction in advanced and 2.9% reduction in developing economies. So it tells us that more AI-exposed firms shift their hiring away from high-substitution occupations, which are kind of occupations that can easily be replaced by AI. And by looking at the last columns, the average occupational AI substitution scores, it shows that There is a decline with exposure in both groups. And again, the p-value is not significant, which means for composition outcome, both groups respond similarly. So overall, the main key takeaway from this table is that more exposed firms shift their recruiting away from high substitution occupations in both groups. However, the decline in the total number of postings is substantially larger in developing economies. And here, this is even the study that we use for high substitution posting share over time. We have even the study for all outcomes, any posting, total posting, and the other 2 composition outcomes, but because of time limitation, I only use this one.

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So here we can see when the composition differences show show up and whether they persist over time right after the release of ChatGPT. So the horizontal axis marks ChatGPT's release in November of 2024, and each point shows how much the relationship between baseline exposure and the highest substitution share changed relative to the reference quarter. If you look at the later quarters, so the left panel is advanced economy and the right panel is the developing economy. You can see that the estimates are generally negative, and it gets stronger and more negative over time. And the pattern is still visible at the end of the sample in early 2026. Here we ask what kinds of jobs are behind the movement in the mix. So these panels show selected occupations with the largest decline and the largest increases. So in advanced economy, we see the software developers are among the largest declines for occupations, and the largest increase is sales and marketing managers. And if you look at the developing economies, again, the largest declines is software developers and the largest increase sales and marketing managers. So here we use a simple conceptual framework that separates 2 channels.

[05:08:35.02]

So as I've mentioned through the motivation slides, artificial intelligence can affect labor demand in 2 opposing— or through 2 opposing forces, substitution and productivity and expansion. So Now let me start with the task substitution. The horizontal axis here shows the AI substitutable tasks, and the vertical axis is output for other tasks. So start at the gray point, which is before AI, and this straight line shows what the firm can produce at a given level of spending. And the curved line shows combination of tasks that produce the same output. Now imagine when AI becomes available, it reduces the cost of performing certain tasks. Then what happens? Firms can get more of those tasks done with the same spending. For example, a software company may use AI to write and test the code, reducing the amount of human labor needed for those activities. This creates an incentive for firms to shift recruiting away from occupations that can— that has greater potential to substitute for workers. And under another scenario, firms also can adapt how they organize production and combine tasks. So this can allow them to increase productive capacity in other activities as well, which is in our case is advanced economy.

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So the key point here is that AI can change the mix of tasks firms demand, potentially helping us understand why we observe similar shifts in occupational composition across both advanced and developing economies. But this does not yet tell us about what happens to the total number of postings, that advanced and developing economy respond differently. That's something that I try to explain using this graph. So here we look at the whole firms, and the vertical axis is the extra revenue the firm gets from one more worker. And the going— at the going wage, the firm wants to hire up to the point where that extra revenue equals the wage. So the gray intersection marks the starting quantity of labor. Now again, imagine AI becomes available. If AI can replace some of the work people did before, then the firm may need fewer workers. And you can see that in the gold case, which is developing economy here, the curve shifts down and the quantity of labor decrease and decline. Under another scenario, suppose the company learns to use AI across teams. Then what happens? At the design, for example, at the design firm, for instance, the designer can use a tool for a shift, for a first draft, and then what matters next is whether she and her colleagues Can check the output, share it, and change how the marketing teams uses it.

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So if those changes let the firm take on more projects, there may be more value in having another worker to help deliver those projects. And that's exactly the scale channel. In this picture, you can see that it offsets part of the decline that we see. That's why we see a smaller

decline for total number of postings in advanced economy, but much larger decline for developing economies, because developing economies have complementary constraints, like, again, education, like digital infrastructure or managerial expertise. So this is what— that's why we Try to bring education. Workers who are comfortable learning a new tool may have an easier time putting it to work across teams. So the firm still needs demand for additional output if it's going to expand. And this diagram shows a possible offset. And they do let us ask whether the count contrast is smaller where average schooling is So here in this example, in this analysis and table, we use education. And we examine whether workforce education helps explain the differences that we observe across both advanced and developing economies. So the first column, if you look at the difference between developing minus advanced for the total number of postings— for total number of postings is -0.22. However, once we add schooling as another moderator to the model, you can see that it turns positive and significant by 0.47. But what does it mean?

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It suggests that the negative relationship between AI exposure and total job postings is weaker in countries with higher average So one possible explanation here is that a more educated workforce makes it easier for firms to adapt to AI and benefit from productivity gains. That's why we do see a smaller decline for total number of postings in advanced economy compared to developing economy. To conclude, our results highlight an important distinction between the types of jobs firms advertise and the total number of postings. So we show that firms with higher baseline AI exposure shifted the recruiting away from occupations with greater substitution potential in both advanced and developing economies. But the relationship with total job posting was much larger and more negative in developing economies. And we find that this negative relationship is weaker in countries with higher education schooling, like advanced economies. So one possible interpretation is that AI creates similar opportunities for task substitution across economies, but firms may differ in their ability to turn productivity gains into business expansion. This is consistent with viewing AI as a general-purpose technology where complementary capabilities matter. Thank you so much.

[05:15:39.32] - Laura Alfaro

Thank you very much. Our 3rd presenter is Daniele Angelini, Aging Population and Technology Adoption. Let's see what my mother will make of this.

[05:16:11.03] - Daniele Angelini

Okay, thanks a lot for being here. I'm Daniele Angelini from University of Vienna. So this paper has been around for a while. So when I talk about technology, you don't necessarily need to think about AI. But I will build a framework in which then you can kind of understand how AI will interact with aging population. So here I analyze aging of— the effects of aging of the population on technology adoption because aging affects the supply of inputs. And the supply of inputs affects the technology adoption since different types of technologies have different degrees of complementarity with different types of inputs. So population aging has a direct effect on the labor supply. It tends to reduce the aggregate labor supply. And this is because the low fertility rates, so the number of young workers entering the labor supply, is smaller than the workers leaving the labor supply because they retire. Moreover, aging of the population leads to an increase in the share of old consumers, and old consumers tend to have different consumption patterns that tends to be lower in terms of amount of consumption than young people, and this tends to increase the aggregate savings in the economy.

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Which reduce the interest rate and therefore the supply of capital. So aging of the population through this channel tends to increase the adoption of new technology, which we define as labor-saving or capital-intensive type of technology. However, the effect on the aggregate labor supply is not the only effect that aging has on the labor supply. But it also— it doesn't only affect the level, it also affects the composition of the labor supply. So aging of the population affects the age composition of the labor supply, and then you— if you think that young people have a different set of skills with respect to elderly people, then aging also affects the skill composition of workers. Let's assume that young people are just better in using new technologies. Maybe because they are just out from the education system, then aging of the population, by reducing the share of young workers in the economy, tends to reduce the adoption of new technology, which is indeed skill-intensive, for skills that are possessed mostly by young people. Then there is another channel through which aging affects the adoption of technology and this, the increase in the retirement age. Aging of the population puts some fiscal pressure on government budgets and what has happened in OECD countries has been an increase in the retirement age to match this fiscal pressure.

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But an increase in the retirement age tends to reduce the incentive to save for retirement and also tends to increase the aggregate labor supply. Which reduces the necessity of investing in new labor-saving technologies. So as you can see, the effect might not be linear because some channels are positive, some channels are negative. So the main question that I will try to answer is, how does aging affect the adoption of new technology? What is the effect? Is it

positive, negative, or non-monotonic? Then what are these channels and what are the macroeconomics implications of population aging, in particular for Europe? And then what are the policies that can be implemented? So the paper is built in 3 parts. I start with a theoretical framework. So on the supply side, I have a task-based production function with 2 technologies, new technologies that is generally defined as a labor-saving, skill-intensive technology, and a vintage technology. So new technology evolves over time through R&D. On the demand side, then I have an overlapping generation model in order to endogenize the supply of skilled and unskilled labor and the supply of capital. Then I have a government. The government sets the retirement age in order to balance the government budget constraint and redistributes pension benefits.

[05:20:35.56]

So this model has one fundamental prediction, so that the relationship between aging— age of the population and adoption of technology is not linear. But is hump-shaped. So first increases and then reduces. I test this hypothesis and I find using different variables as new technology, so ICT, intangibles, and robots, and I find this hump-shaped relationship. Then I proceed with some other analysis, employment analysis, wage analysis, that test for assumptions and predictions of the model. Finally, I calibrate a model using European data. And I find that increasing the retirement age might not be the best option in order to mitigate the negative effect of population aging. So let me jump to the model. I consider a standard Cobb-Douglas task aggregator. So there is one final production good, capital Y. Which is produced by aggregating a set of tasks. So these tasks can be either produced using new technology or vintage technology. So I make this assumption that mu ni and mu vi, which are task-specific productivity— productivities for task i, the ratio between these 2 objects is declining in i. So this assumption captures the fact that tasks are ordered from tasks that are better suited to be produced, produced using new technology, to tasks that are better produced using vintage technology.

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So this implies that there will exist an endogenous threshold, capital I, such that before this threshold, all tasks will be produced using new technology, And after this threshold, all tasks will be produced using vintage technology. So this threshold is endogenous and responds to the relative scarcity or abundance of the inputs in the economy. Then in front of the new technology, I have an AT. An AT is just the output of an R&D sector. So this production function for R&D takes as inputs some workers and captures the idea that new technology evolves and becomes more and more productive over time. So the paper is built on 2 assumptions. So the first assumption is that new technology is labor-saving, and I capture this assumption by setting

alpha, which is output elasticity of labor in new technology, being smaller than beta, which is the output elasticity of labor in vintage technology. Then the second assumption is that new technology and the R&D sector that produces the blueprints for new technology requires skilled workers. Now, since capital I, which in this framework represents the share of tasks that is produced using new technology and therefore represents a measure of new technology adoption, since this is endogenous and responds to the supply of inputs, and since the supply of inputs responds to the demographic, aging of the population by changing the share of young versus old workers affects the supply of inputs, which affects technology.

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So this is the supply side of the economy. Let's look at the demand side. So what I want to do now is to link the demographics to the supply of inputs. In order to do so, I build an overlapping generation model in 2 periods, and the interpretation is straightforward. When agents are in the first period, they are young, and they need to decide whether to acquire skills or not. So they supply 1 unit of time inelastically, they consume, and they save for when they are old in the second period. Also, when they are old, they need to decide whether to acquire skills or not because technology evolves through the R&D. They need to decide they will work only a fraction of their time. So think of young people between 25 and 50. They are full in the working age period. Elderly people, let's say, are between 50 and 75. So they are partially in the working age period and partially retired. This phi therefore represents a measure for the retirement age, which is set by the government in order to balance the budget constraint. As it is standard in this overlapping generation model, capital is endogenous, but also skill acquisition is endogenous.

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So agents are heterogeneous in their ability to acquire skills, and these skills depreciate over time because technology evolves, meaning that an old worker that acquired skills when he's young needs to retrain in order to, to be complementary to the updated new technology. And then there is some skill persistence. So the skill acquisition cost depends on whether you had acquired skills. So fundamentally, I want just to abstract from the possibility that elderly people decide to become high-skilled when they are 50+. Okay, in order to become— to be considered high-skilled when you're 50+, you had to have acquired education when you were young. So now, since young and old people differ in their working horizon— young people supply one unit of time, elderly people only a fraction of the time— Since they differ in their savings, young people don't have any savings, elderly people have more savings, so therefore they have different incentives to acquire skills. And also since I allow them to have different costs of skill acquisition, demographics, by altering the share of young versus old people, also affects the

supply of skilled and unskilled workers. So that's it for the model. So let me now greatly simplify this model in order to go to the core of the analysis.

[05:27:06.11]

So I abstract from the overlapping generation model. So I assume that capital is given. I abstract from the government. So the retirement age is fixed. I abstract from R&D sector. And I assume that only young people can use new technology. Okay, this is an extreme assumption, of course, but it captures the comparative advantage of young people in using new technology. But then I relax this assumption in the quantitative analysis. So elderly people are constrained in using new technology. It's quite convenient to rewrite the model in such a way because then I can rewrite my production function, which is the central object of the analysis, as a step production function. So I can highlight 2 different regimes: a regime in which population is relatively young and a regime in which population is relatively old. So let's assume that we are in the first regime, so population is relatively young. There will be some young workers employed in new technology, some young workers employed in vintage technology together with old workers. So this means that because of no arbitrage condition, young and old workers are somehow perfect substitutes, and this is reflected in the way they enter the production function linearly.

[05:28:38.08]

If instead we are in an economy that is relatively old, all the young people will be employed in new technology, while all the old people will be employed because constrained in that, they will be employed in old, in vintage technology. So let's understand what happens in this type of economy. So on the x-axis, there is the share of old. So moving on the left means that population is aging. Population aging reduces the labor supply because elderly people supply a fraction of their time, elderly— younger people only, they supply a unit of time. So if the labor supply reduces, new technology adoption increases because it's a labor-saving type of technology, up to a certain point. So this is the point in which all the young workers are employed in new technology. So we are shifting from the first regime to the second regime. At this point, further aging of the population reduces the adoption of new technology because of the increasing scarcity of the complementary input, young workers. So this is fundamentally the core mechanism that I analyze. So aging of the population has a positive effect on the adoption of new technology if population is relatively young.

[05:30:00.19]

If population becomes relatively old, the effect is the opposite. So we have a hump-shaped relationship. Okay, what I do now is simply to analyze the hump-shaped relationship and observe whether it's in the data. So I use to test for the hump-shaped hypothesis, Euclides data. Thanks to Filippo in the audience for producing this data, INTANPROD and IFR, International Federation of Robotics data, UN World Population Prospects data for age variables and fertility, and I consider European countries, Japan, and United States in my analysis. Then for the employment analysis and wage analysis, I also use UCLM's data, Liu Cram's labor data, and also the BIBB employment survey, which are micro-level data. Okay, so what I try to test now is whether the relationship between age of the population and new technology adoption is hump-shaped. As a proxy for new technology adoption, I use investments in ICT. Intangibles and robots. So I run a simple OLS model specification, quadratic OLS model specification, in order to capture the potential existence of this hump-shaped relationship. So my age variable is the ratio between population above 50 relative to population above 25. Then in order to remove some endogeneity or reverse causality or contemporaneous effects concerns, I use an IV specification.

[05:31:56.05]

So I instrument the age with lagged values of fertility rates, as it's quite standard in this type of literature. So what we observe here is that for all 6 model specifications, the linear coefficient is positive and significant, while the quadratic coefficient is negative and significant. So this implies that the relationship is indeed the hump shape. However, to test whether the hump shape is actually present in the data, I plot these coefficient estimates, and we observe that this hump shape relationship exists in the range of observed values. So this hump shape relationship remains true also when I use a 3rd degree polynomial or a GAM model specification, which abstracts from the functional form of my— of the relationship. I also use industry-level data in order to capture the potential effects coming from the demand side, because the aging consumers might affect the demand and the industrial composition of the economy. but the results are still there. Okay. Now, for the rest of my empirical part, I will just have a short summary. And what I do is to— so the empirical part of the analysis supports the theoretical model in 3 dimensions. First of all, the existence of this hump shape and also the skill and young technology complementarity.

[05:33:43.58]

But this is something that Marina also has explained in her talk. What I observe is that new technology-intensive industries, so those industries investing a lot in ICT or robots or intangibles, tend to employ young and college-educated workers. Then I also analyze— do a within-industry analysis, and I observe that the likelihood of engaging in IT tasks or engaging in

innovation is negatively related with age. So young people tend to use more IT tasks and are engaged in innovation. I also find some evidence of depreciation of skills. complementary to the evolving technology. So I observe that aging increases the wage premium, but only among college-educated workers. So there is no wage premium if I compare young, unskilled or uncolleged workers and old workers as population ages. I also observe that skill updating can restore complementarity with new technology, and new technologies is a main driver of the increase in wages for agents that undertake some updating type of course. Okay, now in the last part of the presentation, I will analyze the quantitative and policy implications of the model. So I calibrate the model using European Union 2017 data. 27 countries. And what I observe is that the model is able to replicate qualitatively the behavior of main aggregates and key economic variables in Europe.

[05:35:35.51]

So it's able to explain the increase in new technology and also a bit of the slowing down in the last periods, the increase in output, the increase in productivity, the increase in capital, The reduction in interest rate and labor share and increasing government spending. Moreover, the model is also able to explain the change in the composition of government spending. We observe an increase in pension spending as a percentage of government spending until around 2015, which is a period in which several European countries have updated, have innovated their pension system, and we observe indeed a reduction in pension spending as a percentage of the government spending, while we also observe an increase in health spending. Okay, so these are the model predictions. In blue, we observe the aggregate effect, so new technology increases. And then the increase in new technology slows down. The increasing part is driven initially by technological progress, but mostly by aging of the population. The effect is actually, let's say, the opposite in the second period. So technological progress keeps being an important driver of new technology adoption, but aging of the population as a zero or actually negative in my latest estimates effect on new technology adoption.

[05:37:15.40]

This also explains why aging is still an important component of increasing labor productivity because of the increasing capital-labor ratio, but its effect on the labor productivity growth is a bit smaller. What I find more interesting from these results is that— is what happens to the skill premium. So let's look at the skilled labor. So technological change, technological process increases the skilled labor. So choosing whether to be a skilled or an unskilled worker is an endogenous choice in my model. And technological change that makes new technology more productive increases the share of workers that acquire skills. However, the net effect is significantly negative, driven completely by population aging, because aging of the population

reduces the share of young workers which have a higher incentive to acquire the skills to become complementary to the new technology. And indeed, the fact that aging of the population is the main driver of the reduction in the share of skilled labor also implies that the skill premium is fundamentally determined by aging of the population and not by the technological change. And this is quite at odds with the literature that describes technological change as fundamentally the major driver of skill premium.

[05:38:53.49]

It is, but in my model, through aging of the population. Okay, now policy analysis. Population aging leads to an increasing pressure, to an increasing fiscal pressure, and most of OECD countries while they could have used the pension benefits or taxation, actually tried to mitigate this fiscal pressure driven by population aging by increasing the retirement age. However, increasing the retirement age has a strong effect on the supply of inputs because increasing the retirement age, it means that you are increasing the aggregate labor supply, but you are increasing the aggregate labor supply by feeding the market with elderly workers, which have very low incentive to undertake costly investments in order to become complementary to the new technology. And moreover, you also distort the incentive to save for when you become retired, because most of your income will be determined by wage relative— instead of by savings. So this implies that aging— that adjusting the— balancing the budget constraint by increasing the retirement age following an aging shock might lead to a reduction in the adoption of new technology. So, however, there are other possible types of policies that can be implemented. In particular, you can increase the labor tax.

[05:40:35.28]

taxes or reduce the pension benefits. Now, the real question is, can we find a set of policies that are feasible? When I mean feasible, I mean that they will not be stopped by part of the population. Can we find a policy that is Pareto improving? So what I do is to compare 3 different policies. One policy is increasing the labor tax, and it's in red. So increasing the labor tax, keeping the retirement age fixed, implies higher new technology because the retirement age is kept fixed, it's not increasing. So there is There is a higher incentive to adopt new technologies. However, output strongly reduces because savings are lower. The second policy is a reduction in pension benefits. This increases savings, but this policy, policy 2, will be will reduce the consumption of old workers and therefore is not feasible. The third policy is a combined reduction in labor tax and pension replacement rates. This policy strongly increases savings because a reduction in labor tax increases disposable income and a reduction in the pension replacement rate increases the incentive to save for retirement. Capital increases a lot, new

technology increases a lot, And then we have an increase in aggregate output, which is translated in an increase in consumption for all the 6 categories of workers.

[05:42:29.20]

So to conclude, I— in this paper, I produce a theoretical analysis of the effects of population aging on technology. I analyze empirically the hump-shaped relationship, and I find that aging is a strong predictor of wage inequality. And I also find that there are some retirement age mitigation policies that can lead to Pareto improvements. Now, with the last minute, so I didn't talk about AI. How do I think that AI can fit this story? Well, I don't really think that AI can be understood as a shift in I directly because that's a labor-saving, skill-intense technology. For me, AI is a technology that somehow embeds skills that otherwise will need to be acquired by workers. And this fits a bit the story of Marina saying that AI might lower the bar to access the pool of high-skilled workers. So it reduces the cost of becoming high-skilled workers complementary to the automated technologies. So AI reduces the cost of complementarity to labor-saving technology, and when the skills scarcity hits the economy, investments in R&D are redirected towards ability-enhancing AI that reduce the cost of acquiring skills. And therefore, we might have a smaller reduction in technology adoption or even a positive monotonic effect.

[05:43:56.57]

And this is my upcoming— my paper that I'm working now, From Robots to AI: Aging-Driven Directed Technological Change.

[05:44:03.29]

Thanks a lot.

[05:44:12.43] - Laura Alfaro

And to discuss these 3 papers, we have Prasanna Tambe from the University of Pennsylvania.

[05:44:36.56] - Prasanna Tambe

All right. Good afternoon, everyone. Pleasure to be here. Thanks to the organizers for inviting me. These are 3 wonderful papers. It was great to be able to get a chance to read them. I am not going to give a full-throated discussion of each of these papers. The time is too short. I was asked by the organizers maybe to extend to a little bit of policy. We have a wonderful-looking policy panel coming up after this. We have some Q&A. So maybe I'll throw out some of my reactions on the policy side. One of the things I wanted to also chat about or talk about in this

deck, and with respect to these 3 papers, is a question about what happens when we think about AI maybe not as a shock, but as a series of ongoing small shocks that are continuous. You all know this phrase, building the plane while flying it, in a sense. That's kind of what we're all doing. Just to kind of underscore that, by the way, the latest frontier model dropped sometime between the last session and this session. So while you were in line for the chicken back there is when that latest frontier model dropped.

[05:45:38.25]

So I'm going to talk a little bit maybe about the infrastructure around how we acquire skills and tie them to the papers that we're seeing today. OK, so let me begin. So we have these 3 terrific papers that look at different aspects Some overlap as well. These questions of skill diffusion, question of firms hiring— firms can react quickly on the hiring front. Let's see. Is that me, or is that somebody else? Do I do this?

[05:46:20.31]

So this question of who gets hired, what is holding back adoption, this has been a fascinating question from a number of perspectives. I think there's a lot of noise in the ecosystem. One of the roles I play also is one of the— at Wharton, we have an executive program. We get to talk to hundreds of managers who are coming into the school talking about their AI deployment, what they're actually doing, what's deepening, what's not. And so thinking about what is actually driving adoption, how they're thinking about skills, And the question I want to bring it to a little bit is, what do we need to know to extend these to policy, right? So for each of these, I think the question in front of a lot of people in this room is, how do we take this kind of evidence? How do we map it to the kind of policy that's going to address some of these changes? Where are these— where are the gaps? Where might we want to see more work? And so on. So let me talk about some of my perspectives on these 3. And again, I want to focus on 3 particular areas where I think it's useful to think about the infrastructure actually for picking up skills and how that itself might be changing.

[05:47:21.23]

And Danielle, in the last paper— and I didn't know about his next paper— but he's kind of tipping his hat a little bit in that direction as well because there's a lot of channels through which these technologies are also starting to affect how we pick up skills and what that might mean for some of these findings. So a decline in employment in exposed occupations. or hiring can imply some very different policy responses in terms of what's going on here in the economy. You could— it's been a lot of news about first jobs, fewer first jobs. Certainly, as someone who's

teaching undergrads, we hear about that all the time, right? My undergrads are very concerned. There's a lot of questions about decoupling of learning between productivity and learning in jobs like investment banking and consulting. There's a question of job transitions. There's a question of job search and what it looks like now in a market where it's easier than ever to apply to new jobs. And there's questions of skills bottlenecks and what it means to pick up new skills. So all of these have different implications. It's valuable, I think, to see all of the evidence that we're seeing here, but it's also fantastic to be able to go maybe to the next step to narrow down and figure out which of these are actually going to be things that we can start to pursue and which of these might change in the near future.

[05:48:38.14]

So let me start with this paper, Marina's paper here, which is a terrific paper pulling together data from a number of different sources. And it's, by the way, just as someone who sits in my— from my vantage point, we see way too few papers that cut across the world, which is actually a major loss, I think. If you look at the Pew Research data on how different countries right now are perceiving AI in terms of not just the job market, but overall sentiment. It's quite remarkable how underserved that is. So great to see those kinds of data being pulled together. We see a fall in employment, lots of different potential implications for that. It's good to see how the supply side reacts as well. What's driving the fall in employment? Are fewer people entering the occupation? Are people moving new jobs or work? Are people losing work? What does that actually look like? What explains the decline? And how do we think about what this means for what we do about it? So if we think about reading into these falling employment levels, and they do have— I know you do have the Lightcast resume data.

[05:49:37.07]

You mentioned that as well. I don't know if it's large enough. I don't know if that's useful enough. But it'd be interesting to see. Maybe that's another paper. But understanding a little bit about what we're seeing with these falling employment levels, how quickly are workers adjusting, I think would be very useful from a policy perspective to know what to do. So a little bit more on that. If we think about why. We're seeing a lot of pretty recent change, actually, when it comes to how employers are starting to think about employment transitions. Universities, of course, are under a lot of pressure, and they should be. But employers themselves are doing some pretty interesting things. But there's right now very little evidence on which ones are working and how effective they all are. So just to call out a couple, paid training programs like the kind that are being offered by Amazon for the robotics residency Anthropic has a similar one. IKEA had a very interesting program rolled out that made a lot of high-profile press where they took their

customer service workers and reskilled them into kind of interior decorator type skill sets. And they got a tremendous lift from that.

[05:50:35.35]

But just as an example, I talked to a reporter about that particular transition and it was a very— I just said something very— I had nothing much to offer to the report, but the number of emails I got the next day from people who wanted the hard data, like, is this actually right? Is this working? Did this work for IKEA? Do you have the numbers? Like, it just kind of points, I think, to the lack of evidence right now in the economy in terms of if you have a workforce like this, and can you actually reskill them to a point that they are adding value in a way that's concrete and measurable? And of course, job search, providing job delays— where all of these are things that are out there on the table right now. But they are tied to very different outcomes kind of on this side in terms of what's happening to workers when these jobs start to change in terms of exposure. OK, occupational demand, AI. This is a hot question. Clearly, there's a lot happening here in the economy with what firms are doing. What's great about job postings, by the way, is that it's one of the— it's the early indicator, right?

[05:51:33.26]

It's something a firm can adjust right away on day 1. If they want something different, employment takes a while to catch up. Job postings are like that. They do make the change and it starts to appear. So it's an early indicator of intent. And the evidence is mounting that firms are reacting to what they are seeing. Now, in terms of what's actually happening, this is a challenge not just for this literature, but in general. I have a colleague who would always make the— this is sort of generally the question, right? How do you think about when firms are starting to deploy AI. There's various ways people do this. I have a colleague that always says she'll never forgive the AI companies for releasing their models right after COVID, in the sense that it's very, very difficult to really understand what's going on given the timing of these sorts of model releases. So we have these changes that are happening around the pandemic. We have these models being rolled out. We also have a lot of uncertainty in terms of model uptake itself in the sense that there's a lot of discussion about the models. But if you look at the timing— and I'm very comforted by the fact, by the way, that their results are showing up 8 quarters after the rollout.

[05:52:42.22]

That's about right on time. I'm very skeptical of papers that show results in 2022 onwards because I'm pretty sure for 2 years not a whole lot was happening on the employment front. But in their paper, it takes about 2 years for things to roll out. And I think that's probably about right.

But I think from a policy perspective, Anything we can do to close that gap is pretty useful. The other thing I think about a lot, and this is just for the room in general, is how we think about separating deepening at work because adoption has been a slow process. It's one of the features of this technology rollout. It's been hard for managers to deploy. It's been taking a while. But the models have been changing incredibly quickly as well. Unfortunately for all of us, I don't think— there's no evidence that pace is going to slow down, and it may even speed up. There's a reasonable case to be made for that. So as you start to think about, we have a gap, we have a workforce that we need to reskill, how do we think about the fact that this landscape essentially is shifting underneath our feet from almost week to week in terms of what these models can do?

[05:53:49.20]

How do we think about interpreting these results, but how do we also think about from a policy perspective, how do we step in, right? And what do we do? Does it make sense maybe to think about the infrastructure for providing those policy as opposed to the policies themselves? So there's lots of discussion around this. I talk about this sometimes, and I've heard lots of interesting discussions around this, which is just generally rethinking how people learn at work. And I have 2 examples of this. But if we think about jobs, we think about jobs in the US in particular, they're designed in a way where you come to work, you do a thing, you be productive, and you learn while you're doing it. That is true of software development, legal services, investment banking, consulting. You learn and you become productive simultaneously. AI is breaking that link. AI is causing that problem now where you can do one without the other. There are a lot of jobs out there. I have my GenAI picture up here of bankers— not bankers, sorry, pilots, doctors— thank you— apprentices for trades, skilled trades, crafts, where you actually have a very conscious method of learning built into the job, right?

[05:54:54.34]

So pilots are a great example. We automated a lot of what they do. They spend a lot of time in things like simulators where they learn to fly. They hopefully never have to learn how to fly through an emergency, but they learn how to do it as a conscious part of the job design. And so I think there is a world in where we're going to have to start to lean back into how do we think about the job or rethink about the job in a way which brings learning into the center of the process as opposed to it being a byproduct of being productive in a sense. So rethinking what the job looks like so that we can continuously gain experience that's valuable, especially because I think it's going to be very, very difficult to specifically target this particular skill as this ground keeps changing here as we move forward here. And so finally, Last paper on the supply side, which I think is great. I think there's a lot less attention right now on the supply side, which

is too bad. A lot of interesting things happening there as well. So this is not directly talking necessarily about what I'm going to talk about, but it's related to this training question and certainly the last slide you presented around this question of people picking up skills, divesting themselves of skills, and what does it mean, especially in the face of an aging population.

[05:56:04.41]

One thing I did not mention— so I'm actually on sabbatical this year sitting at a frontier lab. And so why I mentioned that is because it's interesting seeing these frontier labs as well as AI-native organizations in terms of how they're structured different in the face of this kind of change. One thing I would— this might be a good resource for people who are interested in this question that Daniel brought up at the end, which is how does AI AI affect the skilling process. A great read for people who are interested is Anthropic's employment report, which was released about a month or two ago. And one of the really interesting things about that report is it talks about how people who have been at the firm for a while, the frequency with which they're switching roles and jobs has just been accelerating so fast. And in fact, entire teams are dropping roles and moving to entirely new roles at this super high velocity. And the reason for that is because it turns out with a lot of these tools, what we think about as being skills or context that you need for a job, you no longer need.

[05:57:01.21]

You can switch to a new role, and all the context is sitting there in front of you. We've heard some of the papers that were mentioned about the flattening of the learning curve. That looks like that as well. But this idea that you can walk into a role, bring your expertise, and the context is sitting there at your fingertips, that might have some interesting implications for thinking about OK, what does that actually mean? I've also worked on some of these overlapping generation models. And in those models, older workers have a disincentive to invest in picking up that skill. They don't have as long a window to reap the rewards. But in an environment where we think about skill acquisition very differently, if we think about a more general level of expertise where context and things like that are not nearly as important, it might raise some interesting questions.

[05:57:42.58]

So—

[05:57:44.12]

Just to summarize a couple of things here. Thank you. I think we have an environment where the skills— the channels through which we might be able to pick up skills probably need to be revisited. Given the pace at which things are going, I think that's also perhaps a productive discussion to have. So I want to just throw these questions out there over the fence as we move into the question and answer session. Then, of course, the policy panel as well. But lots of change happening here. And these papers do a great job, I think, of framing this discussion around what's happening around jobs, what's happening around hiring, and how this all relates to the supply side of the workforce, which again is too often forgotten. So let me pause here. I think I'm at time. But I'll hand back over to Laura.

[05:58:45.57] - Laura Alfaro

May I invite the, the speakers to the table and open up for questions?

[05:59:30.13] - Audience

All right. I'm Romain Duval from the IMF. So I had one question on the first 2 presentations and another one on the third. Thanks a lot. First, great presentations. On the first one, the question is, so at the end of the day, what's your thinking on whether emerging economies are more adversely exposed to AI than advanced economies? Because at the end of the day, they've got a smaller share of AI-exposed jobs. But those are also less complementary to AI.

[05:59:59.38]

I think the second paper was very clear that the second effect dominates the first, and at the end of the day, emerging economies are going to be more adversely affected.

[06:00:09.02]

But it was less clear from your paper, Marina, so I don't know if you could speak to that based on the data you had. And on the third paper, obviously, the thinking on the retirement age was quite thought-provoking. Could you explain why in your model, maybe this mechanism is not there, right? You seem not to account for the fact that, you know, if skill acquisition is an optimization decision, which it is in the whole literature, basically increasing the retirement age should increase the horizon over which you can expect to reap the rewards, right, from skill acquisition. And so it should incentivize skill acquisition. Yet you said exactly the reverse, so that would be very useful to clarify.

[06:00:56.04]

Thanks.

[06:01:04.17] - Marina Mendes Tavares

Thank you for your question, Roman. Yes, so I think this question speaks about the fact that when we look across occupations, there's just more workers in advanced advanced economies that are in these cognitive roles that are highly exposed to AI. So what we find is that in emerging markets, there are less of these workers, but less workers that are more likely to benefit. In other paper that we have worked at the Fund, the AI Mind Gap, we try to put all these ingredients in a general equilibrium model And also take into consideration the AI preparedness. And there the picture is very clear that advanced economies have much more to benefit from AI. And that can— if you think that these productivity gains are also maybe associated with higher revenue, they can maybe also be better prepared to support the workers that are negatively affected by supporting training, lifelong skills, and all that. They are better of doing that. On the AI skills, when we look at the diffusion across countries and tells us a little bit more about what is happening on the ground, we see that advanced economies are demanding AI skills in a much larger share, and the diffusion is So, it also shows us that maybe emerging market economies have a little bit more time to adapt for— to adapt their labor force from when this negative shock maybe arrives.

[06:02:51.55]

So, that's 2 different views, a short-term and a long-term one.

[06:03:08.13]

I think he wanted to mention about your effect, the difference in the effect that you find in advanced economies and emerging markets, in developing economies.

[06:03:23.28] - Faezeh Khosravi

Can you hear me now? As I explained, we do find a very similar pattern for composition of jobs, similar pattern and similar response among advanced and developing economies, but very different pattern for total number of postings. And we connect this with the education because we know that developing economies may face greater barrier into integrating AI into their operations. For example, again, workforce skills, infrastructure, digital infrastructure, or managerial And we try to show this through our conceptual model that if in countries like advanced economies, they have more educated workers, they they can benefit more from AI. So we expect smaller decline for the volume outcomes, while for composition outcome, this could be similar across both groups.

[06:04:27.59]

Yeah.

[06:04:28.11] - Laura Alfaro

Let me just— again, there's a lot of heterogeneity on countries, rich and poor, and we tend to bunch them all together. And so the work we have done for Latin America, there is potentially substantial gains, again, for many different reasons. But just to give you an example, I was booking a taxi in Lima, and I was supposed to change the time via WhatsApp. And I got AI, a sector no one would have thought would be so automated, the taxi. It's not Uber, it's the taxi direct from the airport. Again, I do think emerging markets, and especially some of them, are going to surprise us in the ways they are adopting a lot of these technologies. To Daniele, to these puzzling results.

[06:05:16.50] - Daniele Angelini

Thanks a lot for the question. It makes a lot of sense. Increase the retirement age, you're also increasing the horizon, the working horizon. Therefore, given that you are an old worker, you will become skilled with a higher probability. I mean, your incentive to become skilled increases. That's clear. The fact is that young people still have a higher incentive to become skilled relatively to an old worker. So in the model, if population is aging, you still have an increase in the share of old people which have lower incentive to acquire skills, then you increase the retirement age and the single worker has an incentive to become skilled with a higher probability. But in the general economy, you will have an increase in the supply of old workers which always have a lower incentive relatively to young people. So at the aggregate, what you observe is that increasing the retirement age reduces the incentive to— reduces the skilled labor supply and therefore the adoption of new technology in that part.

[06:06:27.18] - Laura Alfaro

Please state your—

[06:06:28.04] - Audience

yes. Great. Divya, I'm at the IMF. So Marina, apologies, I don't have a question for you. So Faizeh, a question and a comment. So your empirical strategy compares firms that were—that had more of their hiring in the pre-period in the exposed occupations. Can you say a little bit more about what you think drives that difference and how that pool of firms is different in

advanced economies and developing countries? That's the question. And then the comment, I would tone down a little bit the claim that this is the first paper with cross-country evidence, both because Marina's paper has evidence on this. We have other work at the IMF that looks at a broad cross-section of countries. And there are other papers as well. We can chat more about that. I think you may want to play up more the idea that you're looking at different kinds of firms. Daniele, there's a bunch of stuff in your model.

[06:07:29.09]

There are lots of bells and whistles.

[06:07:30.30]

Can you give a little bit of a flavor of which of them quantitatively is particularly important in driving the policy results? Given your—given the audience, I think that might be interesting. And Prasanna, actually a question directed at you. Since you're working with an AI lab now, any more observations about how life there is different from the rest of the world? I think other people may also find that fun.

[06:08:01.05] - Faezeh Khosravi

Yeah, so we use, for my paper, we use predetermined AI exposure measure that we built before ChatGPT because we just wanted to make sure that we deal with endogeneity and those things will not be affected by generative AI. That's why we use 2018 and 2019 as they say, our most stable year before ChatGPT. And then we use high substitution share of occupations and we compare more AI-exposed firms compared to less AI-exposed firms. So some people were concerned that maybe this is not because of AI and it's because of the tech sector slowdown, for example. That's why as robustness check, we exclude tech sectors specifically to make sure that the result is still the same, and it was. Another concern was that maybe this is about US because 84% of our sample for advanced economy was from US. So again, as a robustness check, we exclude United States and the result was robust. For developing economy, India had the largest share, so we exclude India and the result was still the same. And then in order to make sure that this is about AI, we use different AI exposure measure. Our main AI exposure score was from Pisanian co-authors, which shows the substitution risk.

[06:09:27.37]

And we also use another score from Felten and Gimruk, which shows the AI exposure for each occupations. And even under those different specification, our result was So, yeah, that's why we think that this is about artificial intelligence.

[06:09:49.34] - Daniele Angelini

Thanks a lot for the question. So, which was, what are the main drivers of the, of the ham-shape relationship quantitatively? So, in the model, there are fundamentally 3 channels. So, there is this direct channel, which is the one that I explained in the simplified version. So direct aging, aging reduces the labor supply, so the effect is positive, but it also increasingly reduces the supply of young people possessing the skills complementary to new technology, and this drives the downward part. And this is the direct channel. Then there is an R&D channel. Aging of the population affects the supply of skilled workers, and through this channel affects innovation, so whether new technology becomes more productive. And then there is a third channel, is a retirement age channel. So aging of the population increases the fiscal pressure, and the government increases the retirement age, and this has a clear negative effect on adoption of new technology. So for the increasing part of the curve, quantitatively, the effect is driven by the direct aging channel. So the fact that aging of the population reduces the labor supply, while the declining part is mostly driven by the policy response, so the increasing in the retirement age.

[06:11:16.01]

So what I do indeed in the model is to calibrate some parameters in the government spending such that I'm able to match the retirement age that we observe in the data and that are predicted in the future. By matching these retirement ages and then shutting them down, you have different effects. You observe that without these retirement age adjustments, the effects will be fundamentally much less negative through AI, through the aging channel. Thanks.

[06:11:55.32] - Prasanna Tambe

So I'll offer— Divya, I think it was? Yes, I'll offer 3 observations. And I'm happy to talk much longer after the break or something. It's a long conversation. These are different places. So I mentioned the team switching already. This is a very real thing, the rate of rotations, people coming in and out of teams. There's a corollary to that, which is the cross-functional nature of work. It's just extremely high velocity. There was an interesting set of results released a couple of months ago where they were showing that when you start to use tools and agents, people start to cross boundaries like crazy. So almost like everyone becomes a solopreneur in a sense. And so as opposed to being very siloed in terms of what you're doing, people are doing things that traditionally would cross across all parts of the organization, which has implications. The third piece of that— and I'll stop after this— which I find interesting is that as an academic, at least, you kind of get paid to have a point of view. I think as a byproduct—

[06:12:52.58] - Marina Mendes Tavares

Not really.

[06:12:53.51] - Prasanna Tambe

OK, you should have a point of view, I feel. OK, so the corollary to this, though, is when you have an environment where things are— people are switching so quickly, and you also want people to be able to give up— and not give up, pivot very, very quickly. And so I think they're actually screened for not being the kind to hold on to your ideas too, too closely. Like, I've seen that or heard that conversation as well, because that kind of comes— obviously, you want people to have judgment. and be sharp, but also not so attached to their ideas it's going to be detrimental to this rapid kind of switching.

[06:13:26.55] - Laura Alfaro

Do we have another round, or can we just close for coffee? Okay. So thank you very much. This is a fascinating, ever-changing reality that we're all living. For some of us, the older generation, actually, we do think that there might be some benefits And in fact, there's some evidence that has suggested that us, the educated ones, seem to be taking advantage of this new technology more than the young. But again, this is an ever-changing world, and we'll see. Thank you very much.

[06:36:22.22] - Manuela Francisco

I think we can start. Good afternoon, everyone, and welcome to the last session of day 1 of the conference. I'm Manuela Francisco. I'm the World Bank Group Global Director for Fiscal Policy and Growth, and I have the pleasure to moderate this session. We have had a very rich day of discussions. From structural transformation and demographics to AI and labor markets, this session will focus on policies. We want to discuss how policies can help changes ensure that there is broad-based and productive employment. And for that, I have with me a very distinguished panel. Let me start with Minister Niki Kerameos, She is the Greece Minister of Labor and Social Security. I have on my left Jason Furman, Senior Fellow at the Pearson Institute for International Economics, and Signe Krogstrup, member of the Board of Governors of Denmark's National Bank. Thank you so much for coming and joining us for this discussion.

[06:37:41.00]

So as we all know, estimations point for about 40% of jobs worldwide exposed to AI. Studies also show that the impact in employment due to AI will depend heavily on labor market mobility.

So if workers can move or change sector, the impact could be limited. However, if there is no labor market mobility, the impact could be severe. Let me start with you, Minister Niki. From your experience, what would be the 2 or 3 policy levers Greece or a country in general should put forward so that AI complements workers rather than replaces them? And what would be your advice to policymakers so that they get the right balance between short-term costs and long-term productivity gains? Over to you, Minister.

[06:38:52.08] - Niki Kerameus

So thank you so much. I want to thank the organizers for inviting me to this event. I want to say I'm delighted to be on this great panel. Thank you so much. And thank you to you for the moderation. So let me try to take a 50,000-foot view on this issue. So when one thinks about AI and labor markets, there are 2 things that come in mind, come to mind. First of all, investing in technology, and second, investing in people. I feel like we're doing a lot on point number one, and I feel like we're not doing enough on point number two. So to put it bluntly, yes, the planet as a whole is investing a lot in technology and technology that can have an effect, an augmentative effect, I would say. So to augment the capabilities of humans. So that's really important, obviously, in order to render jobs easier, more productive, people more productive. But I feel like there's a long way to go as far as investing in people. And I think that's where countries should focus a lot more. Countries and, you know, for us, for instance, the European Union. And when I say investing in people, not when displacement occurs, before displacement.

[06:40:07.56]

So investing in people means, first of all, detecting what the needs are and what the needs will be short-term, long-term, and carving career paths. So investing in reskilling and upskilling ensuring that there is mobility as far as skills are concerned and portability. So I think that what we as policymakers in general should focus on is a lot more investing in people rather than at this point in time investing in technology. And I feel that if, if we do invest more in people, then yes, one can become even more optimistic about AI and its effects. On productivity because I think it's truly a prerequisite. I'm one of those who are rather optimistic about AI in the labor market with caveats, of course. But I think an absolute necessary prerequisite is to invest in people, to invest in reskilling, to invest in upskilling, and not to invest too late, rather to predict the turn of events and to act proactively.

[06:41:12.11]

Thank you.

[06:41:13.32] - Manuela Francisco

Thank you. Thank you so much for the words of optimism and the point on investing in people. Jason, how would you like to add to this?

[06:41:24.11] - Jason Furman

You said you don't want to be too late, so I'm going to take the other side of that. No, let me just do 2 broad threshold ways about how to think about it before getting into any details. And maybe I'll save details for later questions. The first is, do you want to regulate the technology itself, or do you want to change things outside of the technology? So if it comes to safety, for example, and making bioweapons, one policy could be regulate them so they can't make bioweapons. Another policy is they're allowed to make all the bioweapons they want, and the government will hand out vaccines and gas masks. I would— Prefer the first, just In case you were confused. Talk about something that's worse than mass death is mass cheating on college campuses. And again, you could have a regulation that prevents the models from answering student questions and helping them cheat on tests and writing their papers, or we could change to in-class exams instead of take-home exams, etc., et cetera. I think in that case, the answer is also completely clear-cut. There's no way to regulate the models and have them not help students cheat while also answering all of my questions and writing the solutions to my exam.

[06:42:43.22]

And so there, we need to adapt outside of AI. We can't expect the technology to change. We have to change. When it comes to the labor market, I think it is much more like the latter than like the former. And that's a meaningful statement. There's people like Doron Acemoglu, David Autor, and Simon Johnson that feel otherwise, and they might be right, and I think it's worth exploring their route. But for the most part, the idea of understanding how we can predict whether a technology is augmenting labor, substituting for labor— maybe I should find a different example, but one isn't screaming to mind, so— If it replaces a research assistant, is it augmenting me or is it replacing someone else? And that's just the history of technological progress, is inputs being automated, improved in one space, and that helps create jobs and demand in other spaces. So I think everything we have to do is outside of it. So then the next threshold question is, do we want to be Forward-looking or backward-looking? Now framed that way, sort of most people would pick forward-looking. I'm a little bit less sure of that because the thing about the future is on this topic there's a huge wide range of outcomes, and I think we just don't understand very well what's going to happen.

[06:44:08.35]

Moreover, there's been a whole revolution in evidence-based policymaking, and you can't do an RCT based on your guess about what the world will be like in 2030. You can only do an RCT on 2022 on something in the past. And so to some degree, I think we get pretty far if we optimize labor market policies for the year 2022, where we have good evidence on what works, what doesn't work. I don't think that would be perfect because the world is going to change. So then that's the next part. is how can you build in adaptation, change, and evolution, and sort of no-regrets type policies so that if you're wrong about the world, things are still good. So some things I would do, wage subsidies for younger workers, wage insurance for older workers, everything Gordon wants to do for places, maybe. I'm a little bit closer to that today, this afternoon, than I was prior to hearing him speak. And some of the training and other type of stuff. And then the last thing is I would say there are some things where we should be willing to give a different answer now than we did before.

[06:45:15.38]

And this is the forward-looking, not backward-looking. So if you're worried about training, as I am, for newly hired workers, things like non-compete agreements, which I was very against before, I'm starting to rethink and wonder if they have a role in helping to encourage employers to put effort into people before they can produce a lot for them. So In summary, regulate outside the technology, not the technology. Don't be ashamed to be backward-looking, but for some things, think about how this might lead you to a different conclusion on a policy than you had before the technology.

[06:45:51.26] - Manuela Francisco

Very interesting points, and we'll actually follow up on some of them during the conversation. Signe, what would you like to add to this conversation?

[06:46:02.57] - Signe Krogstrup

Well, just thanks a lot for inviting me here. And thanks for this really rich and interesting discussions we had today. And I'm tempted to comment on everything, but let me give you the central bank view from Denmark on this specific topic of AI and labor markets. And as being a central bank, we are very concerned with what's going on. We also see great potential in productivity growth, but there are also risks in labor markets. Denmark is the country with the highest, at least self-reported adoption among firms of AI. And we also have some really interesting microdata on firms that we just did an analysis of that shows that we do see the transition, that firms that are adopting AI in Denmark compared to otherwise similar firms, they are hiring less people. So we do see the transition. Started in Denmark, and there's a lot more

rich details in that analysis that I can get back to. We don't see the signs in overall macro data yet. What's important for us going forward? So we're expecting this transition to accelerate, but we're not expecting it to lead to produce outcomes with great unemployment in Denmark. We are expecting it to remain gradual, and there were many arguments made today as to why we might expect that.

[06:47:24.58]

What's important though in order to maximize the opportunities for productivity growth and also reduce the risk of displacement in the labor force are many policies, and you already addressed them and I very much agree with those, but what we see in Denmark is going to be putting us on a good strong footing is high labor market flexibility. As we just spoke about, which is very important but cannot come alone. Secondly, I think education is going to be really important. Reskilling is going to be really important. And that's across the board, starting from the very first classes, so also from children. We need to completely rethink the education model. And then we need to couple labor market flexibility, and that's what we have in Denmark, with a strong social security, social safety net. And that has to be designed in a way that there are incentives when you lose your job in order to look for a new job. So I think those are some of the very important features of policy that will be very important going forward, not just because AI and technology are creating supply shocks, but more generally in a world with more supply supply shocks also from the trade side.

[06:48:43.18]

So we need economies that can bend so they don't break. And that's what we call in Denmark, you probably heard about. So I'm talking about the flexicurity model in Denmark. It's setting us on a good footing. I think it will also be challenged in the coming years.

[06:49:00.07] - Manuela Francisco

I have a follow-up question to both of you, Signe and Minister Hennig. So Europe Europe wants both, wants fast adoption, AI adoption, but at the same time it also wants strong worker protection. Is there a way that Europe can deliver both? Let me stay with you, Signe.

[06:49:27.07] - Signe Krogstrup

So I think this is what we have in Denmark. This is a discussion of whether we are protecting jobs and workers' rights within jobs or whether we're protecting workers. So we have a model in Denmark where we don't protect jobs. You don't have workers' rights that ensure that you can stay on for a long time in a job, but you have workers' rights in the sense that if you lose your

job, you will have unemployment insurance that can help you through a difficult time, plus access to reskilling. These were also important issues that we discussed during the pandemic. And so I think that is— those are some of the issues that we will be discussing in Europe and that we will be challenged on in Europe in the coming years with the AI transition.

[06:50:12.11] - Manuela Francisco

Yeah, good point. There will be, however, fiscal implications. So perhaps we will talk more about fiscal at a later point. Minister Miki, how do you see that?

[06:50:25.21] - Niki Kerameus

Look, I think that despite the fact that the two you mentioned, so productivity and on the other side, the risk for workers may appear contradictory. I think in a certain way they're complementary. You will see the optimistic side here in general. So what I mean is the following. If AI manages to increase productivity through an augmented, I would say, view, then that would mean increased wages, better positioning, and greater protection for workers. Is that enough? No, is the answer. And we definitely need to regulate. And that's why, for instance, next week Greece is one of the first EU countries to be regulating limitations to the way AI is used within companies. So for instance, shedding light into what we call the black boxes. So we have companies which every single aspect of the labor relationship is, I would say, dealt with through an algorithm. So who is hired, how much he or she is paid, whether he or she is laid off, everything is done through an algorithm and nobody knows what goes into that black box. So what we're legislating this week is, number one, more transparency to know exactly what criteria the algorithm takes into account.

[06:51:48.29]

And number 2, in critical decisions such as laying off, for there to be a mandatory human oversight as far as the use of AI companies is concerned. So I think that regulation is necessary to a certain extent. And of course, social protection mechanisms— I would fully agree with Signe— social protection mechanisms have to be in place and are in place in most European countries. The unemployment benefit is an example, but an unemployment benefit that incites you to do reskilling and upskilling and that incites you to find a job. For instance, in Greece, we have a regime pursuant to which if you find yourself outside of a job, so the unemployment benefit for the first 2 months is higher and then progressively decreases. And during that period, we will offer you at least 3 job postings within your portfolio and within your region. You refuse the first, you refuse the third— the second. If you refuse the third, then the Greek state can no

longer support you. We want to get the message across that we want to support you in the transition period. We want to give you reskilling and upskilling benefits, but we want you to work.

[06:52:55.41]

So unemployment benefits is definitely something that has to be offered and is being offered. And at the same time, career paths. So when we see an industry which progressively will change, we go proactively. Let me give you an example. Last week we launched a new program for the automotive industry. The automotive industry is changing tremendously, mostly because of climate change and other, I would say, considerations. So what we did is we carved out those individuals who may face risks in the years to come, and we carve out individual learning paths for them to upskill and reskill now before any changes occur. to their careers. So I think that— so to sum up, I think one, regulation is necessary. Two, social protection mechanisms are necessary, but again, in a proactive fashion and not after the fact.

[06:53:49.55] - Manuela Francisco

Jason, would you like to comment?

[06:53:52.53] - Jason Furman

I mean, so first of all, the idea that anyone in Denmark is worried about the social safety net means that I need to be utterly terrified about it. here in the United States. I do want to say, like, this entire conversation, the premise of it has been work and that we want people to work and we want to enable people to work. I think that's exactly the right premise. At some point in the future, I think it's possible that we'll need to shift to a different conception of society, like a UBI and the like. But the AGIs or the ASIs can develop the UBI programs and we don't need to use our limited mortal brains to figure that one out. I do think, though, that we should also be prepared to think about a continuum in all of this. So I believe in the dignity of work, but I'm not sure I believe in the dignity of work on the margin, which is to say, like, the 41st hour of work in a given week doesn't give you that much more dignity than the first 40 hours did. And so if we're in a world where it evolves to people working fewer hours per week or a world where people are retiring earlier, I think in both of those you get sort of almost all the social benefits of work and may be able to have a living standard.

[06:55:10.37]

So I don't think that's quite where we are now. But I do think outside of how you support people in work and in their jobs, it's how do we have a transition So that the vision that John Maynard Keynes had, which was so beautiful nearly 100 years ago, we can finally realize to a greater

degree of letting people figure out how to have meaning and purpose in their life, have an adequate material living standard, but also enjoy other things. So I do think we need to also be— I don't know that I'm ready to do any of that now, but be prepared. Certainly, it's way better if everyone loses 30% of their work than if 30% of people lose their work.

[06:55:51.20] - Manuela Francisco

Very good perspective. Jason, so one of the papers presented this morning argues that aging can contribute to premature deindustrialization and could create an incentive for firms to choose a technology that is labor-saving. How do you see the link between aging and structural transformation in the age of AI?

[06:56:20.08] - Jason Furman

I am torn between the impressive set of research about how endogenous technology is. You have fewer workers, so you invent ways to get around having fewer workers, and that's the mechanism for for example, recent papers on slowing population growth leading to higher productivity, versus a model in which there's just an insane amount of venture capital, an insane amount of research going on right now. And if there is something in the possibility space, they'll somehow find it. And if it can sort of accomplish anything, they'll figure out how to accomplish it. That second view is closer to a technological determinism, and it goes against what you hear a lot of conferences, like technology is not destiny, technology doesn't make our choices, we do. I don't have— there's good empirical evidence on all sides of this question. I have no doubt that technology to some degree is endogenous to either what your tax incentives for different technologies are, what your demographic structure is, what your wage structure is, for example, in raising the minimum wage nationwide in the United States. I think we do need to think about endogenous technological change that that might induce that might be something different than what you would capture in state-level studies.

[06:57:44.35]

But to me, the first-order one here, and this is more hunch than literature, it really is something exogenous, which is to say if there's some set of scale of processors and size of a matrix that will do a certain thing, We're just going to get there no matter what the age structure of our population or demography or other incentives are. And that again gets to my view that we need to figure out how to cope with it, not try to figure out how to shape it.

[06:58:12.07] - Manuela Francisco

Thank you. Minister Niki, how do you see this in Greece?

[06:58:17.23] - Niki Kerameus

So I think that aging and Europe as a whole is facing really important demographic challenges. Greece is one of them, obviously, but other European countries as well are facing such challenges. I think that aging creates a larger pressure for productivity growth. And AI offers, I would say, the power of achieving that. But the 2 forces will not balance each other out automatically. So that needs precaution in general. Now, I would say 2 things. I think that AI will help us in having the higher productivity that we need in order to cover also for labor shortages, not necessarily in the areas where we'll have labor shortages. So for instance, let me give you an example. I think that one of the areas where we're going to have issues in the future, especially in Europe, is healthcare. Healthcare, I'm not sure that every aspect of healthcare will be in a position to be covered by AI. For instance, nurses. You know, it's really hard to imagine how AI would manage to effectively replace a nurse. Yes, a medical prediction, yes. But when you're in pain, you want somebody next to you. So in that sense, I am concerned about how those needs will be covered, particularly given that with an aging population, we're going to need more such personnel for many more years.

[06:59:45.01]

But at the other end of the spectrum, I think we need to work— and following up on what was said earlier— We need to work on broadening the base of the labor force. And I'll give you an example. So we are— we're all going to be living, you know, longer and better years. One thing we've done in Greece, and it has worked, is the following. So Greece having demographic challenges, we have many pensioners who wanted to continue working while receiving their pension. It used to be the case that if you were a pensioner and you wanted to continue working, you saw 60% of your pension be withheld. That was a disincentive for somebody to work or an incentive to not necessarily declare the work that you were doing. So we changed that and we did away with the reduction of the pension. So today, if you're a pensioner in Greece and you want to continue working, you receive 100% of your pension and you just pay 10% of what you earn to the social security system.

[07:00:45.59]

Result, we went from 35,000 declared working pensioners to 320,000 just by that incentive. So what I'm trying to say is that we will need a broader base. We will need more people provided they want to. It's obviously not mandatory, but given the effect of AI on healthcare, by— I would say the default is that all of us will be in a position to be active for more years, and we may also for psychological reasons want to remain active even after our pension. And that's something

we're going to need for the years to come. So I think creating tax incentives for pensioners to continue working if they so choose— I would underline that— is a way of broadening the base in addition to achieving higher productivity for the entire labor force.

[07:01:38.56] - Manuela Francisco

Many thanks.

[07:01:39.51]

Sine, can you give us the perspective of Denmark?

[07:01:43.07] - Signe Krogstrup

I think I'm going to say a very similar thing. So Denmark is a country that early on we started indexing our retirement age. So my age is now 70, so I'll be around for a while. And that has put the public finance— it's been one of the measures that put public finances on an even keel in Denmark. It also means that we have had an increase in labor force coming from the older generation. So we actually had quite a strong increase in employment, increase in the labor force over the last 5, 6, 7 years, and a lot of it has been from these older generations. We also have a lot coming from abroad, and that has been because, partly because of this indexation of retirement age, but not only. We also have little incentives built in so that you can work longer without losing too much of your pension. But that also doesn't explain everything. We actually do see quite a boost from older generations that simply elect to stay longer in the workforce. So that's something that is very much supportive of strong Danish economy. I do want to say that from the last session we had, at the same time in Denmark, we are the country in Europe that has the highest adoption of AI.

[07:02:59.56]

So this is not hindering our adoption of AI.

[07:03:02.14]

On the contrary, I would say. So we don't currently see aging as a constraint on labor force. And now I say currently because of course when we look over the next couple of decades, this is going to be a constraint. And we don't know to what extent we're going to rely on foreign labor coming in. Very important point that is probably more discussed currently in Denmark is that aging will be more on public services. So exactly what you said, healthcare, but perhaps not only. And there is a very strong drive and focus in Denmark on making public services more

efficient and also using AI. And I think this is an area that we need to know more about, is how do we drive the adoption of AI in a sound and safe way in the public sector so that we can also increase productivity in public services. Thank you.

[07:03:56.13] - Manuela Francisco

So Jason, I would like to come back to you because I want to circle back to the point of that with AI, we may work less years, we may retire early. At the same time, because of aging, we live longer, we should work longer, and we need to remain productive at later, at later stage. One of the reasons, because fiscally it will be impossible and will be very difficult for governments to contain to continue providing the services, healthcare, at the same time pensions, if people retire much earlier. Actually, I was in an event about aging at the World Bank last week, and actually what we estimate is that spending on health and pensions will double by 2050 in emerging markets and developing economies. How do we square this? Should we work less? Should we work longer? What is the final answer on that?

[07:04:59.52] - Jason Furman

The final answer. So yeah, I mean, first of all, most of what we've discussed so far costs money, so you're probably right to push us to the other side. But this is one where I go back and forth. 5 years ago, I would have said raising the retirement age should be an important part of the solution to Social Security in the United States. It was last legislated an increase in 1983. The increase finished phasing in about 4 years ago. But now I partly have the opposite view that if we're going to have people not work, I'd rather a 65-year-old not work than a 25-year-old not work. And I understand the lump of labor fallacy and all of that. But If you're going to work a certain amount in your life because you want a certain living standard, at some point maybe you are hitting something resembling a lump of labor. So I go a little bit back and forth on this. That being said, we all have fiscal gaps in all of our countries. Well, Greece is moving in the right direction rather rapidly, but the rest of— and Denmark's probably fine too. Okay, fine.

[07:06:08.08]

It's just the United States. I won't of my fellow panelists. Oh no, my fellow panelists, I understand. Oh no, don't get me started on France. It would be— I'd start to get rude and it's not my country. So yeah, we're in a bad place, but we're less far from a good place than I think people appreciate. The Congressional Budget Office is very, very pessimistic about productivity growth, 1.7%. annually. On CalSHIE right now, they're betting at about 2.2%. And I was all excited they were launching this market because I was going to make tons of money from all the wild-eyed techno optimists. But that was exactly my forecast. So I'm not going to be betting on

CalSHIE. I don't have any edge, evidently. And at that, our fiscal problem's a bit smaller. I think we could make an adjustment that was less than 2% of GDP. How to do it? I would do Lara is about to get very upset at me. I would do a one-time credible wealth tax. And the way you do a one-time credible wealth tax is a VAT. But everyone's wealth buys less. It actually is a one-time wealth tax. I understand.

[07:07:22.25]

I was trying to get Democrats more excited.

[07:07:24.23] - Manuela Francisco

On the question and answers. So let me move to a different topic.

[07:07:29.33] - Jason Furman

As opposed to the hackling?

[07:07:34.29] - Manuela Francisco

The World Bank did a study recently on AI in Poland, and what that finding, that study showed is actually the gains and losses are not evenly shared. And this is typically the case when we have a change like this. But in that particular study, we showed that capital returns rose by more than 15%age points, while labor income stayed roughly the same. How would you go about this? I go back to fiscal policy, maybe because I work on fiscal policy issues, but how would you use fiscal policy to even this out? Do you think it's possible? Should it be from the spending side, revenue, or both? How would you go about mitigating these factors if you think they should be mitigated?

[07:08:31.02] - Jason Furman

Yeah.

[07:08:31.13]

So first of all, you can plug in the extra productivity to try to figure out the fiscal outlook, and then you can decide if things are going to be better or worse than it would normally be for that type of productivity. And part of the narrative for it's not going to be as big a gain as you're expecting is if you get a shift of labor from Shift of income from labor to capital, and capital is taxed more lightly. There's things on the other side, which is we tax a base that in some respects is larger than GDP, which is we at least partially tax capital gains. And so generally in the past with large

productivity, we've also had large capital gains. And so revenue has risen as a share of GDP. So it goes a little bit both ways. But broadly, I think our taxation of capital income's pretty broken. Both at the national level but also at the international level, the ability to shift income to low-tax jurisdictions. I could imagine that could be even easier and more pervasive in a world of AI. I don't think we need to invent fancy new ideas.

[07:09:31.52]

Everything that has dealt with intangibles and the like in the past, things like Pillar 2 of the OECD and a minimum tax, I think is precisely the right way to deal with this. I think a VAT is another right way to deal with this for those countries on this stage that don't have them, which I think is only mine. And so I don't think we need fancy new tax ideas. I think the things that fix what's broken about it would help even more in this world.

[07:10:03.41] - Manuela Francisco

Thank you. Signe, what is your perspective?

[07:10:07.52] - Signe Krogstrup

So I think that there are 2 questions. One is that we may have a change in tax revenues because we have a shift from labor to capital income. And that, of course, needs to be adapted in order to keep fiscal sustainability. I very much agree, we would have to be looking at what actually happens and adjust. And the second issue is inequality. Where do the gains— how do the gains hit? What is the impact on wealth inequality and income inequality? And just a perspective from Denmark again, we did see labor share declining over a long period of time. That has not been AI-related. AI is very recent. What we see in Denmark is that it has been very much related with a number of very large multinational firms that have very high capital income and much lower employment. And that is really shifting a bit the capital labor shares in Denmark. What we haven't seen is that that has not led to stronger wealth inequality. And depending on the measure of income, also not on that. That is because we in Denmark have a pre-funded pension system that is really broad-based. So most Danes have good retirement savings.

[07:11:24.38]

Most of these are based on— they're pre-funded and they are risk-taking. So they're invested in markets and most are exposed to stock markets. And when these big firms, they increase in value or they pay out dividends, it goes very much into the savings, the pension savings of

Danes. And so these gains are spread quite evenly through that system. So just one perspective. There are many ways to spread these gains.

[07:11:55.41] - Manuela Francisco

Many thanks. Minister Niki?

[07:11:58.02] - Niki Kerameus

2 points. First of all, Focusing a bit on the social aspect. So we need money. We need money in order to train people more, especially the most vulnerable groups. We need money in order to ensure the transition for large segments of the population. What we're doing in Greece is we are, I would say, creating fiscal space through tackling undeclared work, underdeclared work, tax evasion, etc. So we are using aggressively digital tools in order to tackle tax evasion, in order to tackle undeclared and underdeclared work. And that has created fiscal room for us to go and invest in those vulnerable groups that need most our assistance. So that's one point that we're really focused on. The second I would want to emphasize is the following. We tend to talk a lot about the effect of AI on the labor market, on job displacements. I find that globally we don't talk a lot about the effect of AI on social security systems. And I say this because many countries have distributive systems. Not all countries have systems whereby pensions are invested, contributions are invested, etc. So that creates a whole host of issues. And even at the EU level, I've been insisting for a number of years for the past 2 years or so for this to be discussed, because some mechanism has to be put in place as to what the effects of AI will be on our pensions.

[07:13:28.19]

We are having demographic challenges. We're going to be having less workers in the years to come, less workers paying Social Security contributions. We're going to have more pensioners living longer, which is a good thing, don't get me wrong, but we are going to have them living longer. And on top of that, we have AI. And potential job displacement. So the elephant in the room, I think, has to do also with the effect of AI on social security systems, and in particular social security systems that are distributive in nature. Greece has, for the most part, a distributive system. And for a smaller part, yes, we have started investing as well contributions, especially for the younger generations. And so when one looks at the 40-year cycle of investment, yes, those younger generations will probably be better off than, for instance, my generation. But it's a topic that needs to be addressed as to solutions and how to address the effect of AI on social security systems.

[07:14:27.01] - Manuela Francisco

Would you like to add something? I see you taking notes. Oh, oh, I think you got inspired.

[07:14:31.42] - Jason Furman

I don't know that I'm inspired, but, you know, in general, in a pay-as-you-go system, higher growth rates help. And certainly in the US, the initial benefit is indexed to wages, which grows with productivity, but thereafter it's indexed to prices. And so if we had faster productivity growth, that would help. And then we have to decide whether to consume that in the form of less benefit cuts, less tax increases, or something else. And the first claim would be on the shortfalls in the system. And then after that, as I said, starting to think Maybe heretically about early retirement or reduced payroll taxes for lower workers if you think they're the ones that are most vulnerable in the labor market and whose employment you're most focused on and whose labor supply is the most elastic?

[07:15:21.50] - Manuela Francisco

Very difficult questions. And actually on the digitalization, so digitalization can be extremely helpful in terms of tax administration and we have seen very good results, but we have also seen that it's more difficult to tax a heavily digitalized economy. So there are both ways. So now let's talk about something else.

[07:15:42.11]

So AI is changing the way that the workers perform their tasks.

[07:15:49.18]

It's changing the skills that firms demand. So The importance of reskilling is very prominent now. So you talked a bit about this, but I want to come back to this point. How should education, training, and reskilling adapt and adjust to today's world? But more importantly, how do you see the division of labor between governments, firms, and workers? Who should do what? So let me start with you, Minister Niki.

[07:16:27.47] - Niki Kerameus

I think education has a huge part to play in this, and I think that it's a very important aspect of the solution. So with respect to your first question, what needs to change basically in education and training, we have to have a different approach. We have to focus a lot more on critical thinking. and on learning how to learn. And I say this because the kids who are now in school, in

all likelihood, they will be called upon to change several professions during their career. We on this panel probably studied one thing and did one thing our entire career, or even perhaps two. But the younger generations, the ones to come, will most likely be called upon to change professions throughout their career.

[07:17:14.58] - Manuela Francisco

Mm-hmm.

[07:17:15.29] - Niki Kerameus

So those who will be, I would say, more effective in that will be those who will have been taught how to adapt faster, how to be critical, how to learn how to learn. So that's why I think that the entire education system, at least from a European perspective, needs to shift in that direction of more critical thinking, problem solving, and also getting the message across in education early on as to what professions will be needed in the years to come and how important lifelong learning is. So that's on the first question regarding education and how education has, in my opinion, to be changed. The second point, who does what? First of all, I think it's really important to stress that people should not solely rely on governments. I think that's an erroneous approach. Governments, yes, have the duty to do everything in their power to reskill, to upskill. But if companies themselves and the labor market itself does not realize how important it is to invest in people, then we won't go very far. This is something at least we say a lot in Greece about how this has to be a combined effort. And all the more so when one thinks Greece has a particularity in this respect, Greece has an economy which is based to a very large extent, it's composed of very small companies, really small.

[07:18:42.35]

92% of Greek companies are really small. So that makes the task even harder. Who's going to reskill? Who's going to upskill? And that's where social partners come into play. And social dialogue is critical in this respect. So to answer your question, I think it should be a shared responsibility. Governments should proactively engage in upskilling and reskilling? Yes. In Greece, we are doing that horizontally. So we— Greece has a population of 10 million. Roughly 800,000 have been reskilled and upskilled in digital skills and green skills. But this has to be a combined effort together with the private sector, together with companies. And the message has to get across as to the importance of lifelong learning.

[07:19:26.29] - Manuela Francisco

What is your perspective?

[07:19:28.39] - Signe Krogstrup

So I just want to add to that, that reskilling, retraining, and access to that is a really important part of this flexicurity system and very important in this future with AI. And it's what we did in the past is just not enough anymore because it's not just about access, having access. It's also about the fact that we have to do it in a different way because AI changes what we need to learn, how we learn. And we do see all the challenges in the schooling systems all the way down to the very small and all the way up to university. And how do we make sure people learn the skills? And how do we use and how don't we use AI in education? And just want to double down on what we heard from the previous session with Prasanna that said, what are the things that we need more information, more knowledge, more research on is exactly how do we adapt education systems, reskilling systems? How do we do it? And I think that is going to be really important. And I fully agree that it's not either public or private sector, it's all of the above.

[07:20:27.00]

A big part of the schooling system in Denmark is public, so there's no way around that, a very strong public role. And I think companies will have a very important question to ask because one of the things that we saw in our research is that it's the young people, and I saw that today also, young people have— there's less hiring in firms that employ AI of young people and people with higher education. And there are a lot of anecdotes also from young people that it's hard to find first jobs. It's hard to know about anecdotes, so we will see. But we actually do see this in the hard data in Denmark. And I think for a firm, you have to ask yourself, if you don't hire the people when they're young, maybe because they will have tasks that are very easy and quick to automate using AI, then how do these young people get the skills that you can actually hire them later on with more experience? That's a good question. And that is the responsibility of the individual firms. But there's also a big public question. It's a public good to ensure this. So I think that's a very important question for us going ahead.

[07:21:33.19] - Manuela Francisco

Thank you. Jason, what is your view?

[07:21:36.18] - Jason Furman

Yeah, so first of all, for education, just my experience with students, is most of them are in a bad middle place where they're using AI badly to do stuff that they could do themselves. They need to be using AI much more to do things they never, ever, ever could have done, which means agentic AI, not chatbots. Then also, as the minister said, learning to think critically and learning

to think without the AI. You need both of those to be better at AI and better at not AI, not sort of mediocre at both. And there's sort of so many aspects to this, but the pipeline is one that I wonder about. It's been a longstanding mystery as to why a firm would invest in training anyone, because the vast majority of younger people who work at a firm don't stay in the firm. So the firms are not giving somebody training because they're going to be there 10, 20, 30 years later. No one at PIIE is training people so that they can be better senior fellows at Brookings a decade from now. So why do firms train people? Because the workers are paying for their training.

[07:22:44.49]

How do they pay for it? They take wages that are considerably less than what they're producing for the firm. And that's the Becker model of training. I think it's the right way to think about it. And once you start thinking about it that way, if you think younger people are going to be producing less for firms, there's less for them to give up in exchange for that training. Goldman Sachs sets you up fantastically for life, but I don't think we're going to be in a world where people are willing to pay $100,000 a year to work at Goldman Sachs. It's not nearly as exciting a place to be as Harvard. But so what do you do? One thing may be having people stay at firms for longer and not move around from job to job. And that's the non-competes I said before. A second thing is maybe more of that training needs to happen before you get to the firm and that it's paid for in some other way, paid for in tuition, paid for through taxes. But if it's a public good and it's a collective action problem, you need to solve it collectively.

[07:23:49.56]

Or if it's about the individual who gets the return from the training, Maybe they can solve it individually. Neither one of those is the firm. And then that raises the last question of what happens to education. And I go back and forth between thinking we need a diversified liberal arts education, which I think the United States is particularly good at, where we don't ask you to specialize at a young age because we can't quite predict the future. You might need a mixture of skills. You might need to change jobs. And so schools that let you take poetry and computer science and certainly my economics class is exactly what you should have. And then there's other days where I think it should all be vocational. If you're not going to get the on-the-job training at your first job, we need to do a better job of that in schools. And then I think we don't know what to do for vocational training. And so I revert back to liberal arts because at least we know how to do that. Whether or not it's useful, less sure.

[07:24:43.22] - Manuela Francisco

So could you tell us a bit about what universities are doing like the University of Harvard to prepare young workers? Is there anything you could share with us?

[07:24:56.12] - Jason Furman

I mean, there's the college, which really is a liberal arts education. I mean, our students are very focused on jobs, but most of their work related to jobs is in the clubs they're in. They're in the finance club, the consulting club, the venture capital club, the student newspaper, the, you know, et cetera, et cetera. And then our classes are sort of a regrettable necessity for being able to join all those clubs. So we're not that vocational, and I mostly like that. I like knowledge for the sake of knowledge. I enjoy both doing research, sharing new things, but also just learning stuff and talking to colleagues in other disciplines. And most of the people who run the school, that's what they like. And they organize it that way. I can then rationalize that now more than ever, if we don't quite know what's coming, you want people to be diversified, have the critical skills, and have all of that. For the professional schools, though, at the Kennedy School, for example, Gordon led a strategic review. And a lot of that involves going heavier in the area of technology and not training people to be coders, because you just need to know how to write English or Greek or Danish or whatever language you want to do your coding, but people that can interface with technology, that can use technology, that can advance it.

[07:26:17.48]

So I think for the professional schools, it's probably a bigger issue, but one that I think Gordon could speak much more eloquently to the ways in which we're on top of it.

[07:26:29.42] - Manuela Francisco

So too late for us, but what about our children? What should we advise them? Should they go into liberal arts or should they go into engineering?

[07:26:40.04] - Jason Furman

I think it's David Deming, who's now the dean of Harvard College, had a paper, I think a decade ago, that found most of the job growth was in soft skills, not hard skills. And also another paper that found things like coding depreciated quickly because you learn one language, you started with high pay, but you probably didn't didn't grow very much because new people came in who knew the next language. So I think that's probably more true now than before, but it's a bit of a challenge to figure out how to teach management, interpersonal relationships, creativity, teamwork, and all of that. I think that's what has higher returns, is harder to replace with AI, but also doesn't have a ready-made template for teaching Thank you, Minister.

[07:27:29.06] - Niki Kerameus

So in Europe, we're lacking technicians. We are lacking— we are— I don't know about Denmark, but in general, in most European countries, we are truly lacking technicians. And we have a large majority of the population that goes towards universities and more liberal arts, whereas the economy needs desperately technicians. So what we do, because you refer to professional schools, what we're doing for the past few years is the following. We have VET schools, vocational educational training. We offer specialties that are in tremendous need in the market— plumbers, electricians, technicians of any sort. And what we do is we have companies come over to us and say, you know what, I'm lacking X specialty of technicians. I'm like, how many? Like 100. So I'm like, if you did have 100, would you hire them on the spot? Yes. So we go and set up a branch of our public VET school within the company. Those who register have a dual education. So in the morning they do practical training within the company, and in the afternoon they take theoretical courses on that specific specialty. Absorption rate, 100%. And this is something we're trying to do throughout the country as long as we can afford it, obviously.

[07:28:43.11]

But we're having more and more companies come over and say, you know what, We are lacking technicians. We can't grow our companies because we don't have enough technicians. So I say this because this is a common theme among European countries. Yes, you know, we do have many kids who go to universities and all of us did, obviously. But the economy also needs a lot of vocational training. And I think there's no better way to address that, but rather than in collaboration with the very companies that are lacking the specialties and know better than anybody else what exact specialties are needed and what will be needed, those specialties that will be needed in the near and far future.

[07:29:22.24] - Manuela Francisco

Thank you. Would you like to add? I have heard a lot about companies and the workers themselves, less so about the government. What should the government do and how to go about financing it? You and maybe Signe, but it will be good to hear from you, Minister, as well.

[07:29:45.07] - Niki Kerameus

So what I just described is the government. What I just described with those branches of vocational educational schools within the companies is a government— is a Greek government initiative. And this because we see the need that arises for those technicians. It requires funding, yes. So we use EU funding and Greek funding in order to cover that need. And that's

because we have a view as a government that obviously growth will not come from the public sector, it will come from the private sector. And given the labor shortages we're facing right now, we need to do everything in our power to address those needs and to assist companies in creating more jobs and better-paid jobs. So that's why we're following that route, and it's paying off for now.

[07:30:32.41] - Signe Krogstrup

I just wanted to add one thing to the education part, is that of course we need technicians and STEM is really important, but we also don't know what the future demand will be. And so I think the most important thing is that people learn, young people learn to think critically, they learn to learn. So I just want to repeat that one. And what the government needs to do, so I'm not going to weigh in on government policies on this. I think there's huge role. They're very broad. But let me just come with this very dry central bank recommendation, is that we are already in times where we have big supply shocks, big shocks in general to the economy, and that probably will continue. So it's also really important that we have governments that are well-funded, that have fiscal sustainability, that make sure that there is fiscal space for when it's needed, and also remove initiatives when needed in order to make— to maintain fiscal space going into the future.

[07:31:29.55] - Manuela Francisco

Many thanks. So we still have about 35 minutes, so I actually would like to open it to questions. If you could introduce yourself and let us know if you want to direct your question to a particular panelist or to all.

[07:31:50.10] - Audience

Antonio Spilimbergo, IMF. All the panelists stress the need for gigantic investment and to complementary to AI. We already experienced this when highways were constructed. They were complementary to the car industry, and the car industry paid.

[07:32:13.29]

They paid by taxes They paid, even tires were taxed.

[07:32:19.55]

Did you calculate how much is the money that the AI industry should be taxed for the benefits they are receiving with public money? Because what you are describing is a huge transfer of public money to these companies.

[07:32:40.28] - Jason Furman

I, oh, do we go now?

[07:32:41.37] - Manuela Francisco

I was wondering whether we could take 2 questions and then Because I see that many want to come in, which is good. The audience wants to ask questions.

[07:32:50.45] - Audience

Thanks. Divya, I'm at the IMF. A couple of questions. So first, I think many AI firms are currently in growth mode and trying to grab market share. What's your view on to what extent users currently pay the marginal cost associated with AI? And could it be that Longer term, AI turns out to be much more expensive than it looks now?

[07:33:16.31]

That's the first question.

[07:33:18.17]

And the second question is that there's some interesting evidence that firms—

[07:33:23.37]

part of the way that they use AI is to understand what experienced workers do and transfer that knowledge to less experienced workers. So David Autor, Daron Acemoglu, and Simon Johnson— Jason, you referred to some of their work.

[07:33:39.23]

One of the points that they make in that work is that perhaps there is a question to ask about who owns the IP from worker expertise. Is that something that any of you guys have thoughts about? Thanks.

[07:33:49.42] - Manuela Francisco

Thank you. Perhaps we can take these 2 questions. Let me start with Jason, then Minister, then Signe.

[07:33:55.23] - Jason Furman

Yeah, so the only reason you would tax the AI companies any differently than anything else is if you think there's some sort of externality. Absent that, you want a broad-based tax. And if that broad-based tax includes shoring up the corporate income tax, which I would do, and they're super profitable, they will end up paying more. But it's not like you'd pay it. So the argument for a token tax, for example, isn't that these companies are rich. It's that you think that adoption is too fast, and you want to slow down adoption because you think there's a set of negative externalities. externalities with it, you could maybe persuade me of that, but you couldn't persuade me to tax them because they're rich. And in that respect, we may have done tire taxes, but that's a really stupid way to have paid for the highway system. Gas taxes are a smart way because there are a set of externalities associated both with the use of roads and with gasoline. But I wouldn't do anything specific to tax these companies. But if we had a good tax system and they're successful, they'll end up paying. a lot. And that gets to the market share question.

[07:34:59.55]

Right now, it's very heterogeneous whether you're paying your marginal cost or not. I have about $1,000 a month of AI bills right now, and I think if I was doing metered APIs, I'd be paying about $25,000 for my token usage. So I'm way below the marginal cost and they're losing money on me and I'm sort of happy about that. But Anthropic at least reported a profit earlier this year, and there's debates about the accounting around all of that and the like. I think the big question is if it's Bertrand competition, then at best you'll be able to charge your marginal cost. And in a world of unbelievably high fixed costs, charging your marginal cost is not enough to survive. And so how does the industry survive if it doesn't build moats? They think RSI means they're going to get more and better than someone else, take the whole market. But RSI gets you to infinity. And that means if you use something that's half as good as infinity, it's still a really large number. In fact, even 10% of infinity is a really large number. And so I'm not sure that RSI helps as opposed to Hertz.

[07:36:12.38] - Manuela Francisco

Signe?

[07:36:15.37] - Signe Krogstrup

So on the question of market shares and pricing, I think that really the jury's out. And that's a really important question because there's also models copying models. And it's really hard to know in the future whether these AI models, AI agents are developing into commodities that can be copied and therefore will run down prices. And so those are important questions, not least for the valuation of AI firms currently. On Antonio's question, so it's not necessarily that there are huge investments needed, and that probably also depends on the situation that different countries are in. In Denmark, it could also be big productivity gains, so it could be the opposite effect. And speaking about taxes was much more of a distributional issue in my view, is that where are the income, where is the productivity gains, who are going to capture those? Is it going to be labor or capital? And where exactly is it taxed in the future in order to keep financing the state? So that's a very broad question.

[07:37:16.27] - Manuela Francisco

Thank you.

[07:37:17.39] - Jason Furman

Oh, I realized we didn't address the intellectual property. I don't have a great answer to that. There's 2 separate things. One, do you want these companies having everything everyone ever wrote? Yes, they're more likely to solve diseases, come up with amazing inventions. Who gets compensated for that? That's sort of a Coasian distributional issue. not an efficiency issue. I guess it would be nice if the people who wrote it were compensated, but I didn't fill out my forms Anthropic sent me to pay me back for the stuff they took. I'm grateful they took it and included it in their models. Finally, the tax system is a way of sharing it. We have a 21% corporate tax. I would go to 25%, maybe I'd go to 28%, and then 28% of the gains get shared with everyone else, and maybe that's the right way to do it.

[07:38:09.40] - Manuela Francisco

Let's take 2 more questions. You want to also take maybe the gentleman there? He had his— You don't have a mic, but if you— ah, perfect. We have a mobile mic as well.

[07:38:21.17]

Please go ahead.

[07:38:22.05] - Audience

Jacob Kirkegaard from the Peterson Institute. This is a question for Jason and the most egregious and heretical thought that he had, namely this idea that non-compete clauses for young people— I mean, that strikes me as— so we're basically— you're basically saying that we have an exogenous technology shock that disproportionately affects young people, and we solve it by restricting their freedom, basically. I mean, that strikes me as basically blaming the victim in some way. Surely it must be better to, if you need additional funding for training that's otherwise not available, that that training is financed through, you know, taxes or a broadly shared burden on society, and preferably maybe one paid for by high-tenured, high-income individuals.

[07:39:15.49]

Hello, I'm Anna Frutero from the World Bank, and So we talked a lot.

[07:39:22.19]

You, Jason, mentioned the 15 hours that Keynes envisioned us working in the future.

[07:39:27.51]

And if we, you know, we saw that this didn't happen, right? So now this ideal of a world in which we all work less seems to me kind of hard to imagine if the world is as it is. And I'm wondering, we have talked about taxation that redistributes, but what about should we have a discussion about how to broaden the ownership of capital? Can we think of ways in which, you know, we can actually redistribute the capital ex ante and then the benefits go rather than using UBI or mechanisms, redistributive mechanisms ex post? Thank you.

[07:40:10.06] - Jason Furman

Jacob, first of all, I'm not sure. I'm not here saying and pounding the drum for restoring non-competes agreements. I mean, more moderate than returning to indentured servitude, which I also considered as an option, but I don't think it's drastic enough for that yet. But people gain from their training. So some of those gains should be broadly socialized. But surely people who go to a fancy software firm or hedge fund and sign a non-competes agreement, I don't think you'd suggest that we socialize the cost of that. Those are choices workers make. They get training in exchange for it. They think they're going to get a higher lifetime wage. They give up some other stuff. And so does that extend all the way down to sandwich shops like Jimmy John's, which used to have non-competes agreements? No, I don't think I've changed my mind on non-competes agreements for sandwich shops. But where to draw the line in between that spectrum, I do think we need to be open-minded and potentially have a different answer

because a lot of the gains actually are private gains. They're not just broader gains. On the capital, I guess I know that notwithstanding like a VAT is a one-time wealth tax plus a wage tax, which is the right way to think about it, Lara.

[07:41:30.23]

Mostly we tax flows, not stocks. And mostly we distribute flows, not stocks. I mean, if you If you took a bunch of the wealth away and gave it away, you'd have a lot of wealth inequality 30 years from now because some people would spend money, some people would be lucky, some people would be unlucky, and then you need to do it all over again. I would mostly focus on the income flows and making those better rather than thinking there's some one-time thing you could do to the stock that will solve the problem.

[07:41:58.59] - Manuela Francisco

Thank you.

[07:41:59.32]

Minister?

[07:42:01.35] - Niki Kerameus

Just one point. I've been thinking about this non-compete issue while you're talking. I'm having a hard time.

[07:42:07.36] - Jason Furman

And I think Greece should try it first and we'll see how it works.

[07:42:10.44] - Niki Kerameus

Greece has a constitution. I was about to say Greece has a constitution which is the higher law of the land, the highest law of the land. I'm not sure, I would have to look into this, but I'm not sure that one could provide for mandatory provisions on non-compete. I think that would go flatly against the liberty that companies and individuals have to agree on the content of their contracts. Again, one would have to look into it. Perhaps you could create tax incentives for the companies that manage to keep workers for longer. That's a different story. But I think there are 2 different optics here. One is regulation and mandatory provisions, which I think would have a hard time, at least in Greece, of actually being implemented. And the other side is creating

incentives. So as to basically incite companies to invest more in training, because I get the point that you're more reluctant as a company to invest if you have a turnover of 6 months, whatever. So you could create tax incentives for companies that manage to keep people for longer.

[07:43:19.03] - Manuela Francisco

Can I follow up on that?

[07:43:21.34]

Tax incentives that keep workers for longer or tax incentives that support more training. But wouldn't that also lead to some distortions? In a way. First of all, forgetting the revenue for gone, but then the state should be indicating what would be the areas where we want the firms to invest. in terms of training, and should that be the role of the state? Just wondering.

[07:44:00.24] - Niki Kerameus

I mean, truth be told, we have received a proposition by social partners in Greece, so by representatives of companies that have asked for tax cuts for those companies that are heavily investing in reskilling and upskilling. So we're actually considering that. It has certain limitations, but it is a proposal that has been submitted, and I think there's some truth to it.

[07:44:23.46]

Why?

[07:44:24.04]

Because right now, if one looks overall at the Greek economy, the largest part of reskilling, upskilling is done— a huge percentage is done by the Greek government in terms of percentage of the population, and a tiny part is done by companies. So we need to find ways, because otherwise this is not going to be sustainable. And if we don't sufficiently invest as globally, I mean, and people, I think then I will turn pessimistic as to the effect of AI. So I truly think we need to find ways to engage more the private sector in reskilling and upskilling.

[07:45:05.09] - Manuela Francisco

Thank you. Signe?

[07:45:06.04] - Signe Krogstrup

Nothing to add.

[07:45:07.22] - Manuela Francisco

Thank you. So let's take more questions.

[07:45:10.50] - Audience

Hi, good afternoon. My name is Samuel Pignaur. I'm with the IMF. I have 2 questions.

[07:45:15.23]

One is about the point about the forward-looking nature of educational systems that was emphasized by Minister Keremeus, and I was wondering if you have any thoughts about how you do this when you have a world where, as someone described this morning, we live in a multiple of shocks happening, right? So the ability to forecast is very hard at this point.

[07:45:37.21]

So your thoughts on how you project the future works that we need would be interesting to hear.

[07:45:46.13]

The other point regards Jason's point about the managerial skills and the ability to coordinate that will be demanded in the future. I was wondering if you have any ideas of how you implement these in school systems and especially in generations that are currently close to graduation from high school, say.

[07:46:06.34]

I've heard, for example, that public service could be an option. Do you think that would be like a good way to provide people with the ability to coordinate and work in teams?

[07:46:17.31] - Manuela Francisco

Thank you. Next question, please.

[07:46:21.13] - Audience

Hi, Gordon Hanson from Harvard Kennedy School. Thanks for an excellent panel. You've raised the issue of worker training a bunch, and I want to kind of probe you on this on 2 dimensions of it.

[07:46:33.37]

One is that, you know, if we look at job loss in the United States, and this is true in— probably not in Denmark, but it's true in other high-income countries— in the aftermath of job loss, people do get retraining. The fraction that do is shockingly low. In Michigan, after mass layoffs, you had about a 4% take-up rate of training. In Ohio, during the Great Recession, You had a comparable rate. Those are cases where we've had good microdata to study stuff. So does Denmark offer us insights in how you get people who we think need it to take it up? The other is thinking about employers. You talk to heads of community colleges in the United States, they complain about employers because employers want workers now. They aren't very patient. And then if you— after you spend 24 months to set up a program, they've said, oh no, We're now— we're off to something else. So connecting the employers and training institutions often work on different timelines, and getting them in sync can be difficult. We do have examples of private sector institutions creating fantastic training operations. Toyota created the Federation for Advanced Automotive Manufacturing Education in the US.

[07:47:49.39]

Kodak, when it existed, created great optical training in Rochester. Ford created Henry Ford Community College. GM created what became Kettering University. Those are all big monopolists. We've got some big— we've got some emerging monopolists in the tech sector. It's not clear they're going to have an interest in doing that same sort of vocational training. So your thoughts on how we might be able to get employers aligned with what I very much agree with you is this need for their deeper engagement on solving the— addressing the training issue.

[07:48:25.08] - Manuela Francisco

Thank you.

[07:48:25.30] - Jason Furman

I mean, on the managerial thing, I don't exactly know the answer. I just would note that a lot of AI skills actually are management at this point, agentic AI skills. So there might even be some commonality between what you need to be good at AI and what You need to be good with people, although there's also obviously some differences, important differences. On training,

Gordon, I guess we'll talk to you later to try to understand how much of it is a demand problem versus a supply problem. I think we spend 0.2% of GDP on active labor market policies. I think Denmark is at the other end at about 2% of GDP. Yeah, I think employers have to have a really central part in the training. And maybe that's non-competes. Maybe that is wage subsidies that enable workers to take jobs for less money and get training in exchange for it. Maybe it's training subsidies, or maybe it's like changing our mind on monopoly policy too, along with all the other sacred things where we have a different view because of AI.

[07:49:36.03] - Niki Kerameus

So on the first question on the education system, I would distinguish between short-term needs and long-term needs of the labor market. Short-term needs, we do have the possibility, at least in Greece and in Europe, of actually predicting. I gave you the example of technicians, right? We know for a fact that in Europe we will need technicians, plumbers, electricians, others for the next at least 2, 3, 4, 5 years. That we do know. Now, how do you equip a kid that's today 6 years old, 6 years old or 8 years old, that's much tougher. And the answer is no. I think you cannot predict what jobs will exist in 20 years from now. But that's where the point that we raised earlier becomes even more pressing to teach them how to learn. They have to learn how to learn as opposed to learning by heart things and substance. So they have to learn how to navigate, how to think critically, how to adapt to different environments. I think that's the critical point regarding education. So we need to change mindsets. And changing mindsets sounds easy. It's very difficult. Why? Because first you have to change the mindset of the teachers, of the educators, and that's much more complicated.

[07:50:48.19]

But I think the way forward is to shift the entire education system, from an education system that teaches you substance, what happened in World War I, what happened in World War II, as opposed to an education system that teaches you how to learn. If you insist more on that, of course you have to do the first part as well, the substance, but if you insist more on problem-solving, on critical thinking, I think that generation will be better equipped to adjust to a world that's going to be changing at a very, very fast pace.

[07:51:21.53] - Jason Furman

I can assure you in the United States, no one is taught anything about World War I or World War II.

[07:51:25.33] - Niki Kerameus

Right.

[07:51:26.17] - Jason Furman

Don't worry.

[07:51:27.10] - Niki Kerameus

And on the second point, as to employers who are really, I would say, pressed for workers, we at least in Greece have several systems. We have 2-year programs, we have shorter programs, we have 6-month programs. Let me give you an example. Greece needs drivers right now. We don't have enough drivers. Both in the private sector and the public sector. So what we're doing is crafting tailor-made programs of just a few months to accommodate that need. So we need to be flexible. We as a country, we as a government need to be flexible in order to address those needs. Why? Because if we cover those needs, that would lead to greater growth, right? It's the number one challenge we have in Greece right now after a major shift in our economy. As you know, Greece went through a really tough time 10 years ago through a really hard financial crisis. We were at the very epicenter of the euro crisis. And right now we have a growth rate of about 2%. We're way higher than the EU average. And our main challenge, given that the unemployment has gone down by roughly 60%, 60%, 6-0, The main challenge we're facing is people.

[07:52:39.49]

We're looking for people. We're looking for workers. We're looking for workers in specific fields. And that's why we will do everything in our power to cover those needs and to support companies that are opening up new, well-paid jobs.

[07:52:56.43] - Signe Krogstrup

Maybe just the last point on this question on what can be learned from Denmark in terms of getting unemployed people to access reskillings. And I'm sure that Jason probably knows more about it than me. You even have some— had some numbers. But without some, I can't speak to the details there. But it's what Nicky also talked about, is that there are built-in incentives. When you lose your job, you start getting income support, and there are built-in incentives in order to keep that. And a part of that is also accessing an education. So taking education is incentivized in the system. system, and I think that's really important.

[07:53:38.21] - Audience

Hi, thank you very much. Jim Maloney, Signal Macro. Jason, I'm going to take your advice and be a little backward-looking.

[07:53:44.37]

During recessions, we see companies displace labor, profits go up.

[07:53:49.32]

That's typically the primary time when labor is displaced. So my question is, if we have less Yes. Monetary space because of upward pressure on inflation, we have less fiscal space, and we have a technology that continues to improve. The chance of major labor displacement that turns into hysteresis— any thoughts on that being a real long-term structural problem and also potentially makes retraining much more challenging because the nature of the labor market is changing so rapidly? the retraining may not actually be effective?

[07:54:24.43] - Jason Furman

Yeah, so I am quite afraid that a disproportionate amount of job loss takes place in recessions and that we could come out of the recession in a different way. So all this sort of, is there job loss? We're seeing a little here, a little there, we're not seeing very much, and then boom, we see it all and it lasts. I wouldn't use the word hysteresis for that though. I think of hysteresis as something self-perpetuating on the demand side, where there's just an adverse shock, and because of it, things are worse off 10 years later. I'm actually not sure that it's quite as big an issue as people have thought and made it out to be. And witness where we are today and how everyone recovered from this. But putting that aside, the issue here that we're worried about is that there's a structural change that's happened. There's some cost of adjusting to it, and the recession lowers that cost of adjusting to it. out of the recession, you don't change back. And in that world, it says it's sort of inevitable that at some point you're going to shed these jobs. And does it happen a little at a time?

[07:55:25.47]

Does it happen all at once, et cetera? So unless you could stop the recession forever, it means you'd get there. So I am worried about that. In terms of a recession, I think you're overstating a little bit the degree to which we don't have tools. There's not only a lot of scope to cut monetary policy, but I'm not in favor of inflation being this high, but one of the advantages of it is you can cut real rates more than you could otherwise cut them. So liquidity traps and things like that are just very far from my worry list right now. And 20 years ago, they were high up on that worry list. And I think we might even have fiscal room if you need it with sort of monetary fiscal

coordination. And there's other stuff like In the US, the housing sector is probably producing 1.2 million housing starts a year. We could do more than that. There's other sectors that could pick up the slack. I'm not super duper worried about a recession, but conditional on there being a recession, I'm super duper worried about how we come out of it. I don't think that's like a cyclical policy to deal with that.

[07:56:28.10]

I think it's a structural issue.

[07:56:31.03] - Manuela Francisco

Minister, maybe you can share from your experience from Greece.

[07:56:36.41]

Signe?

[07:56:37.56] - Signe Krogstrup

Maybe just to say that this is a— of course, that's a risk, that some sort of scenario where we have higher unemployment is the risk. And what we— I think what we have been talking about today that we need to prepare structurally for is certainly not our main scenario. We do think that this transition will be gradual and that we will not end up there. But I very much agree with Jason that these are structural And that is exactly what we need to prepare for in terms of getting the right structures in place in terms of labor market flexibility, social security, and the reskilling part. Those are really important things to get in place for that.

[07:57:14.58] - Niki Kerameus

So just one point, because you talk about recession, you talked about recession, and Greece is a flagrant example of recession. Just to give you the figures, during the financial crisis, Greece was led to a point of an unemployment rate of roughly 30%, and within the youth, 50%. So one out of 2 youngsters was actually out of work. Greece right now has— we've had a decrease of unemployment by roughly over 50%, 53% roughly. As far as the youth is concerned, we're exactly at the the EU average of youth unemployment. And as far as male work is concerned, we're below EU average. So yes, recession does cause tremendous, I would say, effects on the labor market. But I think that Greece's story proves that you can turn it around. And you can turn it around. We are investing, to follow up on your point, tremendously on active labor market policies, tremendously. And on subsidized employment programs that are really targeted and for

short periods of I'll give you just 2 examples. Number one, we still have a higher unemployment for women. Women do traditionally in Greece have a higher unemployment rate. So what we're doing right now is we're subsidizing companies that are choosing to hire women rather than men.

[07:58:37.37]

No offense to the men in the room, but quite frankly, we hardly have any men who are unemployed right now in Greece. So if a company goes and hires a woman, they can have a subsidy that's 70%, and if that woman has a child of up to 15 years old, then that subsidy goes up to 80%. Why? Because we want to incite more companies to hire women. And the second program that's underway in Greece right now, as we're looking for people because the economy is growing, unemployment has gone down, and we're lacking people, we have people who who are— have made a choice to live in the mountains, to live in small villages. They want to stay there, but they're having a really hard time finding a job. So what we're doing is we're subsidizing for one year strictly companies that hire for distance working people who live in the 75 more remote areas of Greece. And we subsidize that employment with 90% for one year.

[07:59:34.22]

Why?

[07:59:34.41]

Because we want to open up a new pool of candidates. Nobody sees them. They don't go to job fairs. They're not in Athens. They're not in the city centers. They want to work though. And for us, it's a huge challenge to decentralize Greece. Just for those who haven't yet been to Greece, but I'm hoping you will come at some point, Greece has a population of 10 million people. Half of them are in Athens. So we are trying to find ways to decentralize further and to respect the choice of somebody who makes that choice to live in the mountains or to live in remote areas. So we're trying to assist him or her in finding a decent job. And that's why we subsidize with 90%. But again, for only one year, because within that year, the company will have made the decision as to whether that employee is worth keeping on or not. But we want to open up that pool of candidates and we want to create more incentives for people to live wherever they want and have a decent job at the same time.

[08:00:34.32] - Manuela Francisco

Many thanks. I don't see anyone coming to the mic, so I think there are no questions, or there are many questions. I think we all leave with many questions, maybe more questions than when we started the conversation.

[08:00:50.20] - Niki Kerameus

I have one final point, if I may.

[08:00:52.01] - Manuela Francisco

Of course.

[08:00:53.40] - Niki Kerameus

So before coming here, I asked my AI agent how the positions of the 3 of us relate as to AI and the labor market. And I want to read you the answer. The answer is their positions largely overlap. AI offers substantial economic benefits, but the effect on workers depend on how transition is managed. The main difference, AI says, is emphasis. Furman emphasizes the vulnerability of analytical jobs. Signe emphasizes what the economic evidence shows. And I focus on policy responses. But I think the fact that the 3 of us have a, I would say, related approach with different places of emphasis proves that the organizers were, you know, prudent in putting us together for this panel. So thank you very much.

[08:01:38.22] - Manuela Francisco

Thank you so much. Let's give a round of applause to our panelists.

[08:01:42.10] - Jason Furman

I've never felt so predictable.