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PARTICIPANTS:

Welcome:

STEPHANIE AARONSON
Vice President and Director, Economic Studies
The Brookings Institution

Moderator:

RICHARD REEVES
Senior Fellow and Director, Future of the Middle Class Initiative
The Brookings Institution

Presentation: Automation - A Guide for Policymakers:

Presenter:

JAMES BESSEN
Executive Director, Technology & Policy Research Initiative
Director and Founder, Research on Innovation
Boston University School of Law

Discussant:

MARCUS CASEY
David M. Rubenstein Fellow, Economic Studies
The Brookings Institution

Presentation: A Tale of Two Workers - The Macroeconomics of Automation:

Presenter:

HENRY SIU
Professor, Vancouver School of Economics, University of British Columbia
Faculty Research Fellow, National Bureau of Economic Research

Discussant:

GABRIEL MATHY
David M. Rubenstein Fellow, Economic Studies
The Brookings Institution

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Presenter:
ZACHARY PAROLIN
Post-Doctoral Research Associate, Center on Poverty & Social Policy
Columbia University

Discussant:
SARAH REBER
David M. Rubenstein Fellow, Economic Studies
The Brookings Institution

Keynote Address:
RYAN AVENT
Senior Editor and Economics Columnist
The Economist

Presentation: The Evolving Effect of Technological Substitution in Low-Wage Labor Markets:

Presenter:
BRIAN PHELAN
Associate Professor and Driehaus Fellow, Department of Economics
DePaul University

Discussant:
OLUGBENGA AJILORE
Senior Economist
Center for American Progress

Closing Remarks and Next Steps:
MARCUS CASEY
David M. Rubenstein Fellow, Economic Studies
The Brookings Institution

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P R O C E E D I N G S

MR. REEVES: Good morning, everybody. My name is Richard Reeves. I'm director of the Future of the Middle Class Initiative. My only role, so far, is to ask those of you who are sitting around the edges, please, that there are spaces at the table. Please don't be shy. We may have a few more coming, but don't be wallflowers; get to the table, please, now. (laughter) Like, seriously. What are you doing?

MS. AARONSON: Good morning. Morning to everyone here. Welcome to Brookings. I'm very happy that you could join us here, both those of you in the room, and also people who are watching online. It's nice to see some familiar faces here, but for those of you who don't know me, my name is Stephanie Aaronson, and I'm the vice president of director of the economic studies program here at Brookings, and I'm truly delighted to join you here for this event on Automation Labor Market Institutions and the Middle Class organized by our Future of the Middle Class Initiative.

For those of you who don't know, I'm actually a labor economist myself, and so I would find any conference on the topic of labor markets and automation interesting, but I'm particularly excited about this conference which aims to move us beyond the typical efforts to characterize the role of automation in labor markets and actually move us toward trying to make that research useful for policymakers, for firms, and for workers and their advocates who have the responsibility now of re-envisioning our labor market policies and institutions to ensure that they are up to the task of providing safety, stability, and security in an economy that in recent years has been transformed by technology. And the time for doing this has never been more urgent.

In the United States we are all too aware of the challenges that have beset the middle class in recent decades including stagnant wages, rising prices for housing and education such that for many workers their ability to reach and remain in the middle class has never been more tenuous. Recognizing the importance of the challenges facing the middle class, for both their own wellbeing and for our polity, the president of the Brookings Institution, John Allen, made the future of the middle class one of his first presidential research priorities.

And given the strong ties between labor market outcomes and economic security more

generally, it's not surprising that the initiative under the leadership of Richard Reeves has chosen as one of its first topics the issue of automation and work. So this conference could not be on a more important topic and it could not come at a better time.

Now, before we get on to the real meat of the program, I do want to thank a few people, Richard Reeves, the aforementioned director of the Future of the Middle Class Initiative for his leadership, Marcus Casey, Rubenstein Fellow, in the Economic Studies program for his efforts in organizing this conference, and our other streams of work related to automation in the middle class, Hanna Vandry and Sara Nizal, also of the Future of the Middle Class Initiative without whose efforts the conference would not have been possible and Anna Dawson, our expert events coordinator.

I also want to thank IBM for their support of the Future of the Middle Class Initiative. And with that, I am happy to turn the podium over to James Bessen from Boston University who is going to get the real program started with his presentation, Automation — A guide for policymakers.

MR. BESSEN: (Applause) Great. Thank you. Thank you for having me. So we hear a lot about artificial intelligence in the news. These --

SPEAKER: Sorry to interrupt. Sorry to interrupt, James. Can you stay near the microphone? It's a general comment to all speakers.

MR. BESSEN: Oh, maybe I should do this thing.

SPEAKER: If you wander around, you won't need it.

MR. BESSEN: Yes. I'll just stay near the microphone.

SPEAKER: Thank you.

MR. BESSEN: So these systems are able to beat humans at many complicated games. They're also able to perform better than humans on a specific task, so they can identify some lesions on X-rays better than the average radiologist. They can drive cars, kind of. They can identify documents in legal discovery proceedings, in some cases better than humans. Does this mean that we're about to see a lot of unemployment of radiologists? A famous computer scientist in Toronto told medical schools to stop training radiologists because the software was going to make them obsolete in just a few years. He said that a few years ago, I'll point out. You know, are we going to lose our millions of truck drivers and taxi drivers, lawyers and power legals?

There was a famous study a number of years ago now by Frey and Osborne which claimed that 47 percent of jobs will be automatable in the near future, in the near 10 or 20 years, and that study spawned a whole line of research. So we have, according to a few years ago, technology review of the MIT publication, put together a list of studies predicting massive job losses, some of them going into the billions, some of them more modest, but there is this, you know, overwhelming body of research of predictions of, you know, serious consequences.

And we know, you know, economists have studied what happens at mass layoffs, and when we have these dire economic events like mass layoffs where a firm closes down or lays off most of its workforce or a substantial part of its workforce, not only do people lose their jobs at that time and enter unemployment, but they have long-term earning losses, deteriorating health, lower consumption, so there are real significant burdens to these kinds of things.

So what is the challenge for policy? Some people argue that we have this impending mass unemployment and the answer is something like a universal basic income, but what is actually happening? Are these predictions real? And what does the actual evidence point to in terms of policy? So I'm going to talk about, first, the background of how we think about automation. In fact, I think many people are very confused about what automation is and how it works, and there's evidence about that, and then I'm going to report on a study that I did with some Dutch colleagues that looks at what the actual burden is on workers at firms that automate.

To get to the punchline, I'm going to argue that the real policy challenge today is not impending mass unemployment. There is a very disruptive change coming, and there are many people who will lose jobs, but there will also be jobs created, so the creation of jobs will roughly offset the destruction of jobs in the near future, perhaps different farther out, but that doesn't mean that there's no policy challenge.

In fact, there is a major policy challenge because what that means is workers have to transition to new jobs. They have to get new skills, they have to often move to a new location, a new occupation. So even if there's no unemployment effect from automation, there is a very serious social burden created by it. That's the real policy challenge, and that's why we wanted to look at what actually is happening to workers who are affected by automation.

So let me start with the background. As I said many people have sort of confused conceptions about what's involved. First off, we have to be very clear that technology and technological change is more than automation. People have focused on automation from artificial intelligence. It's not even clear that automation is the most serious thing, so what else does technology do? Technology creates new products, but that also means old products become obsolesce. They create new occupations. Old occupations become obsolete.

They create greater capabilities. So we conducted a survey of AI startups to get a picture into, you know, what the future is going to look like because these are the companies that are developing the technology. And one of the questions we asked them was, you know, what are the benefits your customers get from your technology?

Two of the benefits were routine tasks and reduced labor costs which are the red bars, but much more important were the benefits that enhanced capabilities like making better predictions or decisions, managing data better, gaining new capabilities to improve services or products. Those things, the enhancing or minting capabilities were much more important than replacing humans with machines. Now that's not necessarily all good news either, because and these aspects can also lead to greater economic inequality.

They can lead to greater domination of markets by large firms. We're seeing these things happening. We're still exploring what the lengths are between new technology in these trends. But it's important to keep in mind that the most significant impact of artificial intelligence may not be on automation. It may be on some of these other aspects.

Okay, the second point is automatable does not mean automated. Before a technology, which is your task, can be potentially automated, that that is potentially automated, can actually be automated. First it has to be adopted. In other words firms have to find that it makes economic sense. They have to find that it makes organizational sense, and it has to be implemented. They have to gather the complementary personnel, the talent needed to manage -- that people need to have the skills and knowledge to effectively implement new technologies. So these are significant barriers.

If we look at three occupations -- so Frey and Osborne decided that these occupations were fully automatable in 2013 given adequate data, accountants and auditors, loan officers, paralegals

and legal assistants. So the first thing to recognize is that all of these occupations have been undergoing automation for a very long time, since the 1950s or '60s. Loan officers had some of their tasks automated with artificial intelligence in one of the first commercial applications of artificial intelligence in 1987 in terms of detecting credit card fraud.

So, you know, we looked at what some of the startups are developing that addressed the work of these occupations, and we also asked them what are some things that the technology doesn't do, and there are real important things that the technology doesn't do. So it's hard to see that these are actually fully automatable and the process of taking the technology that's available today and putting it in place to automate these occupations seems that there's a lot more involved in fully automating an occupation than just simply the theoretical possibility.

In fact, the Bureau of Labor Statistics projects that these occupations will continue to grow as they have been growing over the last 10 years. Another point, and this related point, is that what gets automated are tasks, not jobs. Very rarely is an occupation completely automated. And the reason is, with these examples, is that occupations or jobs require many diverse skills. Technology can automate some of those tasks but often not all of them.

So I did a study looking at the 270 detailed occupations listed in the census in 1950 and asked which ones are around and which ones have been automated out of existence. And first off, most of them are still around. Some like boarding housekeepers went away because demand changed. A few, just like telegraph operators, disappeared because their industry became obsolete. And I found one, only one, that was really automated out of existence. Anybody want to guess? Elevator operator. (laughter)

And actually you can still -- there's some 10,000 still around, but for all intents and purposes they've been automated out of existence. But, you know, if you go back and you look at what these occupations do that machines can't do, it's really quite significant. So, you know, an accountant has to evaluate and advise their clients on organizational controls. This isn't something you just feed some data into a machine and spit out. It requires human judgment; it requires organizational knowledge. It's more complex. And similarly for loan officers and paralegals.

All right. Number four, even if you automate some tasks, the occupation can still grow

unemployment, or the industry can still grow unemployment. Now we tend to think that if we automate tasks that we're going to lose jobs, and I think that sensibility is largely informed by our experience with manufacturing. So this is a chart showing the number of textile wage earners in the U.S. It was over 400,000 in the late 1940s, and it's under 20,000 today. Part of that is because of globalization, but the biggest part of it, because there wasn't all that much globalization before 2000 in this industry, is from technology. That's automation.

But that's not the whole picture. This is the whole picture. If we go back to the early 19th century, what we see is that we experience over a hundred years of intense automation accompanied by employment growth, and it's not unique to the textile industry. We can see it in steel and automotive. We see it today. The barcode scanner came in in the 1980s in big form. It automated 18 to 19 percent of the work that a cashier did in checking out people in a grocery store, but the number of cashiers grew.

These legal discovery systems, it's a billion-dollar industry today. There's a lot of it being done. It's widely deployed, but the number of power legals has also grown since 2000. My favorite example is the ATM machine and the bank teller. The dash line shows the number of ATM machines in the U.S. from '95 to 2005, a huge increase, but the number of bank tellers actually grew.

So what's going on? You know, how is it that automation can destroy jobs at one time and create them at another time and what does that mean for how we think about what's going on today? And the big thing that everybody forgets about is demand. So what happened with textiles, automation came in and it reduced the amount of labor required to produce a yard of cloth which in a competitive market reduced the price, and there was so much pent-up demand that people, when the price went down, they bought a lot more. In fact, they bought so much more that the net effect was to increase some employment of textile workers.

So this shows the analog arhythmic scale, if that doesn't confuse you. The increase in the per capita consumption of cotton cloth in the U.S., and, you know, today we consume 20 times as much cloth as somebody consumed in the early 19th century. Typical person back then had one set of clothing. The price went down, there was this huge pent-up demand, they bought a lot more cloth, employment grew. Today, though, we have full closets. We're using cloth in, you know, upholstery, draperies, all sorts of things.

Today, the automation is chugging away. In textiles for 200 years now it's been about a three-percent per year gain in output per worker, or output per hour, and today that, you know, so the price may go down, but it's not going to generate the same demand because why, demand is satiated. We have all the cloth we need. You know, we're not going to buy that much more. So in the 19th century, elastic demand meant that price declines from automation would dramatically increase demand and offset the labor-saving effect of the technology. Today the labor-saving effect dominates and that's why employment goes down.

So we can think about similar things with today's technology. That automated teller machine made it cheaper for banks to open a bank branches. They wanted to compete geographically, so they opened up a lot more bank branches and the number of tellers decrease, even though they needed far fewer tellers per branch. Similarly, electronic discovery; they made it cheaper and easier to discover electronic documents, and so requests for the number of documents in discovery and litigation went way, way up. So ultimately it's an empirical question, and I'll get back to what that demand effect is in the future.

But I want to make one more point, which is that even when industries lose job -- excuse me -- the economy as a whole can still grow. So my colleagues, David Autor and Anna Salomons looked at what happens when industries increase their productivity. Those industries often lost jobs, but there were effects on their suppliers, on their downstream customers, and on consumer income, and so when they looked at the national level they found that even though the industries might lose jobs, national employment grew. So there were these macroeconomic effects as well.

All right, so what's actually going on today? What do we know? I mean, we can observe what's happening in the recent past about a variety of technologies. First off, I think the general thing -- this comes from our study of -- now, these are Dutch firms. The thing we observe, and this is just sort of the most basic pieces of background information, the top line shows firms that automate and the bottom line shows firms that don't. And this is their employment growth, their logged employment growth.

So what you see is that automating firms are growing faster. Now, that's important. It's not conclusive, but it's certainly at odds with the view that automation is, you know, creating mass unemployment. So the strong form of the mass unemployment hypothesis we can pretty easily reject,

and we see similar things from other studies in other countries. There's a more difficult question is, well, it's still possible that those top-line firms could it be have grown faster without the automation? In other words, we can ask a counterfactual.

We can ask, you know, how much would they have grown otherwise, without the automation, and perhaps that more jobs would have been created, and so economists have ways of trying to tease that out. They're always a little bit controversial. But here's a summary of a dozen studies that have been done in the last few years, and different countries, the top group we're looking at, Information Technology in AI, the second group, Automation Generally, the third group, Industrial Robots which tend to be a much smaller thing.

The overall picture is not one -- only one of these studies finds an unambiguous negative result. Some of them find losses in, say, manufacturing, but growth in services or losses for production workers and growth in other workers are networkers, but it's very clearly not a situation where, you know, we're see across the board job losses. That's significant. I mean, if we put this in the context of thinking about demand, what that's saying is, you know, we have some industries where there is large pent-up demand and automation leads to job growth. We have other industries, perhaps manufacturing sector for instance, where continued automation is going to lead to continued job loss.

Is it different this time? A lot of people argue that things are different, and I'll certainly agree. We're looking at changes where it may be faster which may affect a broader swath of the economy, but think about demand here. If demand is elastic, faster automation means faster job growth, and demand doesn't change very quickly. What the historical studies show is that it changes slowly where, you know it's in 30 years we may have -- or 50 years, we can have satiated demand, but, you know, if the health services sector is seeing elastic response to automation today or finances seeing elastic response, that's likely going to continue even though we may see a more rapid pace of change.

People have predicted massive job loss over and over though history and the thing they always forget including someone like Keynes is demand. Demand is an important factor. Keynes predicted 90 years ago that we would all be on a 15-hour work week in a hundred years. Now, the thing is if we continued the standard of living that people had in 1930 we would have been on a 15 workweek in 1977. But what's happened is implicitly, we've found more things that we want to buy.

We opt for work more than leisure time. The average workweek has declined. It's about 34, 35 hours in OECD countries now, but we're wanting to work a lot more because we demand more things, so it's difficult to estimate human desire and it seems particularly hazard to underestimate human desire when talking about automation. So there may be a real problem 50 years from now when more industries have their demands satiated, but we're facing a real crisis today, a real socially disruptive impact from automation and that's the real challenge we need to think about.

Okay, so let me get onto our study on what happens to the workers when firms automate. So it turns out that

the -- excuse me; let me get some water here -- the Netherlands has been collecting data on firm automation expenditures since 2000, and that's unique and fairly helpful because there really isn't a lot of data out there about automation. They also have very rich data on firms and workers, so we're able to go and look at, you know, this very detailed information about workers at a plant that automates, what happens in five years in terms of their use of unemployment insurance or disability benefits, things like that.

To analyze these data, we looked at what we call automation spikes. The idea is it turns out that a lot of investments in technology and automation in particular -- excuse me -- happened in major episodes. They're -- it's

so-called lumpy investment. A firm will come along and they'll spend nothing or very little for a year after year and then all of a sudden, bam, they'll put a major investment in it.

So we call that a spike. It provides us an episode where we can look and see very cleanly what happened to the workers at that firm before and after, and what we do is we compare the workers at that firm to a control group of very similar firms, in particular, firms that will spike in five years later, and in doing this we're studying -- the results I'm about to show you concern what we call incumbent workers, workers who have been there three or more years. It turns out if you look at the ones who were hired more recently, they don’t see much negative effect from automation.

But there is a very distinct trend, negative impact for the incumbent workers at firms that automate relative to the control group, so I'm going to show you a series of charts like this. The zero line is the year that the automation occurred, and what you see is -- this is a log, or the relative weight salary

income of all the workers at the plant, and it goes down at starting the year of the automation event and 5 years out there's an 11 percent loss of one-year salary, so which turns out to be just under 4,000 euros, the equivalent of $4,000 roughly.

But there's a significant loss. It's not overwhelming. Of course it's concentrated on a smaller portion of the people at that firm, but this is the average loss of all workers at that firm. There are two ways they can lose income. One is their wages can go down, the wage rate can go down. The other is they're working less. The wage rate does not change much, but in fact their non-employed days goes up.

So either they're working less at the firm, or most of the time it's really a story of they leave the firm and they're unemployed for a while before they get another job. And in fact, we can look at the percentage of workers who leave. So the year of the automation event, about two-percent workers will leave, relative to the control group, and there then is a trickle of workers who continue to leave over the next several years. We don't know whether they're leaving because they've been laid off or they decided to leave. Data don't tell us that, and often it's hard to distinguish anyway, but, you know, we're seeing a significant but not overwhelming effect.

So we have the Dutch safety net. In the U.S. we tend to think of Europe as having a very, you know, thick, supportive safety net. Here we looked at unemployment benefits, welfare benefits and disability benefits, and particularly the total benefits rose for those groups of workers. Actually disability benefits fell for some technical reasons; most of it was from unemployment insurance. But here's the key takeaway, which is the amount that they got in benefits over five years is only 13 percent of the income they lost. In other words, the safety net is not helping them very much compared to the actual burden that automation is imposing on them.

So where do they go? About 20 percent of them go to new industries. They're not changing in terms of their -- you know, they're not going to low-wage firms or low-wage occupations. They're not going to smaller firms or larger firms. It's pretty much similar. Some more go into self-employment or early retirement, not huge numbers, though. Who's effected? So in our sample -- I mean, the impressive thing is that automation is affecting a huge number of workers every year. Nine percent of the workers in our sample were firms that were automating each year.

And of course when a firm automates, it doesn't automate all workers in the firm, but, you know, we're still seeing, you know, a very broad swath of the economy being affected each year. In all non-financial sectors -- I studied in cover of finance, so it's not just about manufacturing; it's not just about robots. All workers pretty much equivalent by gender, by wage, both high-wage workers and low-wage workers, and maybe even high-wage workers had a bit more of a loss, both small firms and large firms, and the only result that really stands out strongly is that older workers were more severely affected. Older workers who leave, for instance, will have a harder time finding a new job and will spend more days unemployed or non-employed.

It may be helpful to think about this in comparison to the mass layoff literature. So there's this large literature in economics where people have looked at what happens to workers when firms shut down, when plants lay off 30 percent or more of their workforce. These events happen for a variety of reasons. Global trade, of course, is a big one. Demand shifts, technological obsolescence in some cases, mismanagement in other cases, and so it's established that people go through periods of unemployment.

They have reduced wages both in the near-term and in the long-term. There's a long-term loss of daily wage rates, what's called wage scarring. So workers who are at these plants that shut down or lay off heavily, their, you know, future prospects for a long period of time are adversely affected. These people consume less, they have poor health outcomes. So, you know, there's a real significant impact.

So how does mass layoff compare to automation by these numbers? Well, one thing is mass layoffs are fast. You know, a plant shuts down, 30 percent of people are laid off, boom. What we see is slow. We see two percent of workers leave the first year, then a trickle more over the subsequent years. With mass layoffs we're seeing a permanent wage reduction, with automation we're not. And in aggregate terms, both in the Dutch economy and in the U.S. economy, about four to five percent of workers are affected by mass layoffs each year, pretty substantial number.

Doing a back of the envelope calculation on our Dutch figures, we come away with about one percent of workers leave their employers each year as a result of automation. So it's a smaller effect. It adds to the burden of mass layoffs, but it's somewhat more modest, although maybe more long-term.

So how do we think about this for policy? Are we facing eminent mass employment -- unemployment, you know, being overtaken by the robots; the robocalypse as some people call it? No. The problem is transitions to new jobs is very much like the mass layoff literature, and the kinds of problems, and the kinds of policies we need to think about. So we're talking about people transitioning to new industries, new occupations, new locations, we need to think about training, work study arrangements or apprenticeship arrangements so people can get experience with new technologies. We need to certify new skills so that people who have the new skills get recognized by their employers and the labor market responds effectively. That's been well-established particularly with new technologies. There are new kinds of skills required and employers just have a hard time telling who's got those skills and who doesn't.

We need to provide temporary support temporary support. The level of unemployment benefits, at least in the Netherlands, doesn't seem very supportive of people making a transition. We also need to think about the things that may be affecting geographic mobility. As many of you know, employing mobility has declined for the last 10 or 20 years in the U.S. measured in terms of job changes, measured in terms of occupation change, and also measured in terms of geographic mobility.

Some people argue, and there's some evidence, that land use policies or housing policies have a negative effect that in many cases the cities where the jobs are exceedingly expensive, so the policies that can deal with that or deal with -- I see Mark's in the room -- you know, deal with the revitalizing other areas of the country and creating jobs in new locations may be important. We also need to think about policies that encourage labor markets and new skills, so we have policies today that seem to have gotten worse in terms of restricting employing mobility, so things like non-compete agreements particularly for technical workers.

Trade secrecy laws have been expanded. There's this so-called -- well, I won't go into the details, but in many states it's possible for employers to effectively impose a non-compete terms on leaving employees even though they haven't signed a non-compete agreement. That the so-called inevitable disclosure requirements. Occupational licensing provides a friction in terms of people switching occupations or moving.

We also want to think about standardizing knowledge so that knowledge of new

technologies can spread more broadly. Things like open standards or government attempts to encourage knowledge sharing are possible. So in a sense to conclude, the future is already here. We've been experiencing automation and we're going to continue it. It may accelerate, but we're already seeing large numbers of workers experiencing the effects and it looks something like we already know about it. It looks like mass layoffs.

So you can think about it in a way not as some, you know, dramatic apocalyptic change that's going to completely upend the economy. You can think of it as a depending or a worsening of the effects that we see in mass layoffs extended to more firms and more sectors of the economy, and even though we're not seeing the robocalypse, we are facing a major policy challenge. Thank you. (Applause)

MR. CASEY: I guess I'm not very tech savvy. Okay, I first want to thank Jim for presenting this interesting research he and his colleagues are doing. I think that there were a lot of really nice features of this work that he talked about, and I think in some respects, I think it sort of illustrates the types of work I think people should be doing. So the central question here, I think when reading the paper, was that, you know, given the best empirical evidence what are the best policy options to kind of mitigate harms imposed on workers by the adoption of automation, and what do I mean?

I think, you know, in the subtext of this work that they're doing in addition to sort of introducing -- am I walking away --

ANNA: Yeah.

MR. CASEY: -- I'm sorry. So while Anna sets me up. So I think part of what's missing in a lot of the discussion around this issue is this idea of let's make our policy or make our wants, our desires, in terms of policy based in sort of an empirical reality, and like I said I go to a lot of places, and I hear people talk about, oh, yes,

this -- like, what do you call it, robotapocolyse?

MR. BESSEN: Robocalypse.

MR. CASEY: Robocalypse. I mean, I think that's interesting, but none of the evidence that I've seen of many of the papers that you'll see actually present anything close to that. And so I think, you know, some of this work or a good theme for this work is an implicit plea for evidence-based policy, to go back to the Obama era characterization of how we should make policy. Okay? And so going back

over the background that Jim presented, real quick, you know, a number of studies predict large losses, but none of the studies that actual look at the real data actually find evidence of really big losses aside from the, you know, very special case of the introduction of robotics into the automobile industry.

And so the question that sort of arises is, should we really be thinking about what's going on now and comparing it to a lot of the work that went on in the eighties that focused on the effect of plant closures in the eighties up until now -- there's still people working on this stuff -- that focuses on plant closures and mass layoffs where they saw these really dire impacts on workers; I mean, whole towns going virtually unemployed, lots of negative health effects, lots of negative wage effects, people who were essentially heavily moving into disability programs.

It sort of begs the question, is this the right comparison? And I think from the work that Bessen and some of the other work that we've seen in the literature is that, no, not yet anyway, right? We don't know what the long run is going to be, you know, not- withstanding Cane's (laughter). We don't really know what the long run is going to look like, but at least in the short-term, it looks like there are things that we can do to kind of mitigate harms because we don't expect to see a lot of people in food lines anytime soon.

Okay, and so let's talk a little bit about their empirical work and then we'll come back around to sort of big-picture ideas. One of the really nice things about this work is that they actually use these unique administrative data to study firms and workers, okay? And now most of what they talked about was, what happened to the workers, the workers' experience, individual worker experience in this case, right? It's around investment spikes. But one of the things I think that they should be focusing on, too, is also the firms. And I'll talk about that more in a second, and what's going on here.

Okay, so some very interesting results emerge. Workers exposed to relatively early automation spikes are more likely to experience job transitions, earnings losses, and more likely to switch industries which is interesting, right? Because given some of the graphs that he presented, it didn't look like that that a lot of those companies were going away and they were actually growing at the time. So I think that's an interesting aspect that I think should be studied more.

As expected, given other work, as older workers are more severely affected, but ultimately there's a small net loss in -- well, should be employment; sorry about that -- unemployment

overall, smaller loss in employment overall in large part because there were offsetting hires that newer workers were brought in once the old workers were sort of eased out.

Okay, so as I said before, I kind of disagree with some of the conclusions that Jim made at the end, is that I don't see this experience of automation as looking very much like these mass layoffs, right? I mean, we're talking about, you know, everybody given a pink slip, and I know a number of people were affected by that. That doesn't seem to be happening. And so, but I do agree with Jim in the sense that I think that policy should be focusing on these job-to-job transitions, right? Easing the harm associated with actually leaving a job, losing your job for a small period of time, and moving to the next job, whatever that might be.

That could be pre and post training, additional training, or after a short spell of unemployment, or going back to school and doing a full training curriculum. We should be investing in education and training. We should be thinking about what the nature of income support is here, right? So one of the interesting things is we're talking about a European country, and he said that the unemployment system didn't really support the workers very well. They didn't make up their income, and so it makes me think, well, you know, if we want to mitigate harm, if we want to make sure that we maintain dynamism in our economy, one of the ways that we can do that is to insure that we have sufficient income supports for people who need to change jobs.

Relocation subsidies, some people have argued that one of the reasons we don't see nearly as much mobility here in the United States to work is because the costs of living in the places where work is, you know, a lot of the major metros, is quite high, and so when people do their cost benefit calculations to decide whether they want to move or not, they just see it as just cross-prohibitive. And so in some respects, you know, spending some money on relocation subsidies might actually be helpful in terms of moving people to new work.

I was reading in the, I want to say the *New York Times*, the other day that New York City has given subsidies to people who move to Georgia, homeless people, and so I think that we could definitely find some money to move people to actual work. Again, I thought this was a really nice use of administrative data to study the impacts of automation and I think that the other thing that, you know, he touched on it a little bit, but this is important, is that they're capturing all automation expenditures here, so

some of the early papers focused a lot because that's where the data are on robotics technology, but, you know, I also think it would be interesting to kind of figure out what are these actual expenditures.

So I think, you know, spending some time to kind of disaggregate how much of this is actual just transition costs that are built-in to this automation expenditures; how much of this is spent on actual technology; how much of it is spent on support staff, which might actually in an aggregate since sort of mask some of the potential unemployment effects. We don't really know. But I think it would be interesting to kind of dig-in into the data a little more on that margin.

You know, one of the things that sort of stuck out to me, and I think, you know, he showed the graph, this graph right here. I thought this graph was the most interesting graph in the paper. Why? Because not only do we find that the automating firms tend to be more dynamic and growing and, you know, look like they're actually flourishing while not automating firms or not. There's' also evidence that at the initial point, at least in the data, that there were level differences between the two types of firms.

And so it sort of, you know, sticks out in my mind, I'm an economist, so I think about selection a lot, and I want to think about a little more carefully. I would love for them to get in and look at the types of firms who are deciding to make that choice to go into automation, spend the money, and also sort of relate that to other sort of aspects of the environment around that, right? Are there things that the Dutch government is doing to incentivize certain firms to move towards automation and others?

Are there certain features of their composition, whether it be their management composition or their worker composition that makes it that the dynamic firms seem to be moving towards including automation into their production processes and firms that look a little more stagnant, at least in terms of the data, to not move in that direction, right? Especially given the lumpiness of these investments. These are serious choices being made and it would be interesting from both sort of a general economics perspective to understand who's selecting into automation early, right, because some of these firms do it later as well, but also to think a little more carefully about how policy is effecting that, right?

There are preexisting polices that might be pushing some firms towards automation or certain types of automation, going back to my question about the disaggregation of expenditures, and we

need to learn a little more about that to be able to plan and form policy for the future, especially if the future is going to look like this and not one in which we have massive unemployment.

Okay, last thing I wanted to talk about was this issue of, you know, business cycles. Now, they have a large observation period, and what was interesting to me in that I didn't see was any sort of discussion about the experiences of workers affected by automation in times when the economy is booming versus times when the economy is in a recession, right? And I wonder how much of that overall effect that they're estimating is driven by the recession, okay, that went on during that time period, and so I would like to see some more work on that, right?

And then if we do learn something about that, what are the implications for policy in this case, right? If it's a lot of counter cyclical features that we need to build in better sort of counter cyclical features, then that should

be -- we know how to do that as a modern economy. I mean, we've seen this before. But if it is the case that the workers are seeing similar outcomes regardless of what the overall aggregate macroeconomic environment looks like, then we need to think about what are better policies in this case that we can potentially institute to ease those job-to-job transitions that we need.

So anyway, just to conclude, I think this is a very interesting research program. There's lots of room to learn more and given this complementary work in other countries showing that, you know, it's a just trickle and not really a mass unemployment events, we need to sort of think about what works best in these other countries and try to apply those things here in the U.S. Thank you. (Applause)

MR. REEVES: Marcus, would you like me to moderate the Q&A? I can't remember what I wrote (inaudible). Okay. I'll stay here -- shall I stay here, if you don't mind? Okay, so we have some time on the schedule. I'd like to thank both speakers for remaining on time to allow time for Q&A, and look at the other speakers and hope that they will follow suit. But we'll open it up. We have a distinguished crowd here to either the speaker or the discussant or for general discussion, so if you could just let me know by raising your hand you'd like to speak and I suggest that we'll take two or three if that's okay, Marcus, and James, and then come back to you and do a couple of rounds.

And so we'll start over here with Martin. And the way these work, you have a button in the middle and when it's red next to the little speaky thing, it means that it's on, but you do, as for the

speakers, you have to bring it pretty close to be able to hear you. Martin?

MR. FLEMING: Okay, thanks, Richard. Hopefully it's close enough. So congratulations, Jim, on a terrific paper. I thought it was a great summary of some of the prior work and quite interesting new work that you presented today. My first comment is I really like the way you have renamed the remainder principle which I always thought was poor branding. Automatable does not mean automated is a much clearer explanation or a catch phrase to be able to communicate that notion.

The work by Anna Salomons and David Autor that you referenced the Brookings paper that they gave here in this room not only shows a relationship between productivity and employment, but also between productivity and wages. I know we would argue perhaps that we haven't seen a robust enough wage increase associated with productivity improvements, but it does exist in the data, and I'm just wondering for those who remain in firms that deployed automation, did they see a step-up in their wage gains or somehow benefit themselves by being able to function and provide labor support in a more highly productive organization?

MR. REEVES: Thank you, Martin, I forgot to ask people to say who they were, just --

MR. FLEMING: Oh, sorry. Martin Fleming, Chief Economist, IBM.

MR. REEVES: All right, thank you.

MR. FLEMING: Can I make one other point?

MR. REEVES: Of course. Briefly, all the others in.

MR. FLEMING: In ties to Marcus' comments, if we look at the work Nick Bloom and Erik Brynjolfsson and John Van Reenen have done, they find that the more highly productive organizations are those who have stronger management practices and capabilities. You know, and we've seen that in the data over many years. There's a relationship between the deployment of technology and the ability to manage and function in a much more effective way, so it'd be interesting to see if the firms who have benefited are somehow idiosyncratic in their industry or are different some fundamental way?

MR. REEVES: Oh, yeah, ask Marcus his selection point, too. Is it the stronger firms in some other way anyway? Okay, yeah, the gentleman, there, right at the end. Don't forget to turn your mic on and bring it close.

MR. MCCRAE: Thank you. Christen McCrae, Crae foundation. So my father worked at

Bay (inaudible) all his life and his favorite subject was your subject in terms of how can we make sure that we create more jobs as technology sort of accelerates. The perspective my father had was very much to do with Morse Law in terms of technology is sort of increasing a hundred fold in certain respects whether that's satellite telecommunications, whether that's the ability of a computer to have a far huger analytical brain than ourselves, then we needed to keep ahead every decade on the assumption that there'll be more innovative change in terms of skills that were needed in each decade than the whole generation previously, and that led my father to believe that we radically have to change education to be lifelong on skills rather than.

So my question is which branches of economists still follow that kind of idea, honest and maybe labor economists, but, I mean, how do we -- there seemed to be two segments of economists, those who want to create jobs out of changing the world around things -- I just wanted to add one last thing which is my, father was actually tutored by Keynes for a year in Cambridge 1947. Keynes changed his mind. He said there would be a huge amount of work provided. We went to making the number one systemic goal of all economist of being ending poverty which is the same goal as the STG one is now.

MR. REEVES: Okay, thank you. Your father was Hamish; is that right?

MR. MCCRAE: My father was Norman McCrae.

MR. REEVES: Norman McCrae. Okay.

Mr. MCCRAE: Thank you.

MR. REEVES: Thank you. Good channeling. Okay, yeah, there, I see behind against the wall. So if you'd come up and sit next to Alan Beruvie. You went by. Press the button in the middle and then -- yeah, there you go.

MS. HILLBRID: Yeah, My name is Yasmin Hillbrid. I am a --

MR. REEVES: Bring it a bit closer. So as a general comment, these are annoying, so don't be shy, just yank --

MS. HILPERT: So my name is Yasmin Hilpert. I'm a senior policy director at the Global Federation of Competitiveness Councils, and I had a couple of comments regarding the presentation. One was, I think you mentioned it as well. I came in a little bit later, so I'm sorry if I maybe missed a few aspects, but the employment effects of automation seem to vary quite strongly across industries and

industries very geographically, right?

And you mentioned it later, Marcus, in your comments regarding the relocation, but I think one of the effects that in light of automation is probably the strongest, is not really the fact that we are facing mass unemployment, but that we are facing an increasing urban/rural divide. And so I think what would be interesting is to get your perspectives a little bit on the future development of areas, for example comparing something like the San Francisco Bay area, to something like West Virginia where we're already facing really precarious situations, and then when we talk about relocation subsidies I think it would be interesting -- I think it's a really good idea, but then what happens to those areas where people leave from, because those are essentially left with their skilled people leaving the area.

And I come from Germany, so I wanted to offer two sort of maybe best practices, I think, because I really think that exchanging ideas globally would be an important one in this aspect, and one is the so-called solidarity package in Germany which was established in 1993, I believe, after the fall of the wall where the western states of Germany were essentially supporting the eastern states and they are still to this day, so this is something that is still going on.

And then the second aspect obviously when we talk about just transition and transitioning people into new jobs, the one from the rural area after the coalmining came down, and the last thing I wanted to make a comment about was about the graph that you pulled up later regarding the effects of automation on the numbers of workers in a plant. I think it would be interesting to see what the starting situation of those companies are and the starting situation in terms of technological advancements because I think that varies quite strongly, so I can image that, let's say, the aerospace industry will vary strongly from a paper industry, for example.

The paper industry in the U.S. is basically by global comparison at a state of the eighties still, and that is something that I think would have an impact on how that curve develops and whether that curve sort of develops into an end curve rather than a sort of steeper curve upwards.

MR. REEVES: Because it's a different sector, just to be clear?

MS. HILPERT: Yes.

MR. REEVES: Yeah, okay, fine. So I'll come back to the speaker discussant, and then hopefully we'll have time for another round as well, so from Martin's questions where you were about the

selection effects that I think you had already mentioned and then wages of those who remain in the firm and the productivity link. Chris' point was about this acceleration, the Morse Law point, channeling your father, and where you kind of still -- is it getting faster and faster, and what does that mean for job growth versus poverty prevention, and Yasmin's point about geography, left behind places, do we have to think geographically more strongly, and then you offered a couple of ideas around solidarity packages and mobility packages, so.

Well, James, why don't we start with you and then Marcus?

MR. BESSEN: Yeah, thanks, everybody, and thanks, Marcus, for your comment -- is it on? You can hear?

MR. REEVES: When the red light is on, it's on. (laughter) You need the red light to be on and then it's on.

MR. CASEY: Marcus is on.

MR. BESSEN: That's the problem.

MR. REEVES: It doesn't work. Okay. It's the technology.

MR. BESSEN: Great. I guess I've got to be fairly brief here. First, so a number of people brought up selection issues and this is something that we actually looked at quite a bit. We also have very limited data. We don't find much of anything that predicts which firms are going -- given the data we have, we don't provide -- we don't find much of anything that predicts which firms are going to automate and when they're going to automate.

We did look at business cycle, and interestingly in this study, and this is true in some of the other work we're doing, we don't find significant business cycle effects. Firms are just as likely to automate in 2008, 2009, as they were in 2003 or '04. It is very much, though, the firms that automate tend to be the firms that are growing faster. I'm speculating that they are probably better managed. They probably have better technical capabilities. But there's a lot more research done until we understand that.

Let me -- let's see. In terms of wages, so we're not seeing much of a wage effect here. Some of the other studies do see wage effects. What we did see -- so the incumbent worker wages don't change much. What we do see is that they're bringing -- even shortly the year or two before the automation event, they are bringing in some higher paid workers. There's some lax in the data, so we

don't have a very clear picture about who those workers are, what their capabilities are, but there is something going on there, and some of the other studies are seeing wage effects, a polarizing sort of wage effect.

Education. You know, I think, you know, some of these ideas about lifelong learning and we're talking about really a change -- societies need to change the whole philosophy of education and what it's intended to do and, you know, this idea that we have to abandon -- we're no longer in a world where you learn when you're 20 years old and it's good for a lifetime. The urban/rural divide's very interesting. Unfortunately we don't get much of a handle on that in the Netherlands. So we're looking at some other data, US data, but I think that's probably going to be a very interesting angle, but I can't say much.

And then finally in terms of differences across sectors or industries, you know, we're finding a similar effect across all industries. There's some differences. The impacts in manufacturing unemployment or income tend to be a bit worse in accommodations and -- I forget the name of the actual -- the other part of the way the sector was grouped in the Dutch data. You know, we're finding very modest effects, but that's also the sector that has the least automation.

So it's not clear that -- and we're not able to sort of parse things out into very fine industries which where we might see some real differences of the sort you mentioned.

MR. CASEY: Thanks, Jim.

MR. REEVES: Do you want to add a point?

MR. CASEY: To jump in real quick, so one of the -- this result about similar sort of no business cycle effects across industries, sort of I think maybe speaks to the sort of demographic change in these countries, right, industrialized countries. The aging of the population, seems like it might speak to kind of the issues that firms -- especially that these are dynamic firms, growing firms are more likely to automate than ones that are not growing.

There might be labor shortages due to the fact that they just don’t have the workers that they need, partly through the aging of the population that might provide more incentive to automate, and just a quick point on the urban/rural divide, part of the relocation subsidies thing would be potentially giving incentive to firms to move, but, you know, given the sort of changes in our overall preferences for

being around the major cities, plus the glomeration economies, it sort of seems like a hard thing, and this is an issue of considerable debate among urban economists, right, is this issue of, you know, how much should we invest in

place-based policies versus sort of providing people incentives to move to work, and to this point the evidence isn't really good on place-based policies.

Now, I'm actually a proponent -- it puts me in bad odor in some circle -- of place-based policies for the precise reason because you can't move everybody to opportunity, so-to-speak, you know, and so I think in some respects one of the debates we will have going forward, at least here in the U.S., is how much are we going to expect for other states to redistribute to less well-off places, especially given that the preferences in the job growth and all that tends to be going on in these major metros.

Two of my colleagues here, or one of my colleagues here, Mark Monroe, just recently published a report in Metro on precisely this issue, so I think that is an important issue and I think that's going to become much more politically divisive going forward because we're talking about sort of redistributing across states in a decentralized system like the one like we have in the U.S.

MR. REEVES: Yeah, I noticed that Joe Biden also just picked up the idea of heartland visas to offer immigrant visas to people who are going to go and work in particular areas which is something that the IG has written about and that Mark has written about, too. I think he just did that. So there are all kinds of place-based policies, right? Okay, we have about 10 minutes. Let's try and do at least another round. These are two down here, yeah.

MR. REBRENOWITZ: Thank you. Dave Rebrenowitz, retired. Dr. Casey made a very important point, and that is you have to look behind the numbers. If you just look at the numbers, you're going to be blindsided, and economist tend to be blindsided a lot. Now, this is a --

MR. REEVES: They do like numbers. That has to be current.

MR. REBRENOWITZ: But they don't look behind them, and this is a topic -- automation is a technology topic. I look at the lineup of speakers today. There's one journalist and everybody else is an economist. I don't see any technologist here, so I'm wondering whether -- I'm wondering how relevant the outcome of all this is actually going to be. And in defense of Keynes, it's not enough to take some of his quotes out of context. You have to read the whole paper, *Economic Possibilities for our*

Grandchildren, because he makes some very relevant points.

MR. REEVES: I couldn't agree with you more about reading the whole thing. As to whether or not it'll have any impact, well, let's hope for it. But anyways, keep going. The lady next to you.

MS. HEGEWISCH: Ariane Hegewisch, Institute for Women's Policy Research. Firstly, I'm very glad you kind of debunked the unemployment effect and focused more on the restructuring of jobs. One of the issues, though, we all cite the bank teller impact the study that you that there was the unemployment loss was much slower, but we checked recently and the jobs have disappeared and the conditions have really declined, so I think one of the lessons perhaps is that the change is coming more slowly and obviously feeds into other structural demand changes and consumer demand.

Two questions, one on that very interesting chart of the innovating versus the non-innovating firms. Do you have data of what proportion of employment each of those firms represent, because EPI has done -- Economic Policy Institute here has done very interesting work on the monopolization in the labor market, monopsonization , I guess, and so feeding that into the very slow growth in real wages that we're seeing, so, you know, I'm just wondering who's swallowing up who and what other sectors presenting.

And the third issue is, we work a lot on the kind of office work where those jobs that present stepping stones into the middle class for women who don't need a college degree, and where there seems to be -- you're not quite sure what's going on, but there seems to be some change and the innovations there often are cheaper than if you have to buy a robot and automate a factory, and it's also spread out more across the whole country, and so --

MR. REEVES: Could you give an example? Sorry to interrupt, but --

MS. HEGEWISCH: You know, secretaries, kind of basically travel agents. You don't have to book your -- you know, don't need travel agents anymore. You need less typing. In West Virginia, now you can't get a fulltime job in office work, right? You get a $9-job part time even if you have an associate degree in office work, right, and there was a very good article yesterday in the *Washington Post* that picked up some individual stories. So I'm just wondering those kind of the big innovations versus the cheaper innovations and the impact on gender.

MR. REEVES: Well, sorry.

SPEAKER: Yeah. Good. Can you hear, Jeff? Great. I just wanted to thank Jim again for more totally sensible, you know, grounded firm-based granular work, and I wonder if that focus might have led you to unveil anything about transitions within firms? You know, I think we're all getting very interested in incumbent worker transitions, and, you know, and noting that that may be the first opportunity for either a good or a bad transition. So I wonder if anything surfaced in this interesting administrative data on that front? And, again, thanks so much for joining us.

MR. REEVES: All right. I'm going back to the speakers. You have four minutes, so that's two minutes each if you allocate it in an egalitarian fashion. I won't summarize just in the interest of time.

MR. BESSEN: Okay, so quickly. So, yeah, I mean, the purpose of the ATM bank teller story isn't to say that bank tellers are never -- you can hear? I just wasn't talking into it. Bank tellers are permanently protected in the inner occupations, but that particularly technology did not appear to adversely impact them. Now, it turns out that since the end of that study, the banks have actually been reducing the number of bank branches and there are new technologies. Online banking is coming on and is a very big thing. And, yeah, we're seeing some modest declines in the number of bank tellers, but not a drastic decline, so it's hard to say.

In terms of monopsony in firm sites, so we're seeing this automation is taking place both at small firms and at large firms. Large firms, more so, so both in relative and absolute terms, but it's not just the largest firms. Gender and the cost of innovation. So I think it's very hard to generalize. We're not seeing big gender differences in, you know, what we're seeing here in the Dutch data. You have to remember, some of the implementations of systems that automate back office jobs are huge and they're expensive and, you know, it's not -- I'm not sure that there's a clear correlation there.

Transitions within firms. We weren't seeing -- in terms of the measures that we have, which are in some ways limited, we're not seeing things like wage effects. I have other sources of data. I went to a very interesting meeting with top large firm human resources managers or there's a new acronym and I'm forgetting what it is, but that that's who they are. So it's very interesting that a large number -- a lot of these firms were struggling with ways to get people new skills within the firm, and there are the obvious things like training, an internal training programs, and that's

well-known, and you're seeing some significant efforts there particularly by some of the larger firms.

But was very interesting was they're doing things to encourage mentoring and they're sending up networks so that, you know, somebody in Dupont gets identified as being the internal expert, regardless of their rank and other qualifications, but internal expert on a particular technology and they have these techniques for facilitating communication within the firm about that knowledge which I found pretty interesting. That's my time, I think.

MR. CASEY: And final thoughts, Marcus?

MR. CASEY: No, not --

MR. REEVES: Great. Please join me in thanking both Jim and Marcus for that session.

(Applause)

(Recess)

MR. REEVES: So, we're moving on to our next session. I'll introduce our next speaker. Henry Siu is a Professor of Economics at Vancouver School of Economics. He's going to be presenting his paper on *A Tale of Two Workers -- The Macroeconomics of Automation*.

And then we're going to hear from his Discussant, Gabriel -- Gabriel, how do I say the surname -- Mathy, good; Gabriel Mathy who is Assistant Professor of Economist at AU. So, we're going to hear first from Henry, and then from Gabriel.

MR. SIU: Good morning. Thanks so much for having me. Thank you to Gabriel for serving as Discussant. This is very much a work in progress that my coauthors and I are working on. We are just waiting for the slides to come up. But this is joint work with Nir Jaimovich, Itay Saporta-Eksten, and Yaniv Yedid-Levi.

I'm going to tell you now about some that we've been working on, in terms of explicitly thinking about policy proposals and policy experiments that we think might be more or less useful in aiding those who have been most negatively affected by automation in the U.S.

So, as a lot of literature has demonstrated, there's been a profound change in the nature of work, the types of jobs that are performed in advanced economies like the U.S. and across essentially all industrialized countries. The primary factor behind this change in the nature of work, not the only factor, but the primary factor is advances in automation technology. And what you see in the U.S. is that

there's been a sharp fall in a fraction of the population that's employed in what we refer to in economics as a routine occupation.

This idea of routine comes from thinking about all jobs as being able to -- you know, you being able to describe them along two dimensions, routine work, versus non-routine work, routine work is the work that focuses on a narrow set of tasks, tasks that can be performed if you follow a well-prescribed set of instructions. So there's routine, non-routine. There is manual versus cognitive. Essentially manual would be the brawn jobs, cognitive would be the brain jobs. So, you can split all jobs roughly into one of these four quadrants.

Okay. So there's been a sharp drop in the fraction of people employed in routine jobs, both routine manual and routine cognitive. And today, you know, I think the punch line of what we've done is, we've put together a macroeconomic model to evaluate policy proposals.

The punch line, if you want to take a nap, go ahead, I'll just give you the punch line now, all the pillars we consider, you know, things that we've heard people talking about, some are better and others are worse, so promising proposals that we find within the context of a model, is a reform to the U.S. system, making unemployment insurance benefits more generous, labor income tax reform in terms of magnifying progressivity.

Large scale retraining programs, there's an asterisk there, I'll tell you why there's an asterisk there when we get there. There are also some pretty terrible policy ideas, within the context of a model, UBI, not a great thing.

Okay. So, this is obviously a relevant topic, or a relevant search topic nowadays, so if you just type in WIL (space) R, apparently this is what Google will propose to you. I have to admit I had to get one of my (inaudible) to do this because I'm from Vancouver, as Richard said. You know, you called it the Pacific Northwest, in Canada we call that the West Coast, because we have no northwest, so it's the West Coast, or the West Coast.

So, if you type W-I-L (space) R, what you get is: Will it rain in Vancouver when I try to do this? So, no, okay.

So, again, disappearing job opportunities and routine -- these are routine manual jobs, the classic is the machine worker, middle-class job, already been in decline according to BLS predict a

decline even more in the future. Here's a routine cognitive job, classical example as a Secretary, already been in decline, middle-class job, predicted to decline even more.

Here's just a picture to -- you know, of all the work being done in the U.S. economies from the 1980s to today, lumping the routine manual, and the routine cognitive jobs in the middle, they have been in decline, high-paying non-routine cognitive jobs, like policymakers, managers, CEOs, software engineers, economists growing, non-routine manual, caretakers, grounds keepers, personal care aides, home health aides also, especially recently, growing.

Okay. So, there are two parts to the paper, in 35 minutes I can't talk about both, but there's an empirical part which informs our model construction, okay. And so I'm not going to you about this in detail, but essentially the idea is, you know, in the 1980s, you could identify someone who is working in a routine job. Okay? There are specific characteristics.

You know, the question is, that we need to address is, if you were somehow able to cryogenically freeze that person and teleport them into today, a lot has changed in the past 40 years, one of the major things is automation. You plop that person down into today, unfreeze them; that person might be able to find work in a routine job, but likely they're not going to be able to find work in a routine job.

So the question is, what are those people doing instead? And so that's the kind of thought counter factor we need to address to be able to make our model analysis relevant. So, we've developed some new approaches to doing that, and one is that, you know, matching people on AFQT scores and the NLSY 1979 versus 1997.

Another is to, you know, essentially our coauthors were automating our own work rather than actually, you know, looking at all those individual level of characteristics, and trying to, like, you know, sort people here and there, we are just asking the computer to do it. So, that's the new thing.

But the punch line is as follows. So, if you were somebody who is likely to be a routine worker, you've seen a large fall in the chances that you're doing that kind of work now. So what are they doing instead? You know, as already been discussed by Jim, it's not that these people are more likely to be unemployed nowadays. Okay.

And it's equally not likely that they'll somehow become software engineer. What's taken

up the slack, of the slack that needs to be taken up? A smaller fraction of a third of it has been taken up by movements into non-routine manual work, so low-wage work, much more than the U.S. is that they're out of the labor force, they're much more likely to be a non-participant in the labor force.

And this is what's driving, you know, the fall in the U.S. working age, prime age labor force participation rate, it's this. So this serves as guidance into what we think of as an empirically relevant, macroeconomic model that we think is fit policy analysis.

You know, it's a general equilibrium model, so rather than a partial equilibrium model, you know, a simple elaboration of an ECON100 labor supply and labor demand model. We are going to be thinking about equilibrium in the whole economy, so we are going to be thinking about job creation, people making participation and occupational choices in conjunction with other people making investment choices to balance off the whole macro economy.

There's going to be heterogeneous agent model, so we're going to explicitly think about, you know, the entire income distribution and how automation affects people in different parts of that income distribution.

Automation obviously is reflected as an aggregate in the large improvement in welfare, but this masks winners and losers, we're trying to identify who those people are, and we're going to use this model as a lab.

The two types of programs that we're thinking about is a retraining program and other redistributive programs. Okay, so I hope I have adapted this presentation sufficiently from an-hour-and-a-half down to a 35-minute talk. So here are the basics.

You know, we're going to think about two broad classes of workers, they are going to be, you know, the high skill workers in economics we use the word skill and wages synonymously. So they're going to be the high-wage workers. These are the relatively boring people in the model, they're all going to be identical, they only work in the high-paying, non-routine cognitive jobs. Like in the data, these people will face very little unemployment, so there's going to be no unemployment among these people in the model.

But they do choose how much to work, and we are going to be taxing them, and so, you know, the more you tax them, the less they're going to want to work. All the action happens among the

other people, well, you know, what's the opposite of high, it's low. I'm not saying that these are all low-skilled people, these are going to be middle-class and low-waged workers in our economy.

They're going to be heterogeneous, and they're going to be endowed with a workability, a skill in the two occupations that they work in, routine jobs and non-routine, manual jobs.

And that skill distribution is going to be summarized by Gamma, and these people are going to be making the important choices, they're going to choose whether they want to participate in the labor market, or whether they want to set out, and if they decide to participate, they might be unemployed, but they might be working, and they need to choose whether I want to look for a routine job, or whether I want to look for non-routine manual job.

There are also tax and labor income but at a lower rate. The key thing is that there's also going to be this automation capital, automation capital. You know, you can think about it as personal computers or robotics, automation capital substitutes for work done in routine occupations, firms are going to be making investment decisions on how much automation to adopt, we've got the taxes from the futures capital income and profit taxation.

Who is going to own these firms in capital, like in the data, where you give them all to the high-skill, they're going to be the capitalists? And we do that for analytical tractability reasons, but it's a pretty good approximation to the way the world looks. Okay.

So, yeah, automation is going to directly benefit the high-skilled. This is the only equation I'm going to show you -- maybe I shouldn't even show you -- but again, yeah, automation capital that X, it substitutes for routine work, so if you want to build a car, you either -- you know, hire a bunch of metal smiths, engine builders, welders, or you just buy a robot to do it.

So, you know, you're going to produce a bunch of cars there, you could build the cars, but you've got to sell them, you're also going to need high skilled people to get that out the door. You're going to need market analysts, market researchers, you're going to need managers, you're going to need financial specialists, so the more cars you have to sell, the better it is for the high skilled individuals, the high skilled individuals are the red.

Low skilled people, they either choose to work in the routine occupation or in the non-routine manual occupation, and those jobs, those job openings are going to be created by firms in a

standard search and match and literature. We are just going to adopt that. There's going to be unemployment amongst these people. Yeah.

Okay. One of the key things about the search and match in literature that we think is relevant, is the idea that the wages that are going to be negotiated for these low-skilled people, that are going to depend on a bunch of things. It's going to depend on bargaining between the firm and the worker. The key thing here to -- you know, to be useful later on is that, one of the key ingredients to a low-skilled individual's wage is their outside option of working for that firm.

The government is going to balance a budget. What are the revenues? It's going to be all the income taxes, and capital profit taxes we talked about. What are they going to spend on? They're going to spend on unemployment insurance benefits, and they're going to spend on transfers to people who don't earn an income, and transfers to people outside the labor force, and this all comes together in a macroeconomic model.

Okay. So, the way to picture this, is to think about, this is the skills of the low skilled, so they have an ability in the routine work, in the routine job, they have an ability in the manual job, so I would be somebody down here, I'm not very skilled, I'm close to zero-zero, you folks are picking people over on the other end, you're really good at both things.

But there are all kinds of people. There'll be people who are bad at manual work, but really good at routine work, or they could be really bad routine work and really good at manual work. Those isobars, kind of, are trying to represent that, if you were projecting this into a third dimension, that's where the probability weight is, that's the distribution.

And in an occupational choice model, and you get a dotted line, everybody who sits on the dotted line, those are the people who are equally happy given the payoffs of working in the routine job or the manual job. Okay?

But if you're to the right, you're going to say, oh, it's better for me to work in the routine job, people to the left and to the -- yeah, they're going to be better off working in the manual job.

Again, like I said, we are going to add into this standard occupational choice framework. The idea that, no, no, no, if you don't want to work, you're going to get a transfer that's independent of your ability. And so what that means, is that it's going to be this yellow box, where everybody below this

cut off, and that cut off, and they're going to say, do you know what, I'm better off being outside the labor force.

So that's graphically what our model looks like. Again, because this is a macroeconomic model with a lot of bells and whistles, that diagonal line is in general, not going to be a straight line, but we are going to build back into the model, assumptions that makes it straight.

All right, so now I want to consider, well, what happens when there's automation? So, what automation does is it reduces the relative value of working in a routine job. So, how do you represent that in this picture? Well, what happens is that that diagonal like, the flow changes. So, if I flip back and forth, you can see that with automation, the slope falls, the area in red, it shrinks.

And where are those people going to move to? They're going to move to either manual work, or they're going to leave the labor force. And so the key thing we need to do in our model is discipline, all the parameter value, such that, like I said, of the people who left the routine manual work, a third of them went to the blue, but two-thirds of them went to the yellow. So that's going to be the key thing that we want to discipline the model with.

And so, yeah, once we get to the policy analysis, what the policy analysis is doing is it's essentially either changing the slope of that diagonal line, automation is going to drive it down, certain policies can drive that slope back up. Other policies will say, well, that straight diagonal line is not going to be a straight diagonal line anymore. You've got to reintroduce the wiggles to it.

And the retraining says, well, you know, this was the original probability weight map, maybe retraining can shift that weight away from, you know, these lows-killed people being particularly good at routine work. Maybe we can make them particularly good at manual work. That's graphically the nature of the policy proposals that we think about.

Um not going to talk about this, I'm just going to say that, how do we -- you know -- we are macro economists or economists that really love numbers -- we need to find a way to discipline how much automation has been experienced in the economy and we are going to use the ICT capital as our measure.

Our model like many models, the relative price tells us about advances in automation, the productivity of that type of capital. And again, like I said, we want to the model to the parameters so that

we get this two-thirds/one-third split. You know, if I'm not going to be working in routine, with two-thirds the probability I'm going to leave the labor force, and with one-third probably I'm going to stay in the labor force, but working the other job.

This is, you know, important from an academic perspective. We don't target to fall in on the amount of routine work so we have some testable, untargeted implications of the model that we can say, oh, this is a pretty good model.

One of the things I will just say quickly is, there's been this large literature on the fact that, you know, all of national income in the U.S., and this is true in other economies as well, you can broadly split, you know, national income into labor share of income, and capital share of income, so capital would be profits, dividends, capital gains.

And what's true in an economy like the U.S. is that labor's share of pie has been shrinking. What's also true is that it's not all labor's share has been shrinking, it's been shrinking for the routine, for the middle class, and our model delivers that, broadly speaking. Okay.

So, to the welfare results, so again automation is reducing the slope of this diagonal line, and so what you can see is, some people stay who were routine stay routine, others leave the labor force, others go into the other occupation, but again, what also happens is, when you get automation it often draws a bunch of people who were out of the labor force into the labor force but into the low-paying job.

And so, what does our model say about, you know, if I feed in the amount of automation that I've seen over the past 30 years, 30, 40 years, what does that do in terms of welfare? Well, you can see here in the top box who loses, it's the people who used to be in routine work, okay, they are the losers from automation.

Who are the winners? Not surprisingly, the high skilled, they really win. But, you know, they're a small fraction of the population, the losers are the previously middle-class routine workers.

Okay. So, let me talk quickly now about some policy experiments. So, like I said, we have two broad classes of policy experiments, one is a retraining program, and the idea is that we are going to think about targeting, you know, the people who have negatively affected, these low-skilled individuals who have -- essentially who have left the labor force.

And we are going to train them to become manual workers so, you know, I don't want you

to think about this training program as taking these people and suddenly, oh, sending them to a four-year college and making them computer science majors, and getting them a software engineering job. Or I'm not talking about, you know, turning these people into physicians or surgeons.

Again, we're training them to do non-routine manual work, so, you know, I think that this comes -- it kind of addressed the question as to, you know, why is it that there are some Americans, who, for whatever reason they're sitting out of the labor force when there are job opportunities available to them in, you know, what we think of it as in the caring economy.

What are the big growth occupations in the U.S.? Home health aides, personal care aides, child care, preschool type education. This is work that is in high demand. It doesn't require a four-year college degree. How do we nudge Americans into this type of work?

The other programs are going to be explicitly redistributive. I'll talk about that later, but it's going to be transferring resources from the high skilled to the low skilled.

So, we are going to retrain those, who, nowadays in our post automation equilibrium, we are going to train the labor force non-participants by offering them, hey, I have a magic pill you can swallow that will just automatically bump up your ability in the manual job by some increments. Okay?

You know, this is a model. I'm not going to be specific about how you do it, but magically take this pill, you're going to be better at manual work. Some people, their manual ability is so low that, you know, I take this pill, I'm still going to be out of the labor force. I'm going to say, I don't want that training program, I'm just going to stay where I am.

But others, you know, their ability, it was pretty high, and this is going to put them over the bar. Again, they say, yes, I am going to select into that treatment, I select into that training program, I get trained, I become a labor force participant, with the eye towards doing manual work. Okay. So, what we do in our model, in our analysis, is we find that the size of that magic pill, to bring labor force participation back to the pre-automation level. Okay?

So, we're trying to get, you know, the prime working age labor force participation rate back, particularly amongst these individuals.

This is just to indicate, look at the top line, automation caused labor force non-participation to rise, we are going to bring non-participation back down to its old levels through this

retraining program.

Who benefits? Not surprisingly, it's going to be the people who are out of the labor force who went into the manual occupation. This is really good for them. Okay? But this sort of retraining program, you know, that's what this general -- kind of this general equilibrium analysis sheds light on this, it's not a win for everybody.

Who it's at a loss for, it's going to be a loss for the people who otherwise were there, but there's this flood of people who were originally out of the labor force, into my occupation, my skill at this job is now less scarce. You know, it's the classic supply effect.

The supply effect, you know, drives down the return to being who I am, and what happens is, is that a bunch of these people they might stay in that job, you know, they lose out by 3.2 percent, some of them get driven into the routine job because, you know, just too many people this occupation is overcrowded, some of them leave.

Surprisingly, amongst the high-skilled, they actually benefit from this kind of retraining program. Now, this is a large-scale retraining program to bring the labor force participation rate back. You need to essentially treat 3 percent of working population, working age population, so this is big.

How much will that cost? We're macro economists, we are not education economist, so I don't know how to rig up a production function for manual skills. So we just go to back-of-the-envelope calculator. So, what happens is that because of this retraining program you bring all these workers back into the labor force, GDP actually rises by about 1 percent.

So, this 1 divided by 3, that means that if the per-participant cost of this retraining program were less than a third of per capita GDP, per capita GDP is big, so a third of it is big. So, you know, if everybody who selects into this retraining program -- were pretty darn costly -- it would still be a net benefit to the economy.

So that's the sense in which I'm saying these kinds of retraining programs, they look promising because they can be pretty costly and still to the economy as a whole, a net beneficial thing. The often question is, do programs like this actually exist? That's what I leave, as a question, to the floor. Ten minutes.

So, in terms of the redistribution policies that we study, we're going to study four so far,

this is again a work in progress, we've studied four so far, one is an increase in the generosity of UI benefits, unemployment insurance. One that people like to talk about the introduction of a universal-based income, everybody just gets a pot of money to spend regardless if you're high-skilled, low-skilled, unemployed, out of the labor force.

We can explicitly transferring counter people who are out of the labor force, or we can, you know, make the labor income tax schedule more progressive.

Again, all of these programs, we're going to be thinking about financing them through increased taxation of the high skilled. And to make all the experiments comparable, we're going to think about, you know, in all of these experiments its dollar-value equivalent is about $500 per month.

Okay. So, if we're thinking about the increase in the generosity of unemployment insurance, we're going to say, unemployment insurance benefits are going to be more generous by an amount of $500 per months, approximately $6,000 a year.

I don't know if I have time to go through all of them, so by a show of hands, who would like to see the UI benefit increase experiments? Who would like to see the UBI? Okay. More people would like to see the UBI. The labor taxes one, I'm going to do because it's a nice counter point to the others.

So, the UI benefits, I'll tell you just very briefly, it's a winner, everybody benefits if you make unemployment insurance more generous, I could talk about that in 15 minutes afterwards, okay.

The only thing is that the gains are small at the level that is required to bring labor force participation back to what it used to be, the welfare gains are small, but what's true is it's, at least within the context of our model, politically palatable, okay, because everybody benefits.

UBI, and this is the same mechanism as the increasing transfers to those who are at the labor force, UBI is at least, again, within the context of our model, it's terrible. It's great for some it's terrible along many dimensions. Because what UBI does, if it says, look, no matter you do, you don't have to be working, you could be unemployed, you can be out of the labor force, you're going to get $6,000 a year.

So, proportionate to what you're earning, that's really great for the non-participants relative, for instance, to the high skilled. So, it really incentivizes non-participation, so you can see that,

you know, the move from the pre-automation to the post-automation world that increased non-participation by a factor of 2, UBI increases it by a factor of 6. So, you get a mass flood out of the labor force with UBI.

All these people who are leaving and it's really costly. GDP falls, so whereas automation caused GDP to rise by about 12 percent, officially you're killing all those benefits by introducing the UBI. And again, it's how we're financing this UBI, we're taxing the high skilled, the high-skilled labor tax rates have to increase massively to fund this thing. Okay. So, that really disincentivizes work, not only amongst the low skilled but also amongst the high skilled.

Yeah. So who loves it? Non-participants love it. If you're already non-participating and suddenly you get and UBI, you're 34 percent better, and it also causes a whole bunch of people who were working in low-wage and middle age jobs to switch into non-participation. Who hates it? The high skilled, they hate it. Okay, six minutes left.

Is there a better way to redistribute, you know, the aggregate economic pie? We are going to consider labor income tax reform, and we're going to increase the progressivity of labor income taxes. What we're going to do is, we're going decrease the average income tax paid by low-skilled workers, these are the middle class routine workers, and the low-wage manual workers, we are going to decrease their income taxes on average by, again, that same number, that $500 per month. And in the model this essentially means, set their income taxes to zero.

So the government revenue is going to fall because you're not taxing the middle and low class anymore. You need to balance budgets so you've got to increase taxes on the high skill.

Again, what you can see is, whereas UBI caused non-participation to rise, making taxes more progressive caused the participation -- non-participation to fall. In other words, it increases participation. Why? Because I was originally a non-participant, part of the reason was because, you know, part of my income was going to get taxed.

Now, you are not taxing me anymore, that increases the return to looking for work, so I enter the labor force. So you get this rise in the amount of work being done in the routine and in the manual occupation, but again, you're taxing the high skilled more heavily that disincentivizes them from working, so their labor -- you know, the amount of work that they do, that's negative too, that's a negative

but, you know, the fact that more routine and manual work is getting done, it means that on net there's a very small effect to aggregate GDP.

And relative to UBI, it's a smaller increase in high-skilled taxes, okay, because it's a less-costly program. And so what you get is that, you know, this tax experiment where we make taxes more progressive is pretty effective in redistributing the income towards the middle- and low class. Again, for obvious reasons, the high skilled are worse off, but they're not that much worse off, at least relative to something like a UBI program.

So, it's not too costly to the high skilled, so perhaps this is politically palatable. Well, that statement must be qualified by time and place obviously. Okay, so again, you know, what we are working on, you know, is a framework, an empirically-relevant macroeconomic model of automation that emphasizes the fact that automation has winners and losers.

The reason we're doing this, we think of it as a useful laboratory that we can evaluate various policy proposals that are being discussed. Some are better than others. And again, we think this is useful for, you know, what people are talking about now and what people should be talking about in the future as automation progresses. Okay, so thank you very much.

MR. CASEY: Thanks, Henry. Gabe?

MR. MATHY: All right. Thanks very much. Thank you, Henry. I hope you'll excuse my voice, I'm a little under the weather, but I really wanted to be here today with you all.

So this is a really great paper, I hope everyone gets a chance to read it, you know, these authors are real leaders in this field, there's nobody else probably on planet Earth that's better to write this paper. And labor search and matching framework is really the right way to go. It allows them both to look at the consequences of automation as well as this kind of rich set of policies that they can really dig deeply into this.

You know, a lot of macro papers, the kind of policy experiments that are not always very credible, that's really not the case here.

So, I'll talk a little bit about some of the, like the modeling aspects of the paper, and then I'll move on to kind of big-picture questions, and I'll suggest that some more work for the authors, some new policies they could look at.

So, you know, in terms of the UBI, they find that it's pretty bad, there's been some empirical work on the subjects, if you look at Jones and Marinescu, they look at a UBI-like program in Alaska, and so they find kind of offsetting effects so that the net effect is zero. So, they do find this kind of labor supply effect, that when people have UBI they're able to work less, and they find an increase in part-time employment rather than full time.

But overall the net effect on unemployment is zero, and we don't know if the part-time employment is people playing video games, or if it's, you know, mothers taking time to spend with their children or, you know, people taking time to go to school. But overall, essentially it's two factors, and one is modeled in the paper and one is not, one is the negative labor supply effect.

But there's also liquidity constraint households, and so they're going to spend more when they get this UBI, and so they find a kind of offsetting effect where the tradable industries where demand is not going to be local necessarily, are going to see a big decline in employment, but you're going to see a relatively stable employment level in the nontradable industries, where demand is going to be locally based. So, the authors might think about looking at kind of hand-to-mouth consumers to try and think about this effect.

And also in terms of taxes, these are fairly standard framework, so it's not as specific to their paper, but in general macro papers, you're going to find that in general when taxes go up, net wages go down, and so then labor supply is going to fall, so that's essentially kind of substitution effect that you get -- that the value of leisure stays the same while the value of work falls.

But, you know, a fairly standard kind of micro ECON 101 effect is that you have an income effect too, and so in general if you look at societies across time, as they get richer, and wages rise, they actually tend to work less because you have an income effect. So people buy both more consumption goods and more leisure, you know, we've talked about gains.

So, obviously he wasn't right about how far ours would fall, but over time as societies get richer, they tend to actually work less, if you look at, you know, richer versus lower-income countries, the higher-income ones work less. So the Germans work less than the Greeks, because Germany has a higher average income per capita. And then as countries grow over time, they tend to work less.

So, you know, this is not specific to this paper at all, this is across, you know, kind of all

the macro literature back to papers by Prescott and others. But it's kind of strange that we haven't yet really modeled this very simple kind of result. And so if you look here over time, on the upper left, we have the U.S., and you see ours falling over time, and then here's a sample of some OECD countries.

So, you know, Japan as they've gotten a higher income they actually work fewer hours than Americans now, and the bottom line here is the Germans, so you might think of France as having low working hours, but actually, no, Germany has lower working hours. And so I'll talk more about Germany in a second.

So, in terms of automation, there's this framework in Acemoglu and Restrepo, so they've got to confuse us, there's AR, Acemoglu and Robinson, this is the other AR.

So, this is the framework to think about automation, and so they think about two kinds of effects. There's a displacement effect that the workers directly affected by automation are going to be worse off. And that's kind of the main channel this paper looks at. There is also productivity effect, because automation is going to increase productivity, it raises demand for all products, and so it's going to raise demand for all the other tasks that are not automated.

I mean, so there is going to be a kind of race between these two effects. And so for automation to be a really big problem we need the displacement effect is going to outweigh the productivity effect.

And so, you know, in terms the current situation, obviously there is some affected workers. In terms of the aggregated, you know, is augmentation going too fast, are we seeing some kind of robopocalypse, and we heard earlier? And in the aggregate we actually have a somewhat slower productivity growth, and we have kind of record employment.

So it doesn't seem to be a kind of mass problem, but we still can have some problems with specific aspects. I mean, one might be inequality, so the paper doesn't focus specifically all that much on inequality, but implicitly you've got kind of middle-skilled workers, kind of middle-class workers, that are being pushed into being low skill and low wage. And so then that could increase inequality, potentially.

And so, you know, the authors only have data for a few decades, and it's true that over this time, you know, inequality has risen, but in the eyes of an economic historian this is a fairly small slice

of, you know, human history.

And so if you look, you know, you have different authors they find different increase in inequality, obviously, Piketty is going to find a much larger increase, Auten and Splinter found a smaller one, but overall we know the general trend since about 1980 that you've had increase in inequality, so if you look at the period since 1980, you think automation, and it looks like, you know, those two things are linked up.

But, you know, if we take a longer span of history, we'd want to think about periods when inequality is falling, or those periods with slower automation. And so some of the terminology in the paper is, I find a bit strange because they talk about a pre-automation period, but obviously, we've had automation on things like cotton textiles for a quarter of a millennia at this point.

And so you have, you know, from the beginning some middle-skilled workers, these are the Luddites, the famous Luddites who were kind of middle-skilled craftsmen who were weavers, and their jobs were being automated away in the early 19th Century, and so they raged against the machine, and tried to break these machines, because their jobs were being replaced by low-skilled textile workers in the Industrial Revolution.

And so what's the case here? You know, were they irrational? If you look on the right, you can see Greg Clark's numbers on the ratio of craftsman to kind of low-skilled wages, and it's true that these people got automated away, and the craftsmen skilled premium relative to low-skilled workers is going to collapse over the 19th Century.

So, they're going to lose out. But, you know, overall it takes some time. If you see on the left, you can see when, you know, Engels is writing about the dire conditions in British factories, but eventually this kind of productivity effect is going to cause gains in wages, and all this demand for low-skilled labor is going to raise living standards. It's a story of modern economic growth, and the prosperity that we see today.

So, you know, what's going to happen in inequality over this period? Here we can see from Lindert and Williamson, you can focus on the U.K. earlier, England and Wales, to when the Luddites are destroying the machines, there's actually going to be a period when inequality is declining.

And so it is not inevitable that automation will cause inequality, it's going to depend on,

you know, how institutions are set up, and this productivity versus this displacement effect.

As they're seeing their kind of middle-class jobs being destroyed, it's creating a huge amount of demand for low-skilled labor, which is going to raise living standards and actually see a decline in inequality from about 1,800 Luddites or about a decade after that. In the U.K. inequality is going to fall for almost two centuries after that.

So we periodically have these kind of panics about automation, I guess this conference is part of that, but you see it in the Great Depression too, there's panics about automation causing the unemployment in the Great Depression, and so then, you know, the idea then was that you have industrial skills, and all the farmers just can't hack it with these new skills in industries.

And so then, once the economy recovers, you kind of infinite demand during the war, then everybody kind of forgets about this automation fear once unemployment ends.

And so another thing to think about is that being routine is not going to be inevitable. So, you know, something like and accountant, would have been unimaginable to be routinized, now it's always kind of a frontrunner for being routinized away. But, you know, to some extent we have institutional framework to think about too and in the U.S., the tax preparation companies block the government from automatically filling your tax forms.

And so, unlike the Luddites who eventually would lose the tax preparation companies have been successful at blocking automation, I mean, so he institutional framework is going to matter for how institution matters for economic outcomes.

So, in terms of alternative policies, I think the UBI comparison is nice, you know, it's kind of topical for thinking about automation, but I think we should consider some other policies, you know, we've got the real wage that's related to productivity, but it's really going to be mediated through these labor market institutions.

And so I'd like to consider a case of another country that I think has been more successful with automation dealing with the kind of social consequences of that. So we only thing about Germany, they've got these codetermination institutions that are going to give workers a lot more power to determine how the labor markets function. What's going to happen to jobs when jobs are automated away? And how wages are set within a large firm?

So, we've got things like work councils that are going to have workers advising firms, and then codetermination where workers are going to sit on the Boards of large firms. So, it's been successful at having relatively higher wages in manufacturing, as we'll see in a few more slides, and it hasn't really had adverse impacts on unemployment. So something that people are worried about.

You know, will this discourage investment, or employment, or job openings. Well, Germany has an even lower unemployment rate than the U.S., at about 3.1 percent.

So, you've got a lot of automation and capital deepening in Germany it's much more manufacturing of the economy. And so, you know, if you've got things like higher profits from automation, and because of these labor market institutions you're going to get higher profits being shared with workers to some extent, a kind of standard effect, and also you don't necessarily get wages falling.

So, you know, you've got wage scales that are set, and so then if there is automation, then those wages won't fall, you'll just reallocate workers into other jobs. So, I think that this would fit really well thinking about a kind of collective bargaining in this Nash bargaining framework, the search and match model, just said that you have a kind of labor aggregate, and the firm essentially has to purchase a whole labor aggregate rather than bilaterally bargaining with an individual worker.

So, they're going to buy the kind of full of set of labor that's appropriate for the technology, and then you negotiate the price ahead of time so the wage se for any kind of task distribution and then, you know, once the wage is set then workers are going to encounter firms, and they are going to set a match without bilaterally bargaining the wage would already be set, and then they'll just form an employment match if the wage is in between the reservation wage, and the value of the worker.

And so, you know, you get a lot of distortions from these kinds of tax and spend policies, part of the reason for implementing the kind pro-determination institutions after World War II, was to avoid the kind of big government or tax and spend policies to keep.

You know, the kind of free market system, but just strengthening bargaining of workers, so that then you don't need to have all these distorted policies. So I suspect they're considering these kind of co-determination institutions, would likely be a relatively favorable policy relative to the others like UBI.

So, you know, we've got a lot more automation in Germany, this is from the Dauth et al.

paper, so if you look at robots per thousand workers, it's much higher on the black line in Germany, the U.S. has a lot less per thousand workers, and that's because manufacturing is just a much larger share of the economy in Germany. So, the U.S. has largely, you know, kind of the industrialized, and so there's just a lot more robots per worker in Germany.

And you see the same kind of effects from automation. So the medium skilled are seeing their jobs destroyed, and it's really in these kind of routine things like a machine operator, so the kind of standard factory worker. So, you're seeing the same kind of facts that this paper finds that you're destroying the kind of middle skill jobs, but it's not going to have the same impacts in terms of the social consequences like in the U.S. Rust Belt, and where you're seeing high unemployment.

So, workers are simply moving into different tasks, and overall this paper finds no effect on unemployment. So, essentially firms are no longer hiring new workers, they're just going to move automated workers into different tasks, and so Germany is kind of the leading manufacturing country, because despite having less than a third of the population of the U.S., it exports about the same, and a larger share of its exports are in manufacturing.

So, you know, we might want to consider them really as a leading industrial power today rather than the U.S., because they've kept a higher share of manufacturing. If you look at manufacturing the way it is, you might say, well, Germany is just doing wage repression, they are able to compete just because they've kept wages low, or you're much better off being a manufacturing worker in Germany, so you're wages are much higher, about 33 percent higher.

So, this kind of profit-sharing mechanism is working. And if you look at inequality it has gone up a bit in Germany, it has gone up a bit in the U.S., but overall it still remains a very equitable country, so I would argue that this is a fairly successful model, that would be one kind of policy to consider relative to automation.

So, overall, you know, we like this paper, and appreciate that the authors would write it and then I could discuss it. I could be bold, if I can be bold and argue that automation is largely a solved problem, that we do have cases of policy that have worked to address automation selection season, so you vote for codetermination if you want.

Some candidates that are looking at that, and hopefully we can provide some better

policy frameworks to address the problems of automation going forward. Thanks so much.

MR. CASEY: Thanks, a lot, Gabe. Okay. We've got some time for some questions. I'll probably take two or three initially. But first I wanted to make a comment, as when Gabe mentioned that it seems that we have this spark and worry about automation, I'm reminded. So, one of my guilty pleasures at night before I go to bed, is I watched the Twilight Zone.

And I've counted six episodes over the last three seasons that focus specifically -- six episodes over the last three seasons that focus specifically on what robots and authentication is going to do to people, and society, and so on, and so forth. So, clearly they cared about this around the time my mother was born in the early '60s.

Okay, Molly?

MS. KINDER: Hi there. I'm Molly Kinder. I'm a new David Rubenstein Fellow with the Metro Policy Program. I have two questions for Henry. One is, I'd love unpack a little bit, and I know you had to go pretty fast because of the time, the empirical model where you derived a third, two-third.

My understanding is that, I'm assuming your data on the routine work is primarily comprised of the clerical and secretarial work, as well as the more production work. And my understanding of looking over the last 30 years of automation experience is that the predominantly female labor force of clerical has had a very different experience than the more male-dominated production work when it comes to this question of labor force participation, and whether or not those workers are falling down into low-skilled work or moving up.

And the reason why I'm raising this is I'm wondering how you're factoring in your model not -- you talked about freezing the worker, but in fact there's a more dynamic experience that was happening with women, which is over those years they were gaining more human capital in education. So, if you look at what happened to women over that time, many of those women moved into higher-skilled, higher-paying jobs, because of the human capital formation.

So, I'd love to just unpack that a little bit and question some of the assumptions given some of those changes. How do we take that into account in your model?

And my second point is, I just wanted to bring a little bit of a human perspective on the job quality question to your -- you had a slide up that talked about: Why aren't more people taking jobs

such as these fast-growing personal care jobs? I just finished this large human-centered research project, where I led a team where we interviewed workers in exactly some of the see routine jobs, and low-skilled jobs, that are at the highest risk of automation.

So, secretaries, administrative assistants, legal assistants, and we asked about: if you lost your job what would you do? It's interestingly, many of those workers had previously worked in those female-dominated, care-based, social work, child care, personal-care aides, for them moving from a routine administrative job into one of those jobs, it's a huge fall in the job quality.

Those jobs are tiring, because a lot of these women are older, they're physically exhausting running around after kids, lifting people in beds, they are terrible pay, they are horrible hours. And I think this question of what motivates someone to go into some of these jobs, we have to talk about job quality. So I'm wondering in your model, why something like raising the minimum wage, or by raising the quality of those jobs so that people who may be losing welfare and moving into those jobs, are not losing welfare so much.

MR. SIU: Marcus, can I answer that? There's a lot there that --

MR. CASEY: We'll come back to it. Or, well, if you want to start by answering it.

MR. SIU: Okay. You know, my short-term memory is not great, so I want to address your question as soon as I can. So, okay, yeah, first, with respect to the gender differences and the experience of routine work loss.

So, you know, what's interesting and this gets back to one of the questions that was asked earlier one, is that the male and female experience is very different, so if you look at the typical male routine worker, I think a good characterization of it would be a production worker on the factory floor, you know, the technology to automate some of their tasks was introduced in the late '60s, in the 1970s.

That's when the industrial -- you know, CPU-controlled robotics was introduced, but you don't see there, employment losses happening concurrent with that time. It wasn't until the 1982 -- the back-to-back 1980/1982 recessions -- when those -- when employment in those occupations were lost during the recession and then they never came back.

If you think about secretarial work, bank tellers, you know, that was really -- automation of those tasks was really enabled by the introduction of the personal computer, which happened in, you

know, the mid- to late-1970s. But of course throughout the 1980s employment in those occupations, and especially amongst the women in those occupations continue to rise through the 1980s, and employment losses in those occupations, the disappearance of those routine jobs, that didn't happen until the 1991 recession, and the 2001 recession, and really now, after the financial crisis, the Great Recession of 2009.

So, you know, as to this business cycle effect, and kind of this delayed effect, you know, you've seen it in the past 30-40 years. Automation doesn't come necessarily when the technology comes, it's usually delayed, and this automation happens in short, sharp bursts. You know, the losses happen in recessions, and those occupations don't come back.

And in terms of, you know, the fact that the female/male experience has been very different, you're exactly right. You know, these routine jobs are amongst men are typically occupations that involve little more than a high school education, whereas the routine jobs that women are working required some post-secondary education, and what women have done is they've actually moved up the educational ladder, to a much greater extent than men have.

They've moved up the occupation ladder, they've been able to get the better high-paying jobs, and other work that, you know, my colleague, Nir and Matias Cortes and I have done is we've actually provided what we think is credible evidence that, you know, it's not -- you know, technological and automation doesn't just affect what occupations are getting worked and what occupations aren't anymore, it also changes the nature of work within occupations.

And so we have evidence, I think that shows that there's been an increase in demand for interpersonal and social skills within jobs. You know, I think one of the reasons why bank tellers didn't disappear right away, is because the nature of what they did changed. They didn't just, you know, take your money, stamp a receipt and hand it to you, you know, or just dole out money, their work became much more consumer focused, than in the past.

And so the nature of work and change, the nature of tasks within occupations can change, we have found that it's changed towards more human-based tasks, like interpersonal social skills, and that's one of the factors that have allowed women to better withstand automation than men.

MR. CASEY: thanks, Henry. I do want to direct you, if you want to learn more about this topic. In our first conference we had a paper written by Patricia Cortes and Jessica Pan, where they talk

about these issues at length, and developed some new techniques to actually measure them. So, you can check our automation page, the Future Middle Class Initiative page in the automation stream for a copy of that paper from the September 13th conference.

Okay. We are going to take a few more questions, and then I'll come back to Gabe and Henry.

SPEAKER: Grace Sekhu , Jachin Capital. So, thank you for the discussion. I find the framework very interesting. The question is for Henry. On The macro policy implications, you highlighted two areas of potentially high potency training and taxing. So, on taxing have you thought about, you know, we take tax income as an accepted practice. Have you thought about taxing robots, or taxing disruptors?

MR. CASEY: Okay.

SPEAKER: Thank you.

MR. CASEY: Well, first Morris , and then you two.

MR. MISHEL: Okay. I'm loud. Larry Mishel, I'm with the Economic Policy Institute. I appreciate the paper, I want to question whether it's useful to focus on job polarization as anything useful for an insight, because I think the main phenomenon that needs to be explained is wage inequality, and wage stagnation. And we know that changes or occupational composition has had very little to do with anything about wage stagnation or wage inequality.

Most of wage inequality is within occupations, and if you want to connect it to personal skills or something like that, I'm waiting for evidence on that, but I have not seen that.

And I think the comment by Molly is exactly right on. You know, the idea of shifting people to routine manual work when it's been -- even though it's been expanding, but to its very low wage, and exploited, and without benefits is kind of surprising.

One comment on labor share, similar to what Gabriel said, he's presented data on household income and inequality, but if you look at actual distribution of wages, the only real significant phenomena within the wages is the near doubling of the share of the top 1 percent, so I'm not sure of the top 1 percent, so I'm not sure, you know, whether this automation is really a salient thing.

And last, I find the discussion in this paper policy, and in the earlier discussion somewhat

other worldly, in the sense that if you went back 30 to 35 years to people in this room talking about manufacturing experience and the implosion of manufacturing, you would find they would have said, let's have more productivity, let's have more innovation, and let's educate people.

And if you look what happened, manufacturing workers even -- there is no evidence that any educational training really helped them all that much. There was not enough given, but what happened was they got shifted to lousier job, and so what that brings forward is we're missing the deterioration of the quality of jobs, and the deterioration of wages and benefits for most people, and it's surprising to find a discussion now, that ignores the crisis of the last 40 years, and thinking about the crisis that may be coming.

MR. CASEY: Okay. Let's take two more down here and then Gabe and Henry can respond.

MS. ROSS: Martha Ross, a Fellow at the Brookings Metro. So in response to your open question, we currently, I would say have no capacity, very, very limited capacity to do the kind of large-scale training that you proposed. Which is not say that we don't know how to do it, there are good models, there is knowledge, it is underfunded, we don't have the political will to make the hard choices to allocate funding to where it needs to go, or to overcome institutional inertia to get places to do it better, or to focus on it, and we don't have the kind of employer involvement that we need.

Secondly, I wonder if there is a way to pair what was described earlier as companies with better management practices doing better to pair some kind of business services assistance to help more companies have more efficient, more productive, internal processes along with a focus on helping them derive greater productivity from their workers which would probably involve some skill development.

And lastly, this is a sort of a plea to policy wonks, and economists at large, I really think we should stop conflating low skill with low wage, because it is disrespectful. If you look at the work that -- you know, just to highlight the care occupations are doing, that is skilled work, it's just skills that are not valued in the labor market.

MR. CASEY: One more.

SPEAKER: Thank you. Dave Rubinwitz . You seem to be -- the goal of your policy seems to be increasing labor force participation rather than increasing quality of life of people. And I'm

wondering if that's a good idea, because the points just made are basically getting people into these bad jobs is not increasing the quality of their life at all.

And as for a personal care, in Japan and China right now, they're already employing robots for personal care, it's being tested now in some residents' homes in the U.S., and it's coming very soon, robots have the advantage of not forgetting, not getting sick, and actually enjoying hearing the same story and over and over again.

Should we be worrying about labor force participation, or quality of life? And this is the where rest of Keyne's payer is very relevant, the parts that hadn't been quoted yet today.

MR. CASEY: Okay. So, first taxing robots, is it useful to focus on job polarization, issues related to management firms, and quality of life or labor force participation.

MR. SIU: Yeah. I can say that those are great questions. So, yes, in terms of taxing robots, that is something that we do consider in the paper and, yes, you can tax robots. Essentially what advances that automation technology does is it makes it cheaper to buy this automation capital. You tax the purchase of that capital, and you could just undo the improvements in technology, and you can just wipe that all away.

So, in our model, it's a very easy thing to do. The question is whether you want to do it, whether you want to stifle that -- whether you want to stifle the economic pie from growing, or do you allow the pie to grow and then redistribute better.

The question about, you know, whether we should be talking about automation or wage inequality, and unfortunately this is a conference on automation, so I have to talk about automation. But I do agree, but the wider question about wage inequalities, is relevant.

I do think that, you know, within the context of our model, which is obviously a very wonkish model, we do have an ability to think about the labor market institutions, and how the economic pie is split up over and above redistributive policies. Like I said, there is built into the model a wage bargaining process which depends on the relative bargaining strength of firms and workers.

Gabriel pointed out, you know, rather than having bilateral bargaining you could think about centralized bargaining as done in the German works councils. But, you know, at least within the context of bilateral bargaining, we can think about evolution or changes in the bargaining power of

workers versus firms.

You know, it's interesting to think that, you know, I think there's an understanding that at least in the U.S. context, these personal care, basic health care occupations are low-paying jobs in the U.S. That's not necessarily the case in Canada where I'm from.

They're relative low-paying, but they're not in absolute terms the same level of lowness, and I think one of the things that informs that, is that our labor market institutions of Canada, you know, are different. You know, just as a simple thing to observe, unionization rates in Canada, even though our industrial composition is very similar across U.S. and Canada, the unionization rates are two to three times that of the U.S., and that is an example of a labor market institution.

MR. REEVES: I'm sorry to interrupt you. Does that mean you could use your model to increase worker bargaining power?

MR. SIU: Yes.

MR. REEVES: That's the effect that had -- it would have had on the model?

MR. SIU: Yes that is -- we have not done that, no.

MR. REEVES: That will be great to see.

MR. SIU: Okay. Yeah, and then in terms of -- you know, as Gabriel was talking about, yes, the German works councils. You know, again, because Germany is, you know, those work councils exist largely in manufacturing, you know that's tied into the apprenticeship system, but my understanding is that in Germany the works council which represents these machine operators, they are much more involved with the adoption and implementation of automation technology.

And that means that in -- like I was saying before, the machine operator occupation has evolved much more in Germany than it has in the U.S. You know, a machine operator in the U.S. is just someone who pushes a button. Whereas, in Germany, you know, they are training the machine operator also to calibrate the machine and to optimize work flow.

So, that's another example of evolution of tasks within occupations that, again, differs across labor market institutions, and representative by works councils, the U.S.-Canada comparison is perhaps measured differences in the unionization rates. But yeah, these are things that are worthy of discussion; absolutely.

MR. CASEY: Gabe, have you got anything to add to that?

MR. MATHY: I do not. I think that was good. I mean the apprenticeship system is something I didn't have time for but, you know, it's part of the story. So, it's not just a codetermination story. You know, I think there are a lot of lessons though from Germany that, you know, we could think about here, related to the various points. Yeah, I mean, you know, that was kind of one of the points I was trying to get across in my discussion was that --

MR. CASEY: Gabe, Gabe, speak into the mic.

MR. MATHY: Okay. What I was trying to get into my discussion was that, you know, it is really conditional on these labor market institutions, so in terms of the modeling, you know, thinking about that deeper, I think is useful.

MR. CASEY: Okay. One last question, anybody has another one? Okay. So, I want to thank Henry for his interesting paper; and Gabe for his fantastic discussion. We are going to take a quick break and we'll be back for a paper on Unions. (Applause)

MR. REEVES: It is a very quick break everybody, just 10 minutes.

MR. CASEY: Yeah. At 11:30 sharp. Thank you.

(Recess)

MR. PAROLIN: I'll give five seconds for the gentlemen in the back to find their seats and then we'll get started. All right, hello everyone. First, I want to say thanks to the Brookings team for coordinating this event today and for inviting us to be here to speak. My name is Zach Parolin, I'm at the Center on Poverty & Social Policy at Columbia University. And the focus of my research and the presentation today, as you can see on the screen, is trying to understand the role of organized labor, worker power in general, in shaping the employment and earnings trajectories of workers who are in routine occupations. And I'll be testing some -- showing some results using the PSID which is a source of panel data that follows individual workers in the U.S. over time for about a three-decade period.

So, the nice thing about a conference like this is that I don't need to spend much time on background. But I'll just say a couple words about this idea of routine biased technological change. Or this idea that technological advancements generate declining demand for routine tasks. And we know from our conversation this morning, from plenty of prior research on this topic, that routine biased

technological change can generate a couple types of consequences.

The first relates to employment shares. So, for these occupations that are more routine in nature; your manufacturers, your office clerks, and so forth, we've seen over the last few decades, a decline in their employment shares relative to other types of occupations. Again, we know from the discussion this morning that these occupations tend to be in the middle of the wage and earnings distribution. So, when their employment shares fall, if the employment shares of lower pay and higher pay jobs increase, we have what's called job polarization.

Employment shares are one thing, but we could also look at occupational wages or even annual earnings. We know that there's a possibility that due to declining demand for routine tasks, that workers in these occupations will experience, perhaps, declining relative wage growth over time. But what I want to emphasize is that if you actually look across states in the U.S., if you look across other high-income countries, this is not a universal trend. And even in the U.S. you can read Blair Michelle's work on this, is perhaps confined to one decade at a particular point in time in this country.

So, what I'm going to focus on and the questions I think we need more research on, in general, relate to what you see on the screen right here. It's so often when we assess the consequences of technological change, we do so from a very macro-level perspective; looking at changes in the aggregate to see how employment shares of certain types of occupations change over time. But perhaps not enough focus on the experiences of individual workers. A couple exceptions that I'll talk about, but you can think about why this might be important. If you are in this routine job and you -- your job is made redundant due to technological change, what does it mean? To what types of occupations are you moving to? Are you more likely to live in poverty? Are you sent to unemployment? What is that experience like? And using panel data we can try to answer some of those questions.

And the reason we're here today is because there's a need for more research on the role of labor market institutions in shaping variance and earnings in employment opportunities of these occupations at greater risk of automation. Labor market institution's a broad category. We could talk about, you know, minimum wages. We could talk about a number of things. But I'm going to focus on worker power in the role of organized labor in the form of trade unions in particular.

I want to, again, highlight a couple of the advantages of using panel data to follow

individual workers over time and what this might be able to add to our conversation. First, we can answer this question of where are the workers going? Is it true that if you're in a routine job, your job is made redundant, that you're more likely to move to a lower paying sector type job? Or, perhaps, might you move to a higher paid job. Are you sent to unemployment? What does that process actually look like on average. How do these individuals fare when their job is made redundant? Again, are they stuck on unemployment, are they more likely to live in poverty? And then is this conditional on certain policy choices that we make.

And then we can also get at some of the mechanisms that sit beneath these macro-level changes. So, if we see a decline in the share of routine jobs, is this because there's accelerated layoffs of these individuals in the jobs or is it just a slowdown in hiring that occurs over time? Using this individual level data, we can start -- do more, perhaps, to answer those questions.

I mentioned there's a couple papers and maybe more that are using panel data already to answer these types of questions. In the British case, Thomas Curr and Inak Gallego find that about 64 percent of British workers, in routine jobs, remain in that routine occupation five years later. A pretty small group is switching out. In their study they actually find very few are unemployed five years later. Interestingly they find that most individuals who transition out of routine jobs are not moving to service sector or lower paid jobs but are, in fact, moving to higher pay or at least higher status jobs. And Mateus Cortez finds something similar, that high-ability workers are more likely to switch out of routine jobs and tend to fare better over time if they do.

What I'm going to add to this, hopefully, is a focus on labor market institutions; a focus on worker power and how that shapes the employment trajectories of these types of individuals. Why focus on organized labor? I think many of you are probably familiar with this literature. But if not, there's plenty of evidence that greater union coverage or greater collective bargaining coverage in cross national comparison is associated with lower levels of in-work poverty rates, more compressed wage distribution, more employment security for individuals in precarious jobs, higher wage premiums for workers in routine occupations. I've shown in work for the OECD that union membership is beneficial for the relative earnings growth of routine occupations. And we know that unionization is on the decline here in the U.S. but that is not a universal trend, particularly when we look at collective bargaining coverage and look at

other high-income countries and I can talk about that more later.

So, here are the precise questions I'm going to try to answer over the next half hour or so. First, I'm going to look at employment tenures and transitions of workers in routine occupations. So, where do these routine -- these individuals in routine occupations, where do they go if they leave their routine job? Is it the case that unionized routine workers are more likely to maintain their jobs for a longer duration of time relative to non-unionized routine workers? In other words, can unionization help, sort of, slow that transition process into this labor market of the future. And then I'm going to look at, are unionized routine workers less likely to become jobless, in general, relative to the non-unionized group.

So, then I'll switch to earning, so that's the employment focus so we can look at earnings. Is it the case that unionized routine workers experience higher earnings while they're in their routine jobs relative to non-unionized routine workers and relative to former individuals in routine occupations who have switched to other types of jobs? Okay.

To answer these questions, I'm going to use micro-data from what's called the Panel Study of Income Dynamics or the PSID. This is panel data that follows the same individuals over about a three-decade period; 18,000 individuals in this sample. I'm primarily focusing on outcomes from 1980 onward for data consistency purposes and I'll be looking at adults between the ages of around 25 to 64. Anyone who's worked in a routine occupation throughout their career was included in this sample, and I'll be looking at their transitions and earnings trajectories.

We've talked a little bit about how we can categorize different occupations in the earlier presentations and I'm going to use a very similar classification to what Henry and others have used. It's these three that you see here on the screen. So, we have these non-routine cognitive occupations which tend to be more of your managerial, professional level occupations. In the middle we have the routine occupations. Again, your office clerks, customer service clerks, trade workers, manufacturing, et cetera. And at the very bottom we have the non-routine manual group, tends to be more service sector, healthcare type occupations. And on this side over here I've just simply laid out an indicator of low earnings. This is if your earnings, annual earnings, are below 50 percent of the national median and you can see the share that has low earnings by group; it's exactly what you would expect. So, among these non-routine cognitive jobs only six percent with low earnings from 2013 to 2015. Among the routine

occupations about 14 percent and among the non-routine manual about 21 percent. So, it's what you'd expect and I'm going to use this benchmark of low earnings throughout the rest of this presentation as well.

So how am I going to answer those questions that I put to you before? A couple different approaches. I'm going to try to do as much work as possible with just descriptive data. So, looking at the different employment and earnings outcomes for adults who were unionized versus non-unionized at different intervals after they were first in that routine job. So, for example, I'll look two years after they were in that -- first entered the routine job, see how they are doing; four years later, six years later, eight years later and ten years later. And at each time interval try to get some assessment of the role of unionization in shaping the likelihood that they're still in a routine job, they switched to another type of occupation, their earning status, and so on.

Then I'll use an individual fix-effect model. So taking advantage of the fact that we have data on individual workers over time. We can try to weed out some of these between worker differences and take advantage of the fact that many individuals when they start their routine jobs are not unionized but, perhaps become unionized during that employment process. And if that's the case, do we see on average, that contributes to different earnings in employments and outcomes? And finally, those who know the, you know, union wage premium literature know the selection effects are always a massive challenge. I'm going to try to address for selection effects using propensity score weighting techniques but, of course, it's not a perfect fix. But I'll talk about that more in a little bit.

Quickly, for those who prefer equations, this is very simple. Our outcome variable here is simply, you know, the occupation type at two, four, six, eight and ten years later. I'll estimate these separately. So, are you still in routine work? Are you in a non-routine cognitive job? Non-routine manual? Unemployed? Low earnings? Controlling for things like age, sex, education, race, ethnicity, year dummies and state dummies, and when we move to the individual fix effect model it looks almost identical. But of course, adding these person-level fixed effects and treating unionization as a permanent treatment here. So, in this model if you became unionized at all during routine work, I'd, you know, count you as a unionized individual and look at your employment and earnings outcomes, even if later on you leave your job or leave your union.

And, again, I'll take some steps to try to account for selection effects based on observables. I talk about this some more in the paper and I'll show you what happens when we do that but recognizing that it's not a perfect fix to selection problems. So, if we get into the results, first just some very basic descriptive stuff. We're going to look at employment shares of all employed adults and union membership as polled by the PSID data from 1981 to 2015. And so, if you see the very top line there, the triangles, that's your non-routine cognitive jobs. You know, more of these professional and managerial type occupations. You can see a slight increase over time from around 50 percent to, say, 55 percent in this sample. The line in the middle with the X's, that's your routine occupations and as we know, a slight decline over time, not massive, but from about 40 percent closer to 30 percent from 1980 to 2015. Union membership is the very light-colored line, third from the top. Again, consistent from what we already know from past work, there's a decline in union membership. It does show up here in the PSID sample from about 25 percent to closer to 15 percent. And the very bottom line are these non-routine manual occupations, more of the service sector type jobs. And again, you see a rise in their employment shares over time so consistent with what we know from past work.

But now let's get to the more exciting stuff. What happens to the individuals who are in routine jobs? We'll start will ten years later. Where do they end up and does this vary based on whether they were unionized while in routine work during those ten year; at least one of the ten years, versus not? And so, the line I want to highlight first is this dark grey line that sticks out for both groups. This is the unconditional means, so not controlling for age, sex, education, anything yet. But this is the share that is still in a routine occupation ten years later. And for this unionized group it's about 72 percent on average, fairly high.

For the non-unionized group, you can see it's about 46 percent. Now, there's a lot of things that could be explaining this, we'll get into that. But if you just look at the unconditional means, you see there is some difference between the group that was unionized versus not. If you look at the first bar, it's the black bar here, this is non-routine cognitive jobs. Again, it's more professional and managerial types of occupations. For the unionized group, only about 15 percent of this group was in a non-routine cognitive job ten years later and contrast the non-unionized group about 30 percent. So, of that non-unionized population, most of them, the largest chunk of them, if they're transitioning jobs, they're moving

to what are generally higher pay type occupations. But that's also true for the unionized group.

In fact, this bar here, the third one is the non-routine manual. This is more of your service sector type occupations. No difference between the two groups, about five percent each. And the last bar, it's hard to see on the screen, but this is unemployment and what you see, this says nine percent over here for the unionized group. Twenty percent for the non-unionized group. So, for individuals who were unionized during their spell of routine employment, 10 years later only about half as likely to be jobless compared to the non-unionized group.

This includes data that spans, you know, 1980 to 2015. So, you might be wondering, well, you know, is this all about the 1980's, the 1990's, does this still apply? So, I'm not going to focus much on this slide but what I want to show you is that in the paper I do segment this by decade and across decades you see somewhat similar pattern. That the unionized group tends to stay in the routine jobs longer relative to the non-unionized group; less likely to be unemployed ten years later regardless of which decade you're looking at.

So, what happens when we start to bring some controls into the model? Now we add age, education, sex, race, ethnicity, year of observation, state of residence, and we can look at the conditional effect now of union membership on the likelihood of employment and earnings outcomes at two, four, six, eight, and ten years after they first entered that routine job. Okay, so on the X-axis for each of these you have two, four, six, eight, and ten. That's years after they were first observed in that routine occupation. So, if we narrow in on the upper middle panel, this is the conditional effect of unionization on the likelihood of remaining in a routine job at these different time intervals. And you can see it's positive and statistically significant suggesting that union membership, again, is associated with the greater likelihood of remaining in these routine jobs; similar to what I've shown you before. And this is consistent at two, four, six, eight, and ten years afterwards. At ten years it's about a 15-percentage point increase in the likelihood that you're still in that job, relative to the non-unionized group.

So, where are these other individuals going? Again, this is what we saw before. Union membership is associated with a decreased likelihood of transitioning into a non-routine cognitive job. Which again, are more of your professional and managerial types of occupations. That's shown here, consistent with what I showed you in the last slide. What I find interesting are these bottom two

indicators; unemployment and low earnings. So, union membership is associated consistently with a decreased likelihood of being jobless two year later, four years later, six years later, up to ten years later. About a five-percentage point decrease in the likelihood of being jobless. And if we look at low earnings, again, this is consistently negative. Indicating that union membership decreases the likelihood that you are going to have annual earnings that are below 50 percent of the median. And this only includes employed adults, the unemployed are not included in this calculation.

I want to show you some more just descriptive statistics on the demographics of these occupation types ten years after they were first in these routine jobs. And this highlighted group here is the routine unionized group and we're going to compare some characteristics of them to these other types of groups. Starting with just overall occupation shares, employment shares, you can see that the routine unionized group is pretty small. It's about 11 percent. We know that this group is traditionally smaller. Individuals in this group are more likely to hang onto their jobs over time. But as a whole there're about 11 percent, on average, ten years after first entry into routine work. This column, it might be hard to read, it's cut off, but it's the share with low earners or earnings below 50 percent of the median. And what stands out to me is for the unionized routine group it's only about three percent of those individuals who have low earnings, ten years later, and that's lower than any other occupation category on here.

So, if you'll look at non-unionized routine it's about 11 percent. Even if you go up to the non-routine cognitive jobs you can split them out into their sub occupations, three percent, seven percent, five percent, all higher than this unionized routine group. And of course, you know, these more service sector type jobs at the bottom, about 20 percent for individuals who moved into these occupations or experience low earnings. Not much differences in terms of the age of these routine unionized workers but there are some differences in education levels. In particular, what this shows is that this group is much less likely to have a college degree, much more likely to only have a high school degree. So, when we think about pathways to the middle class for individuals without a college degree, this is more evidence of -- decades of evidence, that union membership might be important. Particularly combined with what used to be these middle pay type occupations.

What happens when we look at percent male and percent Y -- percent female? You can

see this also happens to be a very male group. About two-thirds of this group is men, only one-third women, and a bit more racially diverse than the non-routine cognitive occupations but comparable to the non-routine manual group. So, do these findings hold when we move to the individual fix effects model? So now, again, we're looking at within in person changes over time. On average, if you started routine work non-unionized but you flipped to unionization, does this have some effect on your outcomes?

The short answer is yes, and everything I'm going to show you here is consistent with what I've shown you in the prior slides. So, the effect of union membership on the likelihood of remaining in routine work for the 20 years after you're first in that routine job, it's about an 18-percentage point increase relative to the -- not being unionized. Decrease likelihood that you move to a non-routine cognitive job. Again, exactly what I've shown you before. Decrease likelihood of experience in unemployment during the 20 years after you were first in that routine job; about a five-percentage reduction, and a reduction in the likelihood that you experience low earnings.

If we try to account for selection into unionization, maybe these people who, you know, become unionized have certain characteristics that just fundamentally make them different than the non-unionized group. That could be driving our outcomes. So, one way to try to get around this is using propensity score reweighting techniques. In the paper, I don't show it here, you can see that this does a pretty effective job of achieving balance between the comparison and the treatment group at baseline. But it's not perfect. But what happens when we try to account for selection? Well, you see the points drop a little bit, by about one-fourth, but still fairly large and significant. So now instead of a 18-percentage point increase, union membership is associated with a 13-percentage point increase in the likelihood of staying in that routine job for a long duration of time. And similar stuff, unemployment and low earnings still at about five and four percentage point reductions, respectively.

In the paper I break this up by decade, I break it up by race, ethnicity, education levels, et cetera. I'm not going to spend time talking about those results but what you generally see is that the patterns are consistent across time, across education group, race, ethnicity, and sex as well. That's discussed more in the paper if you're interested. And there's another way to digitalize some of this, just using an event study specification type framework. Here, looking at the effect union membership, during routine work, on employment and earnings relative to all other adults in routine work. This redline here at

zero is the point of unionization. So, before you can see that the treatment group didn't have different likelihood of having low earnings or to be unemployed. But after unionization you see some pretty clear negative effects consistent with everything I've showed you in the prior slides.

So, some conclusions, some takeaways from this work. First, I find it interesting that individuals in routine occupations, who leave their routine jobs, typically are moving to non-routine cognitive jobs, not necessarily these non-routine manual jobs. In other words, they're often moving towards the sort of light-professional or light-managerial type occupations rather than lower pay service sector jobs. Which is perhaps a positive outcome because those occupations in the non-routine cognitive world tend to pay better than the routine jobs and especially the non-routine manual jobs. Very few are moving downwards to service sector jobs and the only reason I say downward is because they tend to be lower pay. And this is consistent with some prior work as well.

The second point here, we see evidence that routine -- individuals in routine jobs, who are unionized, tend to remain in their routine occupations for a longer duration of time. So, it seems that unions have some mitigation effect on the pace of employment transitions when new technologies are introduced. This unionized group tends to earn higher wages relative to the non-unionized group and they tend to be less likely to have low earnings or earnings that are below 50 percent of the annual median.

And this third point sort of summarizes that organized labor seems to play a pretty important role in shaping the pace and consequences of technological change. And I want to emphasize this point for a moment because I think so often when you talk about automation, or technological change, or globalization, we perceive it as these large, scary, exogenous, inevitable forces that are going to inflict some type of pain on certain members of society and that there's nothing we can do about it. But what I want to emphasize is that that's not necessarily the case. Worker power is one example, as I've tried to show here. But also, we can talk about welfare state institutions. We can point to other countries that, perhaps, do a better job at making sure when you lose your job you still have some basic level of subsistence until you get back on track. And all of these are policy choices.

So, to summarize, I think there's a role for policy. I think there's a role for politics and I think there is a role for worker power when we talk about the social consequences of technological

change. Now, we don't have some magic pill or magic wand to, you know, revive unions across the U.S., that's going to be a pretty tough job. But what we know is that union membership is not the only strategy for enhancing worker power. There's other strategies that exist. We can talk about selectorial bargaining as it exists in many other high-income countries. We could talk about anti-trust enforcement, we could talk about worker representation, wage boards. Gabriel was talking about this earlier in his Germany example. There are other countries that have been more successful in enhancing worker power, institutionalizing that, and not surprisingly, we see different types of outcomes in those countries. So, all of these are within the realm of possible.

And finally, my last slide here, there's still some things that are unclear or that need more work. So, it's not clear, at least in what I presented, if organized labor is slowing down the introductions of new technologies and that's why they're more resistant. Or is it that they're welcoming these new technologies but they're managing the introduction in a way that avoids layoffs and labor substitution. What are the actual mechanisms behind this relationship? I think that's not clear in my paper and more work needs to be done on that.

And moving forward, or course, there's plenty of work that can be done in this paper and I welcome ideas on how to strengthen identification to make a more convincing case for the causal effect of union membership or at least to test it. More attention to heterogeneous effects, race, ethnicity, gender and so forth, and I welcome any ideas on how to improve upon this work. So, thank you all. (Applause) Should I sit here?

MODERATOR: Yeah, yeah.

MS. REBER: Okay, does that work? You can hear me? Okay, I need to have my hands available for the presentation. So, okay, so thanks to Marcus for the opportunity to read this paper and to Zach for writing it. So, I'm just going to start. Having seen the discussion this morning I'm glad that I made this figure. So, just to remind us what's been going on with union membership in the United States, probably many of us know this, but it's been declining a lot and by about half since 1983. And actually, this is a continuation of a longer-term trend since about, looks like about 1950. But particularly the private sector unionization is really very low. So, a little bit more workers would be, sort of, covered by a sectoral bargaining agreement but -- or by a collective bargaining agreement but, you know, we -- unions have

really declined over the years.

So, let me talk now about what this paper is doing. So, he's focusing on the experience of workers in routine occupations that, you know, sort of have been identified as particularly likely to disappear with automation. And really, he's asking, using the data from the PSID which follows workers over time, so this nice data work to ask, what are the trajectories of union and non-union workers in these routine occupations. And so, basically, he's asking what are these workers doing, two, four, six, ten years after entering a routine occupation. And you know, this is with a background of asking whether unions might slow the pace of displacement in these automation prone occupations.

So, Zach did a really nice job of summarizing the findings in a clear way, so I won't spend a lot of time on this. But just to recap, unions workers are more likely to remain in routine occupations over time, they're less likely to be in non-routine cognitive occupations. They're less likely to be non-employed and they're less likely to have below median income. So, this raises, sort of, the question of whether these are better outcomes or worse outcomes. So, you know, transitioning to a non-routine cognitive occupation, like we might generally consider that to be a good outcome. So that's, you know, maybe moving into a professional occupation or something like that. And, you know, staying in a routine occupation is stable but maybe that is not a great trajectory. But I think it's pretty clear that having low income is bad and, you know, being unemployed in the sense of trying to find a job and you can't find one is a bad outcome. But being non-employed, you know, potentially being out of the labor force, is less clear whether that's a bad outcome.

You know, I think we can cover the sins of economists and, you know, one is ignoring the value of things that people do when they're not working and, you know, we can make a judgement about video games and raising children but they perhaps have some value. So, I think that the version I read -- it's not clear whether the effect on low income is driven by non-employment or not. Because if you're not employed, if you have low wages, so just to sort that out a little bit of that could -- that might shed some light on that. But I think, you know, this paper presents a lot of findings consistent with, you know, what we've seen in other work that union jobs, you know, are good jobs. They're more stable, and they're higher paying and so this is consistent with that. And I think, you know, it would be worth, kind of, getting at this non-employment angle and I'm going to return to this in a minute. But I think that that is a clear

finding of the work.

So, a few caveats about the paper and potential extensions or areas where he could emphasize more. So, you know, in doing this type of work and trying to understand what's the effect of being in a union on these various outcomes, we're going to worry about whether there're a difference between union and non-union workers. And I take the point earlier but maybe we shouldn't call this skill, but there could be differences in these workers and, you know, sort of their -- the tasks that they're doing and whether those are, let's say, well remunerated by the market. And, you know, he's controlling for age, education, sex, race, state, and year and so education would be sort of your main -- doing the main work of, kind of, thinking about this selection on what tasks or skills task people are doing or skills they have. That might be pretty blunt in this context. So, I think, he could potentially include some other controls related to the occupations that people are doing in unionized and non-unionized.

And also, sort of related to this, and to the possibility that unionized and non-unionized workers are doing different things or have different skill they're bringing to the labor market. And also, to non-participation, I think it would be really nice to divide the analysis by gender and not just control for gender. One, because -- and primarily because I think it is really important, this has come up a few times this morning that women and -- that women's experiences and men's experiences in the labor market are very different. Their trajectories are very different, and I'm not sure it's, sort, of can be handled by a gender control as opposed to doing a separate analysis. So, I think we'll get a more reliable kind of picture if we do that. But I also think it's just very interesting because we know that men and women are doing different work and have different patterns of labor force participation.

So, this is just one way of seeing that. So I'll admit that I didn't want to deal with the occupation codes but you can kind of get an idea that men and women who are in private sector unions are doing really different work. So, and also, I don't have it here but the unionization rate for women is also quite a bit lower and its lower conditional on industry. So, there are, you know, a lot of differences by gender. So, these are the industries -- the top industries that men and women union workers are in and so you can see that -- oh I can't point -- but the biggest group for women is professional services and like half of that is hospitals. And then, for men, you have manufacturing, transportation, communication, public utilities and construction. So, I think just, in having heard the discussion this morning, I think we

think about this as a male thing and the -- you know we're thinking about manufacturing and these kinds of things and it's important. Not just for this paper but in general to be really looking at the gender difference and then the labor force participation patterns are also going to differ a lot. And so, I worry a little bit that that could be playing into the findings he has looking at non-employment.

Okay, so, thoughts on overall on the paper. So, I think, you know the question is will unions slow displacement in the face of automation? It seems like maybe a little bit at least, you know, at the level of individual works. They're -- those jobs are more stable, they're less likely to get displaced. So, then we need to kind of think about, well what are the costs and benefits of that? Like, is that a good thing? And, you know, normally one of the things we think about when we think about unions is well maybe they raise wages of incumbent workers at the expense of potential new trends.

Now, in this case, that's a little bit less of a concern because if you have an occupation or an industry that -- where labor demand is declining because of automation then, you know, maybe this is a way that we kind of protect the incumbent workers transition. But we don't really care so much that new workers aren't coming into that, you know, into that occupation or that industry because it's kind of, you know over time, being displaced by automation.

And I think, you know, a really important thing to think about for this paper and in general is this question of, you know, do we want to be preventing displacement or do we want to be helping displaced workers? And you know, again, while we're doing economist mea culpa's I think, you know, as a discipline we have focused a lot on this idea that, well let's let the creative destruction happen and technological change will happen. And we shouldn't interfere with that process and then let's have policies that sort of deal with the consequences and, you know, provide income support for students -- I'm an education economist so not students, for workers who sort of lose out in that process. And, I think you know, one of the things we're learning that, you know, maybe lots of other people already knew, is that the cost of displacement sort of go beyond the income loss. And you know, so maybe that argues for in favor of sort of supporting approaches that would actually delay displacement as opposed to trying to adjust dealing with the consequences of that.

Now, I think though, you know, these aren't mutually exclusive in, you know, my view is we need to be doing a lot more to deal with the consequences because, you know, it's happening and

there's always displacement that happens in the economy. So, the question, which I think you got at, at the end is, like, well what role can unions have in, you know, sort of dealing with the consequences of automation? And you know, first I was like well, you know, unions we don't really hardly have them anymore so the role -- it can't be, you know, it can't be a huge role. But I think, you know, I guess it just depends on whether you think that that trend can be reversed. Which, you know, I don't really have -- it seems difficult. But, I think that would also be very good for a number of other reasons and, you know, the fact that the rate is so low suggests that if you were able to bring it back up, you know, maybe there would be some benefits there and I think those do actually go beyond the effects on displacement in the face of automation. But there's a broader set of potential benefits for middle and working classes that would be associated with that.

And I had another point that I thought I wouldn't have time for but listening -- hearing the earlier discussion and I have three minutes. I think another thing the paper raises, and Zach's presentation really brought up, is we should really be thinking about institutions more broadly. So, you know, this paper is looking at union membership and I think in the paper you could -- you say you could do an even clearer job of saying. It's like well, we don't know that these are the effects of union membership per say, but there may be other institutions around, sort of, other things related to union membership that matter. And then, just in the policy discussion, we can think about these other kinds of, you know, labor market institutional features like minimum wage and sectoral bargaining and kind of other things that might have similar types of effects as union membership, per say. Thanks.

MODERATOR: Okay, thanks Sarah. (Applause) So, we're going to take some questions and -- but I first want to get my question in. Actually, Sarah's last point was actually my first question for you. Is the idea of what does unionization really represent? It's represents some set of institutions and so can we think of different ways in a world where unionization itself is seen as kind of, in many respects, pas say in some corners. You know, can we replicate some of the really nice features of unionization if we think institutions matter for some of these things? So, that's my first question. I'm going to go around the room, take about two or three questions, come back to Zach and Sarah and then I think we will have enough time for a couple of rounds here. So, you first, sir and then --

SPEAKER: I think I'd like to elaborate perhaps on your question but is there a way to

segment unions between those unions who are essentially, you know, negotiating wage pensions and maybe those which are engineering or craft-based and are actually asking for skills upgrades of their workers. Which I think Germany does. I go back Adam Smith who actually said lifelong education was more important for the factory workers so that life was spent not just doing menial things the whole time. And, you know, at the end of the day there's so much work to be done to develop communities, to develop families. All of the things that are common and don't sometimes count but otherwise it's self-fulfilling. Because if all the unions are only just negotiating wages and pensions then we're not, you know, being able to look at the second type which is maybe what is needed.

MODERATOR: Great. Okay, Jim and then Richard. Yeah, Jim.

SPEAKER: So, this is a comment rather than a question and it probably applies to the previous discussion, also. We need to be a little careful about identifying changes in jobs for routine workers with automation. That there are other things that effect those jobs. For instance, people bring up this; secretaries and typists being automated away. If you look at technical studies, automation only reduces the amount of retyping that takes place by about 20 percent. It doesn't explain what happened. What really happened was a shift of jobs -- of work from typists to managers and professionals. Similarly, the travel agent wasn't automated away, it was a shift of work to the consumer. So, you know, when we think about unions or when we think about macroeconomic policies, we need to think about the other things that are going on and affecting routine workers aside from just technology.

MR. HECKER: Henry Hecker, I'm retired government and I wondered what your feelings were on the closer of the Lordstown, Ohio GM plant. I had contacted a Senator from my state in Virginia in hopes that it could be continued to remain open and to redesign the Impala and the Cruz into electric vehicles or into hybrid vehicles that would permit the thing to stay open because of the new type of vehicle. Some, I think, is a lack of imagination on the part of a lot of management in these top companies as far as job redesign, product redesign. As opposed to simply introducing automation as a way of redesigning a plant. They are going to build electric vehicles there, now. But it'll be another company as electric pick-up trucks. So, it's not a total disaster. But for the unions of GM that were working there it is quite a disaster. Something that probably could have been prevented if people had stepped in and tried to, you know, take up the bat and try to turn things around.

MR. REEVES: Clarification before a question because the question will be redundant if I misunderstood this, Zach. But I think your estimate showed that only is being a union member associated with a lower chance of becoming non-employed but also a lower chance of moving into a non-routine cognitive occupation. If I read --

MR. PAROLIN: Yeah, that's right.

SPEAKER: -- the chart correctly. So, by using the terms loosely downward and upward mobility, right, with all the caveats that apply to that suggests that unions reduce the risks of downward mobility but also reduce the chances of upward mobility. It's not clear on its face that's necessarily a win. It may well be that more flexibility and more dynamism is quotes, forcing more people to move on and therefore up rather than remaining in place. You know, the assumption that stasis is good rather depends on the counter facts. So, I just love your commentary on the lack of quotes upward mobility you also find among union members.

SPEAKER: Yeah, actually, just a direct reaction to that. I think that's in part, also, a problem with the unions in the U.S. of having a sort of very keeping a status quo and not really looking forward but that's besides the point. I had one -- sorry, I had one question and one comment and maybe a suggestion for an inclusion in your research. So, one thing that I noticed was you broke it down in two different decades and I was wondering whether the data that you are using also permitted a breakdown according to different sectors and more than just a decade. Because what I think what would be interesting is to see how the jobs developed through different sectors, specifically the service industry versus the manufacturing industry. And in particular, the effects during the crisis of 2007, 2008. Because what would be interesting, and I'm not sure if it's possible, but what some data, for example, from the Metropolitan Statistical Analysis Data from the census suggests ia that manufacturing industries have been a lot more stable in terms of employment and in terms of incomes -- excuse me -- over the years of the crisis. So, that would be interesting. I'm not sure if that's possible.

But overall, I think the research that you present is really interesting. I think, in fact, you should turn it into the ALFCIO, they could some evidence-based research. But, I think, if I were to play devil's advocate here and take the position of a company, I would say well that's really interesting and that's great but, you know, unions have a negative effect on companies, right? That's what they will claim

always. So, I think what would be an interesting addition to your research to emit that would be, and I'm not sure, it's just a suggestion of out the blue. I'm not sure if it's possible with data, maybe not with that data set that you're using but maybe it's possible with different data sets, to see whether the unionization actually has an effect on companies and on their economic development. Because if it doesn't, then there really isn't any reason why unions could be or should be bashed in the U.S. if they, in fact, have a positive on workers, on purchasing power long term, and on basically a stronger middle class.

MR. POLSER: My name is Karl Polzer and we are supposed to identify ourselves. I have a small project called the Center on Capital and Social Equity Study and Equality Advocate for the bottom half, don't care too much about the top one percent. So, my question is kind of a follow-on to Richard's. So, I understand the time frame of your study is ten years. So, what if you look a little further and this has to do with the paradox of yeah -- well here's the idea. Maybe the short-term benefits of union membership, you know, payoff in ten years and keep people in unions. But if non-union members are more an incentive to retrain. So, are there, if you look out further, you know, so they might be doing better off over -- because they got a professional job, or they were forced out of a dysfunctional professional.

Like, my grandfather's Austrian, not Schumpeter . He was a typesetter and he was a refugee during World War II. So, I've seen his union booklets. If he had really -- he died before computers came in. But if he had been a typesetter in the 70's he might have kept being a typesetter if he was a young man. And then the computers came in and wiped out the whole back shop of newspapers. So, if he had an incentive to change and, you know, he was very intelligent, he could have -- anyhow, blah blah blah. But that's the kind of thing. Does it -- if you look further into the future, you know, you might see the non-union members doing better because they had to adapt. Or just an idea to research.

MODERATOR: Okay, so we have comments on institutions, you know whether we should be not just focused -- unions shouldn't be focused on just wages and pensions. We have comments on management and how management can potentially mitigate some of the harms associated with plant closures. Richard's question on upward mobility questions if -- I guess the way I take that question is that, you know, unions compress the wage distribution and also mobility from the way we

typically measure and is that necessarily a win. And that actually plays into this gentlemen's question about dynamism and then Yasmin's question about --

MR. PAROLIN: Sectors.

MODERATOR: Right, sectoral differences. And you can address her comment as well.

MR. PAROLIN: Okay, thanks a lot. A lot of questions. I'll try to get to all of them or at least the ones that I'm capable of answering. I'll start with the first question; can we replicate the role of the unions through other mechanisms. We know that we're not, probably not, going to see some great turnaround in union membership anytime soon but can we, sort of, replicate some effect in other ways. And the short answer's yes because many other countries are doing that right now. I'll point to some examples. You look at a country like France, very low levels of unionization there but high levels of collective bargaining coverage. Many other countries in Europe have the exact same features. If we were to move to some system of sectoral level bargaining, then it's not union membership that matters, per say, but the fact that the extensions of these union agreements reach everyone who's working in this particular sector and this particular geographic area. And that's another way to extend what unions provide for workers who uncover that sense of worker power in some decent -- general standards for labor protections and the earnings distribution.

A question -- I'll go to Richard's question about upward mobility. Please.

MS. REBER: Is that because you think it's politically -- I mean, it seems to me a political issue both of these, right? So, like, you think it's politically easier to get the kind of policy that extends, you know, coverage to a broader set of workers than it is to revive unions?

MR. PAROLIN: Yeah, I think so, that's part of it. It's politically easier and from a collective organization perspective, it's a little bit easier as well. So, unionization in this country and the efforts to revive it are difficult for a number of reasons. We have firms that are very hostile towards collections of workers who try to organize. EPA -- EPI had a statistic yesterday in a new report showing that employers are charged with violating federal labor law in about 42 percent of all union drives. I mean, firms are very hostile to efforts to unionize in this country and I don't know how we're going to overcome that other than through some large policy changes like a move towards sectoral bargaining is my general sense around it. But, you know, open to counter perspectives.

To the idea that unions sort of promote this stasis, they don't allow for individuals. Well, what we see in the data is that if you're unionized you're less likely to move into one of these professional managerial type occupations. But what I would emphasize is that when we look at the share of workers who have low earnings within this unionized group, it's actually lower than individuals who moved into those other occupations. Now, if you look at mean incomes maybe it's a different story. People in these professional jobs might earn more. But for those of us who are, perhaps, more concerned with life in the bottom half of distribution. Just ensuring that they have some decent earnings in place. You see that unionized group does pretty well, in fact, better than all the occupation types ten years later. So, you know, from a sort of occupational status perspective, perhaps, yes. You know, it's limiting upward mobility. But from a financial well-being perspective, I think this group is doing okay.

Yes, Jim's point about, you know, is this really automation and what other factors are at play, I think, is really well taken. You know, one other example, I mean, his point is right on. But another example I could throw in is this due to automation or globalization or how do we really distinguish all these macro-factors that are playing in. I don't in this paper expect, you know, looking at routine occupations as though they are the most vulnerable to automation but there's a million other things going on. And I think the point is very right.

Breaking out into sectors or industries, I think it's a really good idea. One challenge in this particular data set is that there aren't very good industry codes -- sector level codes that we can use. In other sources of data, the CPS, et cetera, those are there, and we can test some of the IDS in a different way but just not in the PSID which I'm using in this particular study. I also think the idea of narrowing in on the recessions and seeing what happens during those time periods is particularly important. I know Henry and others have done work on this and find that it does matter when you look at those particular time periods.

I have no smart thoughts on whether GM should have closed its plant, et cetera. All I will say about GM right now is that, you know, we saw a brief return in workers exercising their ability to strike and that was something quite interesting. If you look at trends and strikes in this country, I know that from the 80's onwards it's been incredibly low. But, again, we can look cross nationally and see the power of organized labor come together in expressing their concern. If you looked at Finland in the last two weeks,

if you looked at France right now, regardless of whether you agree with their perspectives, you have to admit that they're pretty successful at letting their displeasure be known. Strikes are important.

Negative effects on companies. Agree it's really important to test. I can't do it in this data and dynamics long term effects really important point, and I'll give that more thought in the future.

MODERATOR: Sarah, you have anything to add or comment on?

MS. REBER: I think that you covered it really well. Just to add one thing to the question of, you know, this movement into non-routine cognitive skills. Like, I think, you know, one question that's hard to get at here is what's the value of the stability? You know so, obviously, you know, upward mobility might be good but then, you know, these jobs may be less stable or so I think, you know, we're seeing -- part of what we're seeing here is that the union jobs are more stable. But I think maybe you could look at that more directly. Like, I don't know if the PSID has job tenure so you could see whether people are staying in the same jobs.

I think that there could be selection happening that explains that finding so I would encourage, like, pushing on it a little bit more to make sure that it's not just the kind of people who enter non-routine unionized jobs. Those are just like different jobs with different paths than the union ones. I mean, to a certain extent, if that's true and they really have the same skill content that's, you know, getting at what you're getting at. But I think, you know, unpacking that a little bit. And you know, one of the most striking things is in the paper is from the individual fixed effects analysis where you see when people transition into unionized status which he refers to as joining a union.

But it could be, and I suspect often is, associated with a job change. And we had a conversation offline that the ability to see what that change -- to see inside that job change might be limited in the PSID. But I think, you know, to the extent that you could say something about that and in maybe in other data like understanding what those transitions look like might shed light on, you know, sort of where some the these effects are coming from. Because there's this huge immediate decline in the probability of becoming un-employed when people transition in to unionized -- you know, become unionized. But that could be changing jobs and so I think it's just -- it's very big and it's very immediate. So, I think it's -- to unpack that a little more might shed some light on that.

MODERATOR: Once again, Sarah anticipated my next question. So, I wanted you to

talk about that issue and she kind of laid it out. This issue of treating, you know, joining a union as an absorbing state, right. And I'm really worried about the idea because there could be job changes, there could be law changes, right; in the geography, wherever they live. And so, part of the reason why you might get variation in union membership is just because of, sort of, environmental changes or job changes, not necessarily something about their act of choice. So, I wanted you to push on that a little bit more. So, any additional questions?

SPEAKER: I just want to address the question about the AFL-CIO if you think they don't have the evidence-based policy are you comparing it to the Chamber of Commerce or the National Association of Manufacturing? And if you want to know whether unions have an adverse effect on employment or firm, there is a lot of research on that, you ought to look into it. And I would suggest that maybe you contact Bill Spriggs, the Chief Economist at the AFL-CIO, who recently was the Chair of the Economics department at Howard University and he'd be glad to provide you with that. Alternatively, if you come from Germany, you might look at the evidence on co-determination and I think all the evidence on co-determination is that there's a very positive impact on firms. So, I think your condescension is very misplaced.

SPEAKER: I don't know if you caught that I said I was devil's advocate in this case.

MODERATOR: Sorry about that.

SPEAKER: So, I wasn't actually suggesting this.

MODERATOR: Yes, sir. There you go.

SPEAKER: I'm surprised right-to-work states haven't played into this conversation yet. I mean, it's a big deal, right? I mean sometimes you just don't have the opportunity to join a union because they're not promoted.

MODERATOR: That's essentially what I was getting at about the question about the environment change --

SPEAKER: Yeah, right.

MODERATOR: -- not necessarily choice changes. Martin, did you have a question?

SPEAKER: I have a follow-up example I wanted to clarify what concerns me. So, the education group of Brookings, one of the cases they were presenting a couple of months ago was on

Bangladesh women's garment workers. Now, if you know Bangladesh that is actually their main exports sector and it's a main sort of of-value thing for the whole garment. But right now, the problem seems to be that the textile industry is going through a lot of technological change. So, if all you did was try and protect the current workers' wages as opposed to upgrade their skills and give them more training, you will actually bankrupt the nation and bankrupt the women's empowerment in Bangladesh.

So, you have to be careful in terms of, you know, only arguing for protecting the wages. I am not clear that what is happening in France is actually going to be good for France, but then I don't know. But the case of Bangladesh I do know what is desperately needed is more training so that they can stay in the smart part of the textile sector and that's why I'm concerned for the second type of union which actually requires the training to advance the worker into the new kind of sector.

MODERATOR: So, any last questions? Okay. Well, thank you Zach and Sarah for great discussion, (Applause) great paper and now we'll have lunch and we'll have our lunchtime speaker at 12:30.

MR. REEVES: No, 1:05, but on the dot.

MODERATOR: Oh, 1:05, I'm sorry. I can't read anymore. Sorry about that.

(Recess)

MR. PAROLIN: All right, we're going to restart. Thank you all for being so prompt, I hugely appreciate it if you could take your seats now. It's now my great pleasure to welcome -- is this working? Yeah, okay. That was my way of saying, shhh. It doesn't appear to be working, because everyone's still talking, even though I'm talking.

So, it's my great pleasure now to welcome our lunchtime Keynote Speaker Ryan Avent, who is Senior Editor and Economics Correspondent with The Economist. He's risen up through the ranks of The Economist, ending up as News Editor in -- from 2015. Author of many interesting articles and books, most recently and perhaps most relevantly, his book, The Wealth of Humans: Work, Power and Status in the 21st Century.

Ryan is someone who's thinking and writing a lot of the intersection of public policy, economics, and some of the issues around power that we've been touching on today. And so it's with great pleasure that I'll introduce Ryan, who's going to speak to you for 15 minutes or so. And then we'll

have 10 minutes of Q&A. So, please join me in welcoming Ryan.

MR. AVENT: Thank you, Richard. Am I appropriately amplified at this point? Can everyone hear? I'll take that as a yes. You guys are all busy eating your lunch. Move it a bit up, yeah. How's that, any better, no?

Well, thank you very much, Richard. It's very nice to be here. As a journalist, I get to get up here and make sweeping statements without necessarily showing my work, which is fun for me and hopefully interesting for you and a bit of a departure from the rest of the proceedings. But as I was thinking about what I wanted to talk about here today, I was thinking to myself that if we are interested in shoring up and enlarging and reestablishing a strong middle class, and we very much ought to be, that it's useful to recall how it was then we ended up with a strong middle class in the first place. And this will be history that I know a lot of you are familiar with. But it's worth reflecting on and considering.

And if we want to think about the Golden Age of the middle class in America and across much of the rich world, we're going to be thinking about the period from sort of the 1950s to the 1970s. This is an era where there was rapid, broad based economic growth. We had a very compressed income distribution. There were high levels of intergenerational mobility. It was not perfect by any stretch of the imagination, but in terms of delivering sort of egalitarian prosperity and opportunity, it was kind of the high watermark, I think, in a lot of ways.

And that's interesting to me, and it's useful to think about how we got there because it wasn't at all an inevitable outcome. It wasn't something that was baked into the cake when we started to develop the key technologies of the Industrial Revolution. In fact, it took quite a lot of luck, it took quite a lot of work, quite a lot of doing.

And so what were the key components? What were the key sort of pillars of social infrastructure that allowed us to develop this successful middle class? One certainly would be education. You think about the massive public investment that went into education to get us to the point where we were in the decades after World War II. There was the push first for universal primary education.

Then for secondary education in America, in the first half of the 20th Century, you had the high school movement, which increased the number of young people going to secondary school from about 10 percent or so at the beginning of the century, to 75 percent by the start of World War II, which is

just a phenomenal increase in the human capital of the workforce.

You had the creation of lots of institutions of technical research. I think one of my favorite pieces of American policy in the country's history is the Moral Act, which produced the Land Grant University systems, one of which I'm an alma mater -- sorry, is my alma mater.

And these were just phenomenally, I think, ambitious institutions in that they were specifically charged with developing new and useful techniques in agriculture and manufacturing. And then also making sure those techniques were diffused out across the people actually doing the work across the countryside.

And then, of course, you had things like the GI Bill, which I think is one of the pillars of the postwar middle class that allowed millions of service members to go and get a higher education to get some sort of post-secondary training, and to set the stage for the rapid growth of the postwar period. So, you had all of these massive pieces of public investment in education. That was just one component though of how we got to the point where we were in the '50s and '60s and '70s.

If you look at the distribution of population, at the beginning of the Industrial Revolution it was dramatically different from where we were in the postwar decades. There was a huge increase in urbanization. Urbanization alone did not lead to a high level -- a high quality of life for the middle class, though it took quite a lot of additional investment in public infrastructure and housing to get people out of slums and tenements.

And water and sewer, utilities, so we could get rid of the sort of the terrible diseases that made cities such killing grounds in the 19th Century and public transport. And it was because of all this these sort of public works, that we were able to generate that midcentury quality of life for so many people.

And then I think if we think about the composition of the middle class in the decades after the second World War, it's clear that a fair share of the workers were white collar professionals. That was -- it's been a growing piece of the middle class over the second half the 20th Century, but there was also quite a large share of people in that group that were blue collar workers, semi-skilled and earning good wages. And the fact of the matter is that those jobs didn't become like that on their own. That it took decades upon decades of organization on labor, of political mobilization to build a labor union movement.

And that labor union movement was important, both because it did negotiated directly with firms. If you're thinking about pillars of the postwar middle class, certainly you want to think about things like the Treaty of Detroit. But also because it was there as a political force during other progressive reform movements that supported other contributors to the development of the middle class.

There were other things that government did as well. There was sort of aggressive antitrust enforcement at times. There was a setting of standards. The funding of research. And the list goes on and on, but I think the important thing to remember is that there was a vast amount of public reform, public investment that went into the construction of this postwar sort of Golden Age.

Now, what would the rich world have looked like in the absence of all of that? What would America have looked like if we hadn't been able to do all of that? I think it would have been much more unequal, certainly. It would have been less educated, less urbanized, quite a bit poorer. Perhaps quite a bit more politically volatile or unstable.

I think if you're looking for comparators, you might think about other new world countries that were land and resource rich, but where the states didn't necessarily develop the same capacities and make the same public investments. When you think about large Latin American economies and those places aren't, they're not awful places to be, but they're certainly a far cry from the kind of economy that we were proud to have in the sort of midcentury America.

And I think also you may see echoes of the modern economy just a bit, as we think about those sorts of dynamics, rising inequality, people not living in the places where the most productive, best paid jobs are. It seems clear to me that we are moving in a direction that's not necessarily one we'd like to see.

So, what does this experience tell us? Well, I think you might say, it doesn't tell us a whole lot. We know that it was important that we invest in education, we know it was important that we made our cities habitable, and developed worker protections and built a welfare state. That was all really good that we did that.

But now we've done it and so whatever else comes down the road, we're going to be prepared to handle; we're equipped to take on these new challenges. And I think that probably just doesn't hold up in a few ways. And certainly if you look at the economic trends over the past few

decades; if you look at the eutrophication of the middle class which is sort of a focus of this initiative; if you look at the diverging performance of many regions of the economy relative to the kind of superstar cities that are increasingly inaccessible to all but a rich few; if you look at declining life expectancy in sort of a shocking development these days, it seems clear to me that the institutions that we had developed to manage industrialization, and the associated technological change of past eras aren't doing the job we would want them to do.

And I think actually that's completely to be expected that there's really no reason to think that a set of technologies and a set of sort of production processes that evolved in one context would have the same effects on society, or demand the same sorts of government interventions at all. And I think we should expect that there's going to need to be radical reform, radical updating of these pieces of social infrastructure. And the more optimistic, I think, and hopeful you are about the potential of new technologies, be they AI, or robotics, or genetic engineering, the more you think those things are capable of transforming society for the better, the more radical you need to expect changes in our social infrastructure to be.

So, if we think that's right, then what are the lessons we ought to draw from this past experience? Well, I think the first one is that the changes in social infrastructure, the development of the welfare state, and so on that led us to the postwar middle class, these weren't simply incidental things that happened along the way that happened as industrialization unfolded. They weren't simply nice things that we were able to afford because we had new and more productive technologies.

They were actually critical contributors to the success of the postwar economy, to our ability to unlock the potential of new technologies. When I'm asked about the digital revolution and what's going to happen, the two questions I get most often are, one, how do we prevent this from doing grave damage to workers, and, two, if these technologies are so powerful, why aren't we seeing rapid growth yet because of them?

And I think really those questions are two sides of the same coin. It's because we are not necessarily making the investments that we ought to be making to allow people to benefit maximally from these new technologies, that we aren't realizing the growth that we would like to see from these new technologies.

Along those lines, I think we need to allow ourselves to be more open to radical ideas. And I think that a lot of people having watched politics in America unfold over the last decade or so would say, we're there. We're very much there, as we're thinking about kind of ripping up the old global trading system. As we think about some of the policy proposals that leading Democratic candidates have, but to be perfectly honest, I'm sort of a little bit bemused when I see leading Democrats arguing about the virtues of free college, relative to the sorts of things that we managed during the Industrial Revolution, relative to the colossally ambitious and optimistic policies like the Moral Acts which led to land grant institutions and so on.

It's the Moral Acts were signed in 1862. I kind of love this. Over the summer of 1862, Lincoln signed into law the first Moral Acts, setting up these institutions. A bill to finance the Transcontinental Railroad. And the Homestead Act, which ended up giving massive amounts of western land to some two million American households.

That's radicalism, that's boldness. That's sort of thing that sets the stage for an egalitarian economic revolution to come. And I think that we're nowhere near getting to the point where we're really allowing ourselves to consider such things.

Now, having said that, if you -- you may agree that we do indeed need to think more boldly about the sorts of things that we can do to unlock the potential of the digital revolution. But we all read the newspapers every day, and we all know what the government in Washington is like. We all know that however successful a Democratic candidate may be, for example, that when they win the presidency, they're going to potentially face a hostile Senate, a court system that may not be willing to uphold a lot of the sort of bold proposals that they'd like to enact.

And that's assuming that they can get agreement within their own party on what ought to be done. So, there's just an extraordinary amount of dysfunction. Why even bother thinking about radicalism? Why not just focus on incrementalism and hope we can make small changes along the way? And I think this is probably -- this probably gets to the most important lesson of the creation of the American middle class, and the American sort of economic growth story. Which is, that it isn't, in a lot of ways fundamentally about economics. It isn't necessarily about policy, but really it's about power. It's about developing a politically mobilized working class that is capable of exerting power on the national

political stage.

And that is -- that's a hugely important development for a few reasons. And I think that if we were able to replicate it, it would in the future, be important for a few reasons. One is that you need, I think, to have that sort of power on the other side of table when you're dealing with pain negotiations, when you're negotiating about how technology is going to be used about what the benefits situation is going to be within firm negotiations, you need to have unions there to make that case.

You also need it in the political arena. I think there's an awful lot of people now who have sort of decided that the way to get Nancy Pelosi to do what you want to do is to tweet at her a lot. And I think fundamentally, that's not going to work. That, in fact, you need to be able to marshal political resources to say that we need you to spend money this way and our support is going to be contingent on you taking these necessary steps.

But beyond that technological change, especially revolutionary technological change, raises a lot of really important societal questions. Questions that go beyond economics. Questions about what we think a high quality of life is or ought to be like. What we think ethical uses of new technologies are. How we want technologies and business to interact with our political system and these are the sorts of things that need to be resolved through a broad and open social discussion. And I think the historical record shows that it's difficult to have those broad and open historical discussions without institutions in place to aggregate and amplify the voices of working people.

You don't have those sorts of things, you have a very incomplete discussion; you have very problematic discussion; and no offense, the people gathered here, you have a lot of elites in rooms talking about what they think is going to be useful, when in fact they may not quite have the answer. And so I think when I think back to the book that I wrote in 2016 about how technology was going to interact with the labor market institutions, I sort of chuckle ruefully. Because I kind of got to the point where I thought, you know what we really need are modern labor unions. But sadly, they don't exist anymore. And of course, because I've had all this economic training and indeed experience at The Economist, it seems quite likely that if we did have them, they'd bungle things anyway.

But over the past three years as I've thought more and more about it, I've come to the conclusion that really the creation of the American middle class in the 20th Century, and indeed, I think

the creation of most of the things about our modern economy and modern society that we hold dear, it really would not have been possible without a mobilized working class, without organized labor, without that voice in the discussion.

And I know it's quite difficult to imagine how we could recreate that, but that doesn't mean it's not indispensable. All right, I'll leave it there and take some questions. (Applause)

SPEAKER: (off mic)

MR. REEVES: And yet that's okay, just to get more voices in the room. So, I'm going to take the gentleman here behind me. Is there a -- is the handheld microphone available somewhere? So, why don't, yeah all right, you can come on down and do that and then I'll -- push, there you go.

MR. DEREK: Is it on? All right.

Hey, Ryan. My name is Alex Derek with Fahee (phonetic) based in eastern Kentucky. And sometimes I get the pleasure of coming over to Brookings when I'm around and I'm not in the region. And I just -- and sometimes I've been a little critical of lacking the perspective here.

But I just want to say that I'm really impressed with this event today, and particularly with your remarks, and a frank discussion about political power. Because if you go out into places like where I work, you see how important and what a difference it makes. And so I just want to thank you and comment positively on the event today. Thank you.

MR. REEVES: Yeah I called on you specifically because you always attack us, and I wanted to be evenhanded. I don't know what to do now. Okay, the gentleman over there, and then the gentleman over there and then we'll maybe come back to Ryan.

SPEAKER: Ryan, thank you so much. My name is Daniel. I work for the OCD here in Washington D.C. Very interesting to hear you mention about what needing a broad and open social discussion taken into account the huge polarization, not just here in the U.S., but also -- I'm Irish myself, we don't have it too much, but in western Europe and just the western world. Huge polarization, and us versus them, and there's real tension between groups who actually should be working together because they're in the same boat. But because you wear a red tie, I wear a blue tie, whatever, red socks, blue socks. And how do you get that discussion? How -- and can -- taken into account disinformation tactics. Taken into account the virility of fake news and false information. How do we go about that, whether is it

through government, is it through private sector? How does one do that? Thank you.

MR. REEVES: Thank you and over here. Yeah, the gentleman there, press the button in the middle. There you go and then speak right into it.

MR. COCHETTI: Yes, my name is Roger Cochetti, I work with private equity in the technology sector. And I wanted to go back to something you said in the introductory part of your comments. And that is, in addition to the distribution of wealth within societies, one of the things that has been striking is the geographic distribution of the benefits of technological development for hundreds of years. And I was what -- for instance, you mentioned Argentina and there was every reason to believe at one point that Argentina would be an economic superpower and the United States would be a second class economic power. And yet the reverse has happened.

And if you look at the western Balkans and the Alpine sections of Europe, you would say that the explanation for the vast differences in distribution of wealth and technology and the benefits of technology, it's not explicable through geology. Because oftentimes you're looking at you geologically similar. It's not the difference of ethnicity, because oftentimes it's very similar, if not identical ethnic stock. And to bring it down to the United States, you can find sections of the northwest part of the United States and Appalachia which are vastly different experiences, even though they are geologically identical, ethnically identical. And yet what accounts for the geographic distribution? And I think if a Martian were ever coming down, that's the first question they'd ask --

MR. REEVES: You mean within the U.S.?

MR. COCHETTI: How does this happen --?

MR. REEVES: Do you mean within the U.S. or between the U.S. and other countries?

MR. COCHETTI: Well both --

MR. REEVES: Okay.

MR. COCHETTI: I mean it's the same --

MR. REEVES: Okay --

MR. COCHETTI: -- it's the same issue.

MR. REEVES: I'll draw you to a close there, just because in the interest of time. And I

think it does connect with the first comment about geographical disparities that you mentioned. I'm going to cheat and add my own as well. Sorry to everybody. But I think this idea that it was a choice and not chance that we developed this middle class is strong, when you talked about a social infrastructure that supported that, that was a phrase you used. And we need to be more radical about that. Just in the interest of being provocative, it seems to me you could argue that the political right has always resisted the idea that you need a social infrastructure, you just need a free market.

But that the left maybe wants to just reinstitute the old social infrastructure that worked before, rather than create a new one. A, would you agree with that way of framing it? And if so, what is the new social infrastructure that we should be pushing for and that you seem to want us to radically call for? So, I won't summarize because you're a journalist. So, you got all that, if you miss anything, I'll let you know.

MR. AVENT: Okay, so polarization. Well, first thank you, appreciate it. Polarization -- so, I guess there's a couple ways to answer that. One might be sort of a Marxist way, which would be that if you think about the sort of racial divisions that kind of prevent certain working class solidarity in the United States, then if you were maybe to be able to build more of a class consciousness that that would -- there'd be -- it'd be easier to overcome those racial divisions because you're working together on kind of collective economic project. But I think maybe to kind of go back to the social infrastructure point. That one of the problems that I sort of think the country suffers from, and maybe a lot of countries suffer from, is kind of an erosion in the sort of social capital. It's kind of a Robert Putnam kind of argument.

That you used to have all these points of contact with people who weren't like you. That didn't mean that you suddenly liked everyone else that you engaged with, but because you had to engage with them in a human level, it was easier in some ways to share perspectives or develop empathy and things of that nature. And I think there has been an erosion in that in the United States that's contributed to political polarization. It's not the only thing that's going on, but to me I think if we had institutions like labor unions, like other sort of -- other civic institutions don't necessarily have any -- necessarily need to have an economic sort of agenda. But if we had those things in place, maybe that would help bridge the gap. I don't know that it would be, but it might. Certainly as a journalist who wants lots of people to read and believe what I write, it'd be nice if those things -- if more people were willing to sort of listen to the

other side.

In terms of geographic differences, I mean I think if you're talking about national borders, economists would probably say a lot of it comes down to institutions. You look at sort of North and South Korea, that's kind of the classic example. Some of it comes down to patterns of trade and things of that nature. But across borders and then and in particularly within borders, I think that we've become way too complacent and sort of are way too comfortable with the idea that technology wants what it wants, the economy wants what it wants, and we're kind of helpless to resist that. I don't think that's right.

Now, to give you a few examples, one, it was never sort of a sure thing that the sort of Midwest and Northern Plains were going to develop in the way that they did. It took the construction of the Erie Canal, it took the construction of the railroads to open that land up and create the possibilities there. I'll say, again, the Land Grant institutions to me, just phenomenal public investment in terms of putting institutions on the map that would help with local economic development; that would help with the diffusion of productivity from the places that were doing the innovating, to the places that were using the technologies. So, I think one answer would be to sort of develop the confidence once again that we can influence the geographic distribution of economic activity.

And then to Richard's point, I think you're probably right that a lot of people on the left are sort of -- probably see the solution to our problems in trying to recreate a lot of the social infrastructure that we had in the midcentury. And that's especially the case when it comes to labor unions. I'm a little more optimistic maybe than others about rehabilitating the labor movement. I think there's been an awful lot of hostile policy that's gone on over the last 40 years, it's sort of taken us to where we are and we could undo a lot of that, and if we work worked on it. But I also think that we're going to have to come up with new social infrastructure, new social institutions. And it's not really clear to me with that's going to look like. I could speculate.

I think at one point, I might have said that social networks would allow us to communicate and organize and develop common interests and things of that nature. Seems clear that they're actually just hellholes. So, I'm not really optimistic about that anymore. But I think technologically maybe there will be other ways to kind of organize and facilitate communication and kind of shared social goals.

MR. REEVES: Thank you. With that, we are out of time. Please join me in thanking

Ryan for his address and for taking our questions. (Applause) And then we are on to the next session. Marcus, you're going to pick up from here. Thanks.

MR. CASEY: Okay, so we have our final paper by Brian Phelan and Dan Aronson, who's not here. And our discussion is Olugbenga Ajilore.

MR. PHELAN: Can everyone hear me? Is this, yes? Thank you to the Brookings team for organizing this conference. Let me grab my slides here. Hold on a second.

All right, just need to pull it up. Oh there we go. All right. Thanks again to, yeah, the Brookings Institution for organizing this and including me. I'm Brian Phelan from DePaul University. This is joint work with Daniel Aronson at the Chicago Fed. So, I believe I'm required to say that this does not represent the views of the Federal Reserve system. It's just the views -- our own views here.

So, I'm going to be talking about low wage automation. So, a little bit of a pivot here, but not really. So, as we've been talking about today, the fear of automation is ubiquitous and there's some reason for that though. There's fairly extensive evidence that automation has played a big role in this carving out of the middle class, both in terms of job polarization, or the ride -- and the rise in income inequality. Where essentially, automation has replaced a lot of middle class jobs and what it's put in place are increased growth at the top end of the spectrum and the bottom end of the spectrum. And for a lot of middle class workers they're not necessarily qualified for the newly created jobs at the top of the spectrum and so they find themselves moving into lower scale, lower paying jobs. And this has played a big role in the rise in inequality.

Much less is actually known though about automation of low skilled jobs. And so that's what I'm going to be talking about. So, why is the automation of low skilled jobs important for the middle class? I'd argue at least for at least two reasons, maybe three actually. So, first, a lot of middle class households are composed of multiple workers, and some of them are going to be working in low skilled jobs. So, understanding what's happening in terms of automation at the low wage piece of the spectrum is going to be important for middle class as well.

Another reason is that, as I said before, with job polarization a lot of what's happened with this sort of disappearing middle skill jobs is that there's been this creation of lower skilled jobs, with sort of the belief being that these are not necessarily automatable jobs. So, what sort of cushioned, in

some sense, the fall has been the creation of these low skilled jobs. On the other hand, if low skilled jobs are also subject to automation that could pose additional problems there.

The third thing that I would sort of say is that what we're going to be using here to try and understand whether low skill automation is taking place, is we're going to be using the minimum wage. So, essentially an increase in the minimum wage is going to change the relative price of capital and labor. And then we're going to see how that changes the composition of the low wage labor market, the composition of employment. And so if we think about the minimum wage as being a potential policy lever to counteract some of these effects we'll be able to say a little bit about that.

So, generally, there's very limited evidence that low wage jobs are being automated. And I should say that when I'm talking about low wage jobs here, I'm largely thinking about things that are, I guess, somewhere in the $10 to $15 an hour range, low skill set service sector type jobs. I'll show you some examples in a little bit though to give you some sense of which jobs are going to fall in here. But roughly jobs that pay up to about 150 percent of the minimum wage.

So, for there's fairly limited evidence that this has been taking place. For a long time, it was largely just assumed that it wasn't taking place, right. And there was probably good reason to believe that. For a long time, right, automation technology was expensive, and, so to try and think about replacing low skilled, low wage service sector jobs, was just not really economically feasible.

The price of technology continues to fall. And so it's quite possible now that low skilled jobs could be automated as well. So, there are some recent studies though that have started to look at this question. And as I mentioned, minimum wage is going to be the key driver here for these studies. They're not necessarily thinking that minimum wages is causing these, although we can make those connections but we're really using minimum wage as sort of a shock to the relative price of capital. So, when the minimum wage goes up, right, in those states, the relative price of capital goes down. And so we're going to look and see. So, some studies have looked specifically at capital adoption. And then some have taken the second approach that we're going to do, which is looking at sort of the change in the composition of the labor force.

So, all of these papers that sort of look at actual capital adoption when the minimum wage goes up, these are all very recent working papers, all within the last year or two, only one of them is

as accepted at a journal. So, this is very new research. And as I said, part of the reason why this may be new is just because it was an economic -- it didn't make economic sense for businesses to invest in this for a long period of time. That doesn't mean it's not happening now. So, those that look at actual capital adoption, in the U.S., it's very -- it's difficult to get that type of firm level or even industry level information. So, most of those studies have focused on other countries. And there's some mixed evidence across the six, well there's four mentioned up here, but six studies. I think the overarching effect is it does seem to be that there's this expedited capital adoption when the minimum wage goes up.

The second types of studies look at sort of the change in the composition of employment. And Dan and I have a different paper that we look over the period 1999 to 2009, to try and see when the minimum wage goes up in certain states whether there is a relative change in the types of jobs in those states compared to other states.

David Newmark and Grace Lordan also have a paper that do something somewhat similar. And so both of these studies, both of us find that low wage automation does seem to be taking place. There's some differences between the two studies. Generally, we find that there's no net decrease in overall employment, whereas, Lordan and Newmark find some net decline in employment.

So, what are we going to do different in this paper? Well, really what we want to do first is just to try and understand how low wage automation has changed over time. Specifically, from the first decade of the 21st Century to the second decade, right. As I mentioned our earlier study only went up through 2009, and now, we're going to be looking from 2010 to 2018. And I think at its face value, right, the cost of technology, the price of technology, has gone down quite a bit over those two decades. And so and wages continue to rise, especially with a lot of the recent increases in the minimum wage, that this could be -- the rate of this type of adoption could be growing.

We're also going to look at one change that's happened recently is that a lot of minimum wage policies have moved to city level, or MSA level. And so we're going to examine this at the city level as well. We're going to be using -- for both -- for our main analyses, we're going to be using the occupation employment statistics. Bureau of Labor Statistics data source that has total occupational, total employment levels by state and then also by MSA.

We're also going to look at, what we do different in this paper as well, is that we want to

look at heterogeneity to try and understand whether different types of workers are going to be disproportionately affected by low wage automation. And for that we're going to be using the American Community Survey. The American Community Survey, I'll talk a little bit more, but it's going to allow us to disaggregate these employment totals in terms of looking at some like less educated workers, younger workers, men, women and minorities. Those are the groups we're going to look at.

So, just to sort of summarize what we're going to find, we find that minimum wages continue to spur automation of low wage jobs. And our approach here, like I said, is going to be looking at occupational employment. So, it sort of follows this routine bias, technological change story, which when minimum wages go up, we're going to see jobs that are intensive in routine tasks decline. Interestingly, we get employment gains, however, at jobs that are intensive in interpersonal tasks. And a lot of the declines in routine jobs will be offset by this increased growth in jobs intensive and interpersonal tasks.

As we compare the first decade of the 21st Century to the second decade, we find that this effect accelerates dramatically. The effects in the second decade, from 2010 to 2018, are two and a half times the size of the effects that we found in the first decade of 21st Century. So, and it's going to spread to a broader range of jobs. In our first study, we see that it was just the routine cognitive jobs are declining. Now, it's both routine cognitive jobs and routine manual jobs.

We get some sort of noisy results about the overall employment effect. As I said before, in our first study looking at the first decade, we found that the growth of these interpersonal jobs offset almost all of the -- offset all of the decline in routine jobs. We get some mixed evidence that maybe the offsetting employment growth now in interpersonal jobs may not be enough to offset the declines in routine jobs. And so I'll talk about that.

As I said, we look at heterogeneity. We see vast differences by geography. Largely, when we look at these effects coming from minimum wage hikes these tend to be in smaller cities and rural areas. And that it's going to disproportionately affect sort of the most vulnerable workers within low skilled jobs. We're going to be looking within jobs, right, within occupations. And it's the most vulnerable workers within those jobs that are most affected by this change. And so less educated workers, younger workers, and minorities are going to be disproportionately affected.

So, let me just sort of brief outline in my talk here. I'm going to very briefly give you some theoretical framework for thinking about this. No equations I promise. Then I'm going to talk about the data that we use. And I'm going to spend a little time going through some summary stats, because a lot of this stuff actually really comes out in the summary stats. Then I'll talk about our empirical specification and some results and finish with a brief conclusion.

So, just in terms of sort of a theoretical framework. So, the standard competitive model of minimum wage hikes would say that when minimum wages go up, right, low wage employment declines because of both our scale and substitution effects. So, when we think about the effects on other inputs though, whether we're thinking about capital or other types of labor, they're going to decline because of the scale effect, but they could increase because of the substitution effect. And so we don't know what happens to capital adoption. What happens to other types of labor when the minimum wage goes up, it depends upon whether there are gross substitutes or gross complements with low wage -- the lowest wage workers.

However, it's not unreasonable to think that there could be heterogeneity even within low wage jobs, right. Essentially that the substitution effect within low wage work doesn't have to be the same, right. So, if we work with the routine bias technological change story, it's the routine low wage jobs that are going to have these larger substitution effects when the minimum wage goes up, right. And so we would expect employment to decline more there.

It's also possible that similarly paying, but other types of low wage jobs, could have -- possibly could be complimentary to the adoption of capital to replace these routine jobs. And so it's possible actually that there could be this offsetting employment growth. In the paper, and in other papers, we sort of speculate a lots of different ways that this could work. I'm happy to talk about it afterwards. But I'm not going to go into too many details now.

But so this sort of the basic framework of the employment response is going to guide exactly what we're going to do empirically, which is that since this substitution effect could be different across low wage jobs based upon the tasks that they do; we're going to be estimating sort of the heterogeneity or the variation in the employment response across different types of jobs in the low wage labor market.

All right, so in terms of the employment data that we use, we're going to be using -- all of this is going to be occupation level. We're going to aggregate up. So, we're going to use the occupation employment statistics, which is occupation level data. But even when we use the American Community Survey, we're going to aggregate that up to occupation level. So, if you're not familiar with the occupation employment statistics, it's a firm level survey based -- each release is based on 1.2 million firm surveys. It is backward looking. It's a three year moving average, because it's based on over the last six surveys.

We're going to be looking at -- so what does it do? It provides total occupation employment levels by state, but also by MSA, and different data sources. And they also give you information on average wages and different points in the distribution there. We're going to be using the average wages of the occupation though to try and distinguish between those jobs that are likely to be affected, right because it's not just routine jobs that are going to be affected, but low wage routine jobs.

And so the average wage information there is going to be particularly important. So, we're going to be in occupations by their average wage to the minimum wage over the span of 2010 to 2018. And so right, if the minimum wage is $10 and cashier gets on average wages $12, right, then they have a wage to minimum wage ratio of 1.2. And so we're going to group occupations that way so that we can distinguish between those most likely to be affected.

We're also going to use the American Community Survey. As I said, the ACS is a 1 percent sample of the U.S. population. We're going to use the ACS to compute -- to create a panel of state occupation employment levels. And then we're going to -- we're looking over very similar time period. We haven't added it added in 2018 yet, it was just released a few weeks ago. But we're going to be in occupations in the same way. So, we're focus in on those low wage routine jobs.

All right, the minimum wage data, this comes from Vacuole and Zipper who've made it -- excuse me, have made this available and easy to use. In terms of the variation in our data there's been quite a bit of increases in the minimum wage over the period that we're looking at, 2010 to 2018 -- sorry, 29 states, including DC, have increased their minimum wage over that period, right. So, you can think of effectively as those are treatment states, we'll compare what happens to employment in those states versus the 22 states that did not increase their minimum wage.

We are going to drop all of those states that had automatic inflation based adjustments

over much of the period. Ten of those 29 are just sort of going up a few percent each year based on inflation.

In terms of categorizing occupations, we're going to use the task data from Assamogoo (phonetic) and Otter 2011. They're using O-Net to classify the 664 SOC occupations, in terms of these six characteristics. They were broken down earlier. It's effectively routine, non-routine, and then cognitive and manual. The one difference is that there's a distinguished here in terms of interpersonal. And so they actually have a cognitive interpersonal and a manual interpersonal. And we're going to combine those into a single interpersonal measure.

Instead of classifying occupations as just being just routine or just interpersonal, we're going to compute what's a task share. And so each occupation is going to have some proportion of it, that's going to be routine cognitive and some proportion that's interpersonal. And so we're going to use those tasks shares to distinguish between again, the sort of these compositional changes in employment.

So, this is just, there's a lot of numbers, but this is to give you some sense of these are the top 20 most routine intensive, low wage occupations. So, here the way that I'm defining a low wage occupation is, it had to have an average wage to minimum wage ratio in one state of at least less than 1.5. Because our lowest wage group are going to be average wage to minimum wage ratio is less than 1.5, right. So, if the minimum wage is $10 these occupations had an average wage of less than 15, right.

So, what you have here is one you can see between these occupations what their average wage to minimum wage ratio across all states is, to give you some sense. Here's our share routine. And so in this table actually I'm combining routine cognitive and routine manual. So, something like a motion picture projectionist is going to be highly routinized, a textile and garment presser, a greater sort of agricultural products. And so you get some sense about how important these occupations are. There's a lot of small occupations. But there's one very important one here, cashiers show up as being highly routinized, sorry, yeah highly routinized, and also a very large piece of the low wage labor market. So, this is one way to sense one of those low wage occupations that are highly routinized.

One thing to point out here is just overall employment trends here. We see about 4 percent. So, this is over the entire period 2010 to 2018. These jobs aren't totally shrinking, but they're not growing particularly rapidly either.

Here our highest interpersonal, so I'm sort of previewing our results a little bit again. We're going to see that interpersonal job growth occurs when the routine employment declines. And so I want to highlight that here in the statistics. So, some things that have been mentioned so far a lot, personal in-home care aides has been a rapidly growing low wage occupation. There was talk about it before, it is very low paying. The average wage to minimum wage ratio is 1.33. So, approximately 33 percent over the minimum wage. These are low paying jobs, but they're rapidly growing. Generally, if we look across those jobs that are mostly interpersonal, an average growth rate of about 21 percent. Yeah.

SPEAKER: Is the average (inaudible) or over all (inaudible)?

MR. PHELAN: These are just for these 20. Yes. So, this is just to distinguish to give you some sense, in terms of summary stats. So, I want to take this one step further and to sort of before we sort of run our regressions and sort of say, okay what does minimum wage do, in one sense is what are the overall employment trends here in the low wage labor market? And what you see is that they mirror quite well what's happened to middle skilled jobs as well. It's just this is now taking place later. So, what does this show is that now I have, I said before I was going to use shares, but now I'm grouping occupations. So, these are -- the routine occupations are going to be all those occupations where these are low wage occupations, where the routine share is less than 1.5 -- sorry, where the routine share is less, or is at least 50 percent. And the interpersonal jobs are going to be the ones where the interpersonal share is at least 50 percent. So, these are majority interpersonal routine.

We're going to base everything relative to 2010. So, what do you see here is clearly over time in these low wage occupations, routine jobs are declining? The highest growth is occurring in interpersonal jobs. And other jobs are generally growing but not nearly as fast as the interpersonal.

So, overall, when you look at the low wage labor market, you see things very similar happening in the low piece of -- the lower wage portion of the labor market. So, now, I also want to sort of, with summary stats, sort of show you that minimum wages may be playing a role here. So, now, I'm just going to show you the routine occupations, and then I'll show you the interpersonal and all others. And so the blue line are going to be where I'm basing occupation -- sorry, employment growth for states that didn't increase their minimum wage. And the red lines are going to be states that did increase their minimum wage. And then the blue bars here are going to be the average minimum wage increase across

those states that did increase their minimum wage.

So, generally, the employment trends in these two states follow each other quite closely, up until about 2014, when the minimum wage starts to increase. And so we see that there's an increased decline in the routine intensive occupations in those states that increase their minimum wage.

The opposite happens when we look at the interpersonal jobs. So, it's one thing, you might look at this and say, well that's just the effect of minimum wages that they decrease all employment. I'm going to show you that this is really unique compared to all other types of jobs. So, here you look at interpersonal jobs, these are going to be intensive and interpersonal tasks, again majority interpersonal.

The two states, minimum wage states in red, non-minimum states in blue. Follow each other quite closely. The divergence doesn't happen nearly as quickly with interpersonal, but the divergence does occur and we see that there's elevated levels of this interpersonal job growth in the states that increase their minimum wage.

When we look at all other jobs we see no effects. So, something unique about minimum wage is happening here that I'll show you in the regressions as well. You're going to see, it's going to be, it changes the composition of low wage jobs. And I'm also going to then show you know how this differs over time and that it's accelerating. So, here regardless of whether they increase their minimum wage or not, they follow the same trajectory.

All right, so what's the regression that we're going to estimate? We're going to estimate, I'm just going to show you one equation, a difference in different specification. We're going to be looking at long differences in employment outcomes in an occupation in a state in a year. Those are going to be four year employment training, excuse me, four year employment changes. We're going to be grouping, like I said, occupations in terms of these wage groupings. And so then this is going to give us the effects of the change in the log minimum wage for those different wage groupings. We're going to focus on those that are closest to the minimum, that's going to be between the minimum wage and 1.5 times the minimum wage, that's our wage group one. Wage group two is going to be from 1.5 times the minimum wage to two times the minimum wage. Wage group three is from two to 2.5 and then week four is everyone else up to six times the minimum wage.

So, we're going to estimate these overall -- this will be our overall employment effect of the minimum wage hike. And then this is going to tell us what's the differential employment response depending upon the task share of the occupation. And so we'll will do this for a routine task share, interpersonal task share and so forth. We're going to have state year wage group and occupation fixed effects on the specification. One thing that, to keep in mind is that we're going to have -- we have a long difference in the outcome, a four year change. We're going to have one year changes in the minimum wage. So, it's not a pure long different specification, it's a long difference in the outcome, but more like a distributed lag specification in the change in the minimum wage. And so that means our key beta coefficients here will represent cumulative effects rather than, say marginal effects if it was a pure distributed lag model.

So, we're going to cluster standard errors of the state and wait observations by the base your employment level. We're also going to control for the task share of the occupation and allow that to vary over time, because of these trends that I just showed you in that figure that these things are trending over time.

All right. I'll skip that. So, I'm going to first show you the results for all the wage groups. Hopefully, convince you that all of the action is happening in that lowest wage group. And then I'm just going to show you the wage group one results going forward. Remember, so if it doesn't work, wage group one is just the lowest wage jobs, those are between the minimum wage and 1.5 times the minimum wage. This is the overall employment effect, in the first four columns for the different wage groups. In the specification here, sometimes pretty much in all of the coefficients that show the relative employment response, we're going to include state by year fixed effects. And so that's what we have here. And this is going to be just the relative employment response in routine cognitive jobs.

So, one thing in terms of the overall employment response, and this is different from our last study in terms of what we get, it's sort of hard to see but what we have here is the minimum wage changing next year, right. So, that'd be changes one year from now. That's our leading effect. And then the minimum wage changed just this past year, it changed one year ago, and it changed two years ago. So, it gives you some sense of the dynamics of the employment adjustment.

So, when you look, the two year effect, two years after a minimum wage hike, you don't

see anything in terms of any major effects, but what you do see is relative to the leading effect you see that employment is declining. And so the difference between the lead effect and the two year effect, we do get some slightly negative coefficients here around negative 0.2, which is sort of at the upper end of the minimum wage literature.

These are elasticities. And so you should be thinking about them as say, okay, when minimum wage goes up 10 percent, what happens to overall employment. So, in the elasticity of negative 0.2 would be minimum wage goes up 10 percent, employment goes down two percent.

These are going to be our interaction terms between the change in the minimum wage and then the task content of the job. What we've done with these shares, these task shares, is that we've seen standardized them so that they're Z scores. So, this is an elasticity for every standard deviation increase in the amount of routine jobs. So, for every standard deviation increase in the routine task share.

So, what does this show? It shows that as the minimum wage goes up, you see that routine employment, or employment at jobs that are intensive in routine tasks, declines. And so the elasticity is if you're one standard deviation above average in your routine task share, minimum wage goes up 10 percent, employment goes down one percent, here about two percent.

So, we see no real, like I said, no effect on the higher wage intervals. So, what do we see here just overall is that you see maybe some employment declines? This is a little noisy and not what you'd want in terms of the leading effect. But very clear declines at routine cognitive jobs. Employment climbs, that's just isolated to the lowest wage occupations, which are the ones that you would expect to be affected by the minimum wage hike.

So, we don't just want to look at routine cognitive. So, now I'm jumping, by the way, I'm just going to show you this column here of results for all of the different task shares. So, from different regression specifications to give you some sense of what's the overall employment change across the low wage labor market.

And so you see, when the minimum wage goes up, these are just duplicates of the coefficients I just showed you, the decline in those routine cognitive jobs. We see that routine manual jobs are also declining. So, those that are intensive in the routine manual task share, they're also

declining when the minimum wage goes up, but there is this offsetting employment growth. Employment is growing at jobs that are intensive and interpersonal tasks. This all happens with a lag. It doesn't happen right away, right. It happens within one to two years after the minimum wage increase and it seems to be growing over time.

And this makes a lot of sense if this is capital adoption that's taking place, right. We don't expect substitution effects to be immediate, right. Capital adoption takes time, it can be lumpy, and so the fact that this is coming up one to two years after makes a lot of sense to us. On the other hand, we see no real effects at non-routine jobs, which is reassuring to us since we don't think about these as being automatable jobs.

I didn't mention it before, but largely low wage jobs are not -- don't have a lot of non-routine activities. If I went back most of them are sort of 20 percent if you will. Largely they're interpersonal or their routine cognitive or routine manual.

So, this is the overall effects in the occupation employment statistics using that state level data. But I want to show you how these compare from what we found in our earlier paper. So, in red we have our estimated effects from 1999 to 2009. These are again -- these are basically plotting out these elasticities and so they should be interrupted, like I said, as this for every -- given a certain percent increase in the minimum wage and for a standard deviation increase in each of the tasks. So, in red we have 99 to -- our first study and then we've got our estimates here using the more recent decades. So, when you look across -- so, for example, if you look at routine cognitive you can see that these things are diverging from each other.

With routine manual, when we look from '99 to '09, there was -- we found no real effects in overall routine manual low wage employment. Now, we see minimum wage hikes decreasing employment at routine manual jobs. When we combine all routine tasks together, right, so that's basically the same of that routine cognitive share and the routine manual share. This is where you get that two and a half times effect -- the effect is two and a half times just in terms of the coefficient. Two and a half times size of the effect.

So, we see that automation is accelerated, it's spread to a broader range of jobs. And the increase in interpersonal jobs has also expanded. But I'll present a little bit more. There is maybe

some evidence to say that the growth in the interpersonal jobs is not fully offsetting this decline in routine jobs.

So, what do I want to do is I want to show you a couple of things? One, we're going to estimate this with the MSA level data. We could think of this as sort of a robustness test, given that minimum wage increases have largely moved to cities. But it's also actually we're going to use it to get some sense of geographic heterogeneity as well.

So, yeah, we do a couple extensions here. We're going to look at the MSA level. And then we're also going to look at heterogeneity and effects across geographic areas, but also across demographic groups. So, I apologize, I should have fewer numbers on this or a figure of it, at least a red box around the key numbers. But the key numbers I want you to focus on are going to be the two year effects. So, the change in the minimum wage two years ago, this is interacted with the task shares, or for the overall employment effects and for the different task shares here. And so we're essentially, in your head I want you to be comparing these to these numbers here. So, the elasticities close to about negative 0.2, if we want to think about magnitudes and where the effects are coming from.

So, this is in our MSA level data from the OES. One thing that first comes out, and I'm just going to focus on the two year aftereffects, is that we do also sort of see employment declines at routine cognitive and routine manual jobs on the MSA level estimates. Although routine manual is not statistically significant and the coefficients are smaller. The overall routine tasks estimate is also smaller, a decrease from about a negative 0.2 to about negative 0.12 in interpersonal tasks as well as decreased.

So, when we went to the MSA level data, we expected it to be noisier because the occupation employment statistics that are going to be based on fewer observations, we didn't necessarily expect the effects to be smaller. And so we spent a little time trying to figure out what's going on. One thing that we did -- does seem to be important, is that when we exclude the 25 largest cities, the coefficients now get much closer to the negative 0.2 that we observe in the overall state estimates, right. So, if you're going to do an MSA level analysis, you're necessarily focusing much more on large urban centers, whereas, overall states it's going to balance out rural areas, as well. This is not going to have any rural areas in it. And so the coefficients go down.

When we drop those big cities, it seems to be that the coefficients now look much more

similar. So, overall, these employment declines, these declines at routine jobs and the increase in interpersonal seems to be in smaller cities. And so we see the same basic pattern, but it seems to be more effect in rural areas.

In the ACS, so now there were a couple issues with using the occupation employment statistics. Again, I just want you to focus on the two year effects here. And so there are some concerns, as I said, about using the ACS -- using the Application Employment Statistics. Here, we're going to use the American Community Survey to try and test that. One nice thing is that the effect definitely just comes through in the American Community Survey the same way, the elasticities are the same way, same size. And then the timing of the response that this isn't some artifact of the occupation employment statistics, which is a three year moving average, that it's two years after is showing up in the ACS as well.

So, lastly, we used the ACS to try and think about this heterogeneity. And so when we look at less educated workers, again, what I want you to focus on here are just this two year effect. So, we have the affects increasing a lot more when we start looking at total employment levels of people with a high school degree or less.

And so this is going to pick up two things. One, this is just sort of heterogeneity across individuals. But also that when we're grouping individuals into an occupation, and this is sort of come up a bit, there's a lot of heterogeneity within an occupation in terms of tasks, in terms of wages. And so when we focus in on those that are most likely to be in the minimum wage job, we get much larger effects. And so this sort of indicates that actually sort of the employment realignment could be even larger on the low wage end of the spectrum.

The last thing I want to show you is just by groups, some heterogeneity. Now, we just sum up for younger workers and older workers. And this is the decline in routine jobs. It's almost entirely driven by younger workers. When we look at minorities and non-minorities, much larger effect, much larger employment declines for minorities. Men and women looks pretty similar, except when we look at the interpersonal job growth, men are getting an increase here. Some of this just may be that men were not really working in interpersonal jobs previously.

But two things that really jumped out is just that larger effects on minorities and younger workers. So, this employment realignment moving across the labor market, particularly important. And

when we look at the overall employment effect, one thing that just sort of, to finish on. Minorities are being particularly hurt if we look at the leading effect there, which is elevated employment growth in those states that increase their minimum wage. And then fairly large declines here.

So, this realignment in employment, which we observe in the first decade of the 21st Century has accelerated quite a bit and there's some arguments to be made that it may be coming more costly to low wage workers, particularly minority workers and younger workers. So, I'll finish there, thanks. (Applause)

MR. AJILORE: All right, can everyone hear me? All right, so just want to thank Marcus and thank Brookings for the invitation. I'm going to do what I always hate what discussants do, and not talk about the paper, it's for two reasons. One, this is a really well done paper. It's an extension from a previously published paper. Some of the things that they added to that was to look at that second post crisis period. But it also, one of the things I really like is to kind of break down by race, by age, by sex and by geography.

And so the other thing is I want to kind of bring this together and kind of like, do a culmination of this whole event because automation has been a very sexy topic, talked about a lot Andrew Yang made -- popularized it. And a lot of people are always talking about, well what's happening with automation, how's this going to impact us? And so when I was reading this paper, the first thing that popped up was this kind of the ATM story. That when ATMs came, a lot of people were worried that that's going to kill bank tellers. And if you look at the data, what happened is that there actually was an increase in the number of bank tellers.

And what happened was that while at an individual bank branch, there were fewer tellers, because you didn't need them. But because there are fewer tellers, you could open more branches and at branches we need more tellers. And so there was actually an increase. So, automation shifted how the nature of the bank teller job and it went from like routine manual to interpersonal, there were more interpersonal skills. And what was interesting in one of your slides, tellers were actually the highest share. So, the top 20 routine tasks for that top 21. But they were the highest percentage of interpersonal. The other thing was there was actually minus 16 percent decrease too. So, that actually might be an effect there.

But one of the things I want to talk about was one of your results, you talked about the impact in rural areas. And so I want to caution you about using the term rural, because this is from the MSA one right, the OAS. And so, rural -- it's very complicated when you talk about rural because rural has so many different definitions. And I'm not sure what you're actually capturing as rural, as opposed to say small metro. So, I think because it's the ones without the top 25 large cities is metro. So, it's just more of a terminology thing. And reason why I bring that up is that in the recent minimum wage literature, there's been a lot of discussion about how minimum wage actually doesn't have a -- in certain cases it doesn't have a negative employment effect. And a lot of that's because there's a -- instead of using kind of the standard neoclassical model, you look at the labor market monopsony model, where there's a lot -- where firms are able to exert market power. And this is especially true in rural communities where you have that one firm.

And so when I was reading the paper, and I saw that rural areas have a larger effect, I was kind of confused. But if you're looking at small metros versus actual rural communities, then that result makes sense. So, it's more of just kind of a terminology thing.

And then the second kind of point I want to make, and I wasn't able to come to the early sessions, but one of the things that I really haven't heard talk about was the issue of race, and how race permeates everything. So, and a lot of it -- the reason why this actually popped up was in Ryan's talk, he was talking about how the evolution of the middle class and how it became strong. And so he talked about the GI Bill, the New Deal, all these great programs, but they were exclusionary. They didn't include black, brown people. A lot of cases they didn't include gender. And so one of the things that I always think about when we talk about these things, and we there was a paper before about union strength. And that you look at the figure of union membership based like 1950 to like 2010, it's just down.

Now, unions in certain cases were also exclusionary, but in the '60s and '70s, they were more integrated. And that happened to correlate at the time when they weren't, there was less they were less popular. And so one of the things that I think we need to think about is think about how race is permeated through this. And so, also someone was mentioning right to work laws, and how right to work laws have spread.

Now, they were first very prevalent in southern states during the 1940's, at the same time

of union strength, right. And then over the last probably 20 years, Michigan, Ohio, Indiana, I believe Wisconsin, have also passed right to work. And a lot of that has had an impact. And so, and the reason why I bring this up is that we find that in this paper, a lot of these impacts, the ones that people are being harmed, are those who are less educated. When we look at which areas of the country have lower educational attainment. Places in the south, places that are correlated with right to work laws. You look at the people of color, same thing, right to work laws.

And so it's something that if we want to start thinking about kind of solutions, and policy and how to mitigate some of these harms of coming automation, we have to think about how do we combat these things. And we can't look at it as like -- we can't like -- like this paper is important because it tells us the results, and it's especially nice because it breaks down the results. But the next question is, well what's the solution? Do we push back on automation, or do we find a way to incorporate it? And so this also goes back to the previous paper that talked about worker power and understanding why stronger worker power has been a positive impact. And looking more into that.

And so, what I think the way we have to think about this is figure out what the impacts are. And the differences geographically, demographically. But then in terms of talking about solutions, or what is the things that we can do to actually continue growth, growth with low wage, middle wage and other groups. And so I'll, in the interest of time, I think I'll stop here and just again, good paper. (Applause)

MR. CASEY: Thanks, Benga. Okay, so I'm going to take some questions, and we'll go around the room a couple times. And our authors actually operated pretty much on time, so we have a fair amount of time for questions. We'll start here. And then that's it. Then Richard. And over here, you --

SPEAKER: I'll just ask the author to elaborate more on just what the -- I would just ask the author to elaborate more on what the problem identified in the paper is. From what I saw from the presentation the (inaudible)

MR. CASEY: Okay we're going to go around the room for Richard next.

MR. REEVES: I had just a data question. I'm not an ACS scholar, but Allen you're an ACS scholar, right? One thing I do know about ACS is that the sample size has gotten smaller, relative to

the population, particularly in the period that you're looking at that's created a lot more noise. I saw your standard errors were bigger for your second half than the first half.

But there's a number, it looked like it anyway from the brief description. But is that something you've considered? Are you afraid that that's going to introduce more noise? Because I know other papers that have used ACS have struggled with that issue of shrinking sample size, therefore, more noise. And making it particularly hard to do these trend analyses. So, just any reflections you have on the data or -- and if I've misstated that, then colleagues will correct. But that was it, thanks.

SPEAKER: Hi, my name is Rosa. And I'm from George Washington University, and thank you for your presentation. I have one clarifying question and then two, a second question. So, the first one was, if I remember correctly, the decline of the routine job was much more severe into the under 30 years or younger court. And I think that was a little bit of inconsistent with what I heard from this morning, the automatization, the impact -- the older population they impacted much more for the automatization. And I just wanted to hear about some story behind that.

And also, I wonder, what do you see all this pattern only for the 20, top 25 metropolitan areas? I am interested in the top metro area these day, like a lot of low wage job is actually concentrated in the New York or just like this big metropolitan area. And do you see any other distinct pattern, related to this occupational -- the changing the pattern? Yeah.

MR. REEVES: Okay so first we have, what's the problem. Marcus you might --

MR. CASEY: That's good news.

MR. REEVES: So, I would -- so first what's the problem? ACS issues with ACS sample size and then discussion of what seems to be a contradicting result. I think that's pretty interesting observation.

MR. PHELAN: So, first, in terms of what's -- can anyone hear me clearly? Yes. What's the problem? I think that what we see is the results are actually fairly optimistic in our first paper we were fairly optimistic. What we think is interesting is that the pattern of employment is very similar to what's happened to middle skill automation, where you see no net decrease in employment.

What's different at the low end of the spectrum is that these jobs generally all require quite little training. And so workers are actually fairly able to move between from the destroyed jobs to

the created jobs. What our concern is, is that what's causing this offsetting employment growth? And I didn't really have time today to talk about it. I think it's a really interesting question. In the context of a minimum wage to try and think about how you get this offsetting employment growth and what's driving it, whether it's a short run phenomenon, and whether it's a long run phenomenon.

So, the I think that the potential concerns or the potential problems are that somehow this decline, or this increase in the interpersonal jobs, one now looks a little less like it's meeting all of the decline in the routine jobs. So, there is some employment loss. But also what's to say that that continues into the future.

But overall when you look at low wage automation you see a similar pattern in terms of like I said, employment types of jobs, but it hasn't been as costly to individual low wage workers as middle skill automation.

SPEAKER: Suggestion on what's causing it?

MR. PHELAN: Sure.

SPEAKER: The market.

MR. PHELAN: Well so, the question becomes then why does it increase in the states that increase the minimum wage? It's just random no, that's --

SPEAKER: It could just be the marker.

MR. PHELAN: I mean, so, we have a couple of possibilities in -- so we have some stories. There could be a fixed factor of production. So, that somehow the adoption of the automation technology eases that fixed factor of production. So, if you think about getting coffee at your favorite cafe, right, there's only so much space behind the counter for them to take orders and make drinks. They adopt the automation technology that frees up space behind the counter which is some fixed factor. And now suddenly they can turn out more drinks.

So, we have some ideas, potential ideas, but we don't know -- we can't -- we haven't been able to disentangle them yet. It could also be a change across firms. Somebody mentioned that earlier as well, about the types of firms, right. So, a minimum wage hike is going to be most costly on labor intensive firms. And so it may be the case that labor intensive firms fail when the minimum wage goes up, or they're more likely to fail. And sort of the high tech firms survive, and then they expand and

fill the customer demand afterwards.

So, that's another story there. We have some other ideas as well. Like I said, we haven't necessarily been able to disentangle them. But it seems important to us just because especially in the context of a minimum wage it's not immediately clear why there would be this offsetting employment growth. And so that has been the saving grace here. And so what's to ensure that it continues.

So, that was that was the first one. The ACS trend. So, maybe I didn't explain this very well. Our comparison over time, the '99 to '09 and then the 2010 to 2018, that's using the occupation employment statistics. So, we're using the OES there. And so the comparison over time. With the ACS, we're using from 2010 to 2018, which may have also decreased in size over that time period. I'm not certain. But I don't know how it would necessarily bias things, but I do think it would add noise. And we do see a tremendous amount of noise, because we're taking the ACS and trying to compute total employment levels at the state occupation level.

And so we do a few things in the paper that I just didn't go over in the presentation to try and minimize that noise. More we're using the ACS for the sort of as a robustness to try and understand whether the OES seems to be accurate, but also to get at some of the heterogeneity stuff which you can't do in the OES.

The next one is sort of the decline in younger, different from the older. I think some of the differences maybe between our study and some of the earlier work is just that we're focusing on low wage workers, as opposed to say, middle skill jobs. And so when we see a larger effect on younger workers, some of that is just this heterogeneity within occupations that we see a total employment level, we see an average wage.

For some of those workers, the minimum wage is binding. And for others it's not. For low -- younger workers, it's more likely to be binding. So, that would be one way to see that they're going to be much closer to the minimum. And so when the minimum goes up, they're disproportionately affected.

It could also be just sort of heterogeneity in terms of who the firm chooses to let go or retrain. But I think some of the difference is just looking at different types of jobs.

MR. REEVES: Yeah, and I wanted to follow up on that. If you remember some of the

work that a Benga and, some of the other people talked about was that because they were focused on middle school jobs, they didn't find nearly as much in terms of demographic effects as they did for other types of, say splits of the data.

I think it's really interesting that you're finding these demographic effects in this segment of the labor market. Because I think as Benga noted this is -- this might be an important distinction in terms of looking at middle skill, sort of routine bias, technological change and lower wage markets, who tend to be -- they tend to be populated by different sets of people, by virtue of education.

SPEAKER: Actually, I just couldn't resist chiming in because they sort of echo something that I've been thinking about since this morning. Which is, I think there's a lot of hype about whether on aggregate automation is going to cause widespread non-employment in the economy. And I think some of the work this morning kind of suggested, like the effects on balance were small. But I think the study really points and it up came up earlier in the day to potentially important distributional implications of automation.

And so I think, when we're thinking about how important this is, as a policy issue, there are kind of a couple of different ways to think about it. And one is what's going on, on aggregate, is this really an aggregate crisis and then economy. And then the other is, well if it's not that suggests a different set of solutions than if it is, but we shouldn't then ignore the what could be important implications for certain groups defined by their skill level, by their race or ethnicity, by their geography.

MR. REEVES: Well, actually I was going to pile on as well if you don't mind. We're bouncing off each other now, which is to ask both of you, given what's just been said what the policy implications would be. So, that's a question to both of you, of particularly let's take race as the example that you both highlighted, Benga especially. What are the policy implications of the evidence that they are differential influences by race? How should we think about that as policy makers?

MR. AJILORE: Well, so I work at the Center for American Progress. I used to be in academia and moved about two years ago. So, I think about this all the time. I think -- and what it is really a difficult topic, because a lot of the issues with race is part -- a large part systemic, but also its behavior. And so what I think about there was an article earlier this week in the New York Times, it was about an African who worked for JP Morgan and was he was a financial advisor. And there was a woman

who had got a settlement, like $375,000. And it's like oh okay well this is money we're going to help invest. But the people he worked with said, well no. And they made a statement said, well, she's Section 8, she wouldn't know what to do with the money. She doesn't respect that money because she didn't earn it. And so the question is, how do you fix that? And so and then what -- so and then when I see research like this, and I see, oh less educated African Americans across the board.

And so it's like, there's the aggregate data, there's the kind of metrics that we do, the analysis that we do. And then there's the individual, like what's happening -- like why are African Americans -- like what's happening with that group? And so, part of it is we have these institutions, we have these Civil Rights laws that we need to try to enforce, but the other is a lot more, and you know Ryan talked about before that there was a rush of social capital. And that's a problem.

But the question is, did we actually have that social capital beforehand? And then it's -- and so there's a lot of policies that we could do, a lot of laws we could put on the books, a lot of enforcement that we could do. But there's also a lot of just, we have to -- I hate to say this but like treat each other better. And so that is that combination. But it's really difficult. I think the important thing is to actually highlight the issue, tell these stories, both the qualitative stories, but then the quantitative analysis to say, hey this is a problem.

SPEAKER: I just have one quick question --

MR. REEVES: Microphone.

SPEAKER: Thank you -- was what's the problem here? So, I think this is one potential problem, right. So, if you look at our results when you start drilling down on different demographic groups, and you think about the most vulnerable populations, it's important to look at a policy like this, or to look at a trend in order to something like automation of low wage labor markets and think about how does it disproportionately affect people. And so just sort of highlighting that. I fortunately don't have a solution either.

SPEAKER: So, on this point, I wonder if you could, in the data or possibly some other data, dig more into the question of whether it's because of segregation of different groups across different types of jobs or occupations, versus the story of in the face of automating this -- do -- introducing some automation here because of the rise in the minimum wage, we're going to upskill some employees and

get rid of some other employees. And if the story is like, well, when that happens, we you know get rid of the women or the people of color. That's sort of a different story than, you know well young people are sort of concentrated in these places that are prone to this. And they're young and so maybe they're going to just kind of find their way into, or it might speak to a different response.

So, I do think that the sort of digging on that point of is this just because of the distribution of where people are, or are people who are have different characteristics but kind of doing the same job more or less likely? And I know you have some limitations in the data, but I think just even understanding how segregated different groups are by across types of jobs in this labor market.

MR. PHELAN: That's a great point. Yeah, we have not done that. But that's great point, we will.

SPEAKER: I had a question for Brian. It may require crunching some more numbers, but it seems if you're addressing policy you might want to understand something about the firm sizes of these businesses that you're talking about. I mean, if you have a small operation with maybe five or 10 people versus a mega restaurant or super bar, nightclub of oh you know 100 people, automation might have different implications for those businesses.

MR. PHELAN: Yes, totally. And I, unfortunately that's not something that we can do with the data that we have here. That doesn't mean that we couldn't look. Like I said, there is this effect, though that it could change -- that it could change the composition of firms, and there's some evidence that minimum wages do change the composition of firms in favor of bigger firms. So, it's not something we can answer but it's a good point.

MR. REEVES: Any additional questions?

SPEAKER: Just real quickly. (Inaudible) Congressional Budget Office. In your results where you have an increase in the minimum wage for an industry, depending on your characterization of routine versus other, you have a decline in employment. And that could either be because substitution is taking place, capital for labor alternatively, that the firm's going out of business, as you suggested. So, I'm just curious if you've matched up your results by industry with capital spending, either gross or ICT equipment to kind of establish that link a little bit more clearly?

MR. PHELAN: So, we have not and it's a good point. We are relying a little bit more, like

I said there are these newer studies that are -- that is getting data on firm investments. Even at the industry level, investments is very difficult. And so we're really relying on sort of the routine bias technological change story and these other studies that are out there, that are looking at other countries, looking at China and a few other places where this type of data is available.

So, I think it's a great point. Ultimately, we see a change in the occupational employment. And we're inferring that this is due to automation. It would be great if we could sort of draw that connection tighter. And it's something that that Dan and I actually have been working on, just we haven't come up with a great solution yet to do it.

MR. REEVES: Any other questions? Comments, concerns?

SPEAKER: Just yeah, I -- do we have access to all these draft paper at the end of this event?

MR. REEVES: So, I'll say something to that. Is there anything else? Okay great.

MR. CASEY: So, I want to thank everyone for coming to the Future of Middle Class Initiatives, Automation, Labor Market Institutions and the Middle Class Conference. I think this was a great discussion. I want to thank all the authors, some of whom aren't here, they've left already. But James Bessen, Henry Siu, Zachary Parolin, and Brian Phelan for presenting some great papers as well as the discussants. Sarah, Benga, myself.

Anyway, so I want to leave on one note to talk about where we're going next with the project. And I think that Sarah's last comment was actually very important and sort of highlighting where we're going. So, one of the themes that went around over and over and over today is this issue of education in reskilling and upskilling.

And so the next set of issues that the automation theme of the Future Middle Class Initiative is going to focus on is this issue of education. Specifically, in thinking about the various different variety of ways, including our formal structures, like colleges and universities, K through 12 education. But also thinking about the broad set of other types of alternative vocational education, apprenticeships and things of that nature that are going on, boot camps. What, in our first conference Paul Osterman called it the Wild West of education.

And so our next conference, tentatively scheduled for next June will focus precisely on

those issues. And so in the meantime, we hope to produce some material of interest. So, I would implore you all to go at least once a week to the automation page, and the Future of Middle Class website at Brookings.edu, to figure out exactly what the next thing that we're working on is.

So, anyway, I want to thank you all for coming. I enjoyed the conversation immensely. I think we learned a lot. I think we learned some things that we need to investigate more. And I hope to see you at the next event. Thank you.

MR. REEVES: And just before you go, let me add my thanks also to Brian and Benga finishing us out, but also to Marcus for pulling us together with huge support from Hannah Van Drake , who is now sitting behind Marcus and Sarah Anzabe , who's sitting over there. So, thank you to all three of you for a great event. (Applause)

And daily look at our website, not weekly.

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