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Welcome:

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Bernard L. Schwartz Chair in Economic Policy Development

Opening Keynote:

JASON FURMAN
Chairman, Council of Economic Advisers

Moderator:

HOMI KHARAS
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Panelists:

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Closing Keynote

ALAN GREENSPAN
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Former Chairman, Board of Governors of the Federal Reserve System

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P R O C E E D I N G S

DR. BAILY: So if any stragglers are outside, please come and join us. We're going to get started. And I seem to have -- oh, here we go. So welcome to Brookings. If everyone could turn off their cell phones, or put them on mute, that would be very helpful. We're going to talk about economic growth.

While the U.S. economy has not yet completed the path to full employment, we're getting close. Looking ahead growth will depend on productivity and labor force growth, and both have slowed in recent years. Looking more widely, growth in the global economy will also depend on those two drivers. In emerging markets population and labor force growth is expected to slow pretty dramatically in most of them.

We're fortunate today to have a wonderful set of speakers to talk about these issues. To start us off we're very privileged to welcome Jason Furman, a longtime friend, and friend of Brookings. Jason is currently the Chair of the Council of Economic Advisors -- best job in the world. He was Deputy Director of the National Economic Council; he's been a senior fellow at Brookings, and at the Center for Budget and Policy Priorities. He's written many articles and books. His Ph.D. is from Harvard. Jason, welcome, thank you. (applause)

DR. FURMAN: So thank you Martin, it's great to be back in my old home of Brookings and to be talking on the most important topic in economics, which is economic growth. The reason it's such an important topic is that the goal of economic policy is to raise the incomes of middle class households, and those working to get into the middle class. And a necessary, but certainly not sufficient condition for sustained increases in incomes is stronger economic growth.

Growth has been stronger lately. Over the last two years it's been 2.8 percent annual rate, as opposed to a 2.1 percent annual rate in the first three and half years of the economic recovery. But we're still not all the way recovered, as Martin said.

And even when we are, we will face the decades long challenge of slower middle class income growth, with middle class incomes over the last couple decades growing at about half a percent per year, much slower than the three percent per year in the decades before that.

Council of Economic Advisors has done analysis that shows that the biggest source of this slow-down in the last several decades in middle class incomes has been, productivity growth hasn't kept up with what it used to be. Although inequality and more recently labor force participation have also played a very important role.

In my comments today, I'm going to focus on one policy instrument that relates to growth, one that I think is quite important, and that is expanded trade increases in U.S. exports. In terms of policies this refers to regional agreements like the Trans-Pacific Partnership and the Trans-Atlantic Trade and Investment Partnership, to trade agreements that we're in the process of negotiating that would put the United States at the center of nearly two-thirds of the global economy. It also includes multi-lateral agreements at the WTO, like the Information Technology Agreement, the Trade Facilitation Agreement, Trade and Services Agreement, and Environmental Goods Agreement.

I'm going to argue first that all of these trade agreements benefit the middle class, and they do that through the mechanisms of increasing job quality and expanding choice. That first part is what I view as the conventional argument for trade, but then what I'm going to really focus on and what really links into today's session is the underappreciated and potentially more important impact of trade, which is actually to expand economic growth itself. I'll then briefly touch on how trade increases the returns to complementary policies and then finally try to relate some of the discussions around trade to some of the recent macroeconomic debates over secular stagnation and global imbalances.

So first I'll start with the traditional case for trade. The traditional case goes back nearly two hundred years to David Ricardo and centers around comparative advantage, the idea that you should specialize in doing what you do better. In the last two hundred years we've added a lot of things to the list, but they all have a similar character. We've added increased returns to scale from the larger scale of markets that a lot of what trade does doesn't just increase the quantity of what's imported or exported, but operates on the extensive margin as well, bringing new goods that would not have otherwise been imported, new businesses that wouldn't otherwise have exported. And we also better appreciate the importance of foreign direct investment.

When you take all of these together you can summarize the benefits they have for the middle class in those two factors -- increasing the quality of jobs and increasing the purchasing power of consumers. In terms of job quality, the wide range of research has found that jobs in export intensive sectors pay 18 percent more than jobs in less export intensive sectors. CEA has done research that controls for worker and industry characteristics and finds that you still have a 1300 dollar additional earnings that you get from working in an export intensive industry, that's the equivalent of two months of the typical household's food budget. You also, for those not engaged in exports still have the benefit of the higher real wages associated with the lower costs of the goods that you import, as well as the consumer benefits that you get from a greater variety of goods.

To quantify these types of effects in the context of TPP, an agreement that includes 11 other countries and nearly 40 percent of the global economy, it is important to start by understanding what it is that TPP does. First of all the United States itself is already very open. Our tariffs average 1.4 percent, and 70 percent of the goods come into our country entirely tariff free. Our partners in TPP tend to have higher tariffs, in some cases like autos in Malaysia they are as high as 30 percent, or agricultural goods

in Vietnam they are as high as 40 percent. So TPP is disproportionately about removing barriers to American exports. TPP also removes a lot of the non-tariff barriers which are even more disproportionate in our TPP partners to what we have here in the United States. TPP would have the highest and most enforceable labor and environmental standards of any agreement. It would be the first trade agreement to include disciplines on state owned enterprises, and to ensure a free and open internet.

Peter Petri, Michael Plummer, and Fan Zhai have the best model so far to quantify the types of effects I've been talking about, these types of comparative statics associated with specialization. It's an 18 sector, 24 region, computable general equilibrium model that takes into account tariffs, non-tariff barriers, foreign direct investment, and a variety of other factors. And they find that in 2025 TPP will expand the economy by 0.4 percent, worth 77 billion dollars annually in 2007 dollars.

The European Union's analysis of TTIP has found a similar magnitude of benefits for the U.S. economy. Now some have described these totals as small, but I think I would risk losing my license to offer economic advise if I counseled anyone to leave 77 billion dollars lying on the sidewalk each year.

This although is based on the conventional traditional case for trade as amended as I said over the last two hundred years, but all of what I've been describing is essentially an analysis in comparative statics. You change something, you move to a new level, it's a better level but you're then staying at that level.

What I want to spend more time on is the new case for trade which is rooted in the role that competition, market size specialization can all play in increasing innovation and thus increasing economic growth. Petrie, Plummer, and Zhai are the first to point out that their estimates could greatly understate the gains from TPP and trade agreements more broadly because they don't incorporate these types of factors that would reflect on growth. As Bob Solo, the Nobel Prize winning economist said,

"Relatively free trade has the advantage that the possibility of increasing market share in world markets is a constant incentive for innovative activity." I want to draw on Solo's contributions on economic research in fleshing that out. One of his contributions was pointing out that output is determined by capital, labor, and the way in which you combine the two of them, a concept that economists call total factor productivity. Total factor productivity we understand better, itself is the function of a production function that produces innovation. I'm going to talk about how trade is both a direct input into that production function, so you get more innovation out of trade, but also how it increases the incentives that businesses have to innovate.

The first way in which it does this is trade leads to greater specialization. The same law of comparative advantage that applies to imports of wine and clothing also applies to the production of innovation itself. So if Toshiba specializes more on improving memory chips and Intel specializes more in improving microprocessors, that will itself strengthen the ability of both of them to not just produce what they can produce today, but to develop new ideas about how to produce new things and produce more cheaply in the future.

Strengthening intellectual property can help facilitate this by enabling more licensing which itself allows more specialization. A second way in which trade can increase innovation is that it helps firms become more productive by accelerating the global flow of ideas. For example U.S. manufacturers have learned about lean production from Japanese manufacturers. There is an increased set of economic evidence associated with leaning by exporting. One of the ways in which this happens is that half of what the United States imports are actually not final consumer goods, but inputs into the production process of final goods itself. We learn from importing those and from the ideas that embodied in them.

Trade also increases the incentive to innovate. This is something that Solo highlighted in the quote that I read to you before. One way in which it does this is it expands the size of the market, and innovation has a certain fixed cost associated with it. So a larger market size won't just help you take advantage of the technologies you have today but increases the incentive to have new ones. For example, the app Stores that Apple and Google have a large global reach, which contributes to the large number of software developers that participate in them.

Studies have also found that the larger size of markets can lead to more research and development. Trade also increases the incentive to innovate by holding even holding the size of the market constant. This is based on an idea that Canaro talked about 50 years ago that monopolists can often have weak incentives to innovate, because they're not able to basically steal market share from their competitors because they don't have any. Trade increases competition and competition can increase innovation. This is something we see in a lot of modern Schumpeterian models that model innovation as a function of the amount of the amount of competition you're under. Now one important finding of those models to nuance what I was just saying is that too little competition can make you sort of a lazy happy monopolist who doesn't innovate. Too much competition can take away some of the returns and benefits you get from new innovation if they were immediately spread to others. So you need to strike the right balance to ensure that you have competition, that you're expanding it but that you can protect for example some of the benefits associated with intellectual property and innovation.

Everything I've been describing is a number of different ways that trade increases innovation. Of course the opposite is also true. Firms that are more innovative are going to be better able to access the global market. Ultimately it isn't that trade causes innovation, or innovation causes trade, but the two of those are jointly determined

by the set of choices that businesses make, choices that shaped by the incentives that we give to businesses. Some recent surveys of the literature have described this relationship between trade and innovation as quote, "a robust finding", unquote.

So in summary for this particular part, the second part of what I was talking about today, long-run growth is the key to living standards, productivity is the key to long-run growth, and trade in ways that have been underappreciated, often not included in the quantitative models we use has played a role in fostering all of that, and if we can conclude TPP and these other agreements will do even more so in the future.

The third part of the discussion I wanted to have is talking about how globalization raises the benefits of policies that complement expanded markets. Part of the importance of this is rooted in the fact that globalization has all the types of benefits I've been talking about, but it's also undoubtedly played a role in increasing inequality, although one that most economists would say comes below factors like technology education and institutions. It's also played a role in worker dislocation although again, probably a small fraction of the dislocation in the economy.

These challenges associated with globalization are real, and they merit a serious policy response. Part of that policy response is in the way we negotiate trade agreements themselves. That many of the issues that people worry about with globalization is a function of the process, a process that is because containers allow you to ship more easily, because the internet allows you to research foreign markets and isn't specifically and explicitly rooted in the agreements themselves. Part of the point of agreements like TPP is actually to better manage the process of globalization. So you're going to have basically almost the same degree of openness of the U.S. market to imports with or without TPP, because our tariffs, as I said before, average 1.4 percent. The difference is that you're going to have higher labor and environmental standards and

more restrictions on state owned enterprises than you would have had in the absence of an agreement.

The second part of policies that complement is no matter where we were on trade the president would be pushing infrastructure; he'd be pushing research, he'd be pushing education, much of which requires us to be able to relieve the sequester, and he'd be pushing productivity enhancing policies like business tax reform. But every one of these policies has even higher returns in a world where there is more expanded trade, more ability for businesses to export because we can take advantage of the economies of scale that those larger markets have, underscoring that these policies are even more important than they otherwise would have been.

In addition, on the other set of policies that complement trade are ones that help protect workers from the downsides of any cause of dislocation and inequality, including trade, help them get back on their feet and succeed in the economy. Programs like the affordable care act and unemployment insurance don't ask why you don't have health insurance or why you lost your job, and in the vast bulk of cases that won't have anything to do with trade, but it will help you regardless of the causes. At the same time, the administration has both proposed programs to help dislocated workers, regardless of the cause of dislocation, as well as to extend and strengthen TAA which expires at the end of this fiscal year. A lot of these complementary policies are fiscal policies and in that respect it's notable that insofar as trade is increasing your growth rate, it'll help relieve some of your fiscal pressures and put you in a better position to pursue these types of policies.

Having gone through a range of things related to trade, I wanted to comment a little bit on the really fascinating discussion and debate that's been going on with a wide range of people, the most notable contributions being Larry Summers and his wonderfully named blog, The Ben Bernanke Blog -- a debate over really the causes of

some of the slower growth we've seen and in particular looking at it through the prism of why equilibrium interest rates have been so low, with Larry arguing that a lot of it is rooted in the lack of productive investment opportunities that leave that interest rate low. And Bernanke arguing, or placing more emphasis on global imbalances. I'm not planning to tell you who I side with in this debate. I recently answered a set of really demanding questions related to the macro-economy, all of which were posed by me. One of them was secular stagnation, so you can look there.

But what I want to talk to you about is if you believe either of these hypotheses, what does it mean for trade? So first, secular stagnation. As Larry has advanced the argument, secular stagnation says we don't have enough productive investment opportunities. In order to get enough, we would need to drive the interest rate to much more negative levels than we're capable of doing, given the constraints of the zero lower bound. And as a result, he warns that the economy will be chronically demand insufficient. Insofar as you accept that diagnosis of the problem, trade helps remedy it, it helps remedy it by creating new productive opportunities that would increase investment for any given interest rate, and in the process of raising the growth rate, and thus raising the equilibrium interest rate giving more space for monetary policy to do whatever it needs and wants without bumping into the constraint of the zero lower bound. I don't want to overstate this argument. I wouldn't claim that there is secular stagnation. I wouldn't claim that if there is, that trade would fully solve it. This isn't to diminish other recommendations that Larry has made, like infrastructure, but it would help. And even if you don't think that secular stagnation, having more room between equilibrium interest rates -- having a higher equilibrium interest rate and thus more room for expansionary monetary policy would help stabilization in the future.

The other side of this recent debate has focused on global imbalances or the global savings glut, as Bernanke called it a decade ago. And it also relates to

aggregate demand. This view posits that a combination of underlying structural economic features and deliberate policy choices have led to an uneven global allocation of investment and savings. The result for the United States according to this view is that we import capital and run an essentially commensurate trade deficit. Notably such trade deficits appear to have been linked to other imbalances, like the debt-fuelled housing bubble the precipitated the financial crisis. Overall, according to this view, large persistent current account deficits force a choice between contractionary pressures and market bubbles that can boost consumption in the short-run, but threaten macroeconomic and financial stability down the road. These global imbalances can be understood as rooted in three factors. The first is macroeconomic policies broadly construed, the second is national exchange rate policies, and then the third is other asymmetries across countries, including the types of trade policies that I've been discussing today.

The largest source of the current global imbalances stems from macroeconomic policies broadly construed. You see countries like Germany that have current account surpluses that have increased to 7.8 percent of GDP, that in 2014 exceeded the current account surplus from China, even though Germany's economy is smaller. This type of surplus is largely attributed both to Germany's high exports outside the borders of the Euro area, and a number of fiscal or structural policies to increase domestic demand such as public investment in infrastructure, increased tax incentives for private investment, or greater expansions in wages in consumer spending could address this imbalance.

A second source of global imbalances can be currency policies that target an undervalued exchange rate in order to shift global demand. The United States has made progress towards promoting more transparent market based exchange rates as a key element of our international economic policy, including commitments we've secured through the G7 and G20.

China has historically had a systematically undervalued exchange rate that has contributed to global current account imbalances while helping to sustain imbalances within China's own economy. In response the United States' intensive economic diplomacy with China including through the strategic and economic dialogue has made some progress in addressing these concerns. The yuan has seen a real effect of appreciation of nearly 30 percent since China allowed its currency to resume appreciation in mid-2010, and the Chinese current account surplus has fallen from ten percent of GDP in 2007 to 2.1 percent of GDP in 2014. The United States and the broader global economic community will continue to push China to fulfill its SNED commitments to move towards a market determined exchange rate.

The third source of global imbalances is other economic asymmetries across countries that include the asymmetries in the level of government interventions that distort the free flow of trade. And for a given set of exchange rates, the fact that the U.S. economy is already very open, combined with the often larger barriers to our exports to the rest of the world, can be a source of imbalances. And in that respect it is notable that using available data, the United States is currently running a small goods and services trade surplus, with the totality of our 20 free trade agreement partners, and TPP would disproportionally result in reducing barriers to U.S. exports and thus could only help deal with that aspect of global imbalances as well.

The bottom line is that whether one places weight on secular stagnation or global imbalances, trade liberalization offers important economic benefits that help address either concern. Secular stagnation would be ameliorated by the faster productivity growth I've been describing, and global imbalances require a range of approaches including macroeconomic policy and currency but also include opening up markets overseas.

I want to conclude by bringing it back though to what I think is the main point, and the point I most want to underscore from this discussion. I think the Bernanke-Summers focus on aggregate demand is extremely important. It's helping us to understand the recession and recovery that we've gone through. It will help us think about the next recession. but it doesn't get at what I think is the most important economic question, which is, what is the future of productivity growth, and what can we do to make a brighter future for productivity growth.

There are a lot of parts to that and what I've tried to argue today is that expanding trade is very much an important part of achieving that. This isn't the only benefit of trade, in the economic report of the President, the most recent one, we documented the ways in which it reduces global poverty, raises working conditions abroad, can contribute to gender equality, can help the innovations that can deal with climate change. But ultimately, the most important of trade is what it can do for economic growth and what it can do to complement the other policies, like infrastructure, education, and research that are also essential for the future productivity of the U.S. economy and the living standards of our people. Thank you. (applause)

DR. BAILY: So I'm going to ask you a couple of questions, and then I'm going to throw it open to the audience. Now let me start by saying I'm a big fan of free trade, and a supporter of free trade, but I think I wouldn't be doing my duty as a (inaudible) here if I didn't press you a bit on some of the benefits and costs of free trade. So some folks, David Autor at MIT, but certainly not the only one, have really said that trade with China and the massive deficit we have with China has had a devastating effect on employment in manufacturing which has declined by several million since 2000, and is only coming back very slowly, probably will never get back to the levels it was at before. He and others have pointed to the effect that that's had on certain communities that,

where plants shut down and so on. So do you buy that, do you think that's trade that's doing that? Give us a response to some of those criticisms that we hear.

DR. FURMAN: I think that work by David Autor and his co-authors is really important and is really worth taking seriously. I've noted that they themselves have very strongly endorsed TPP and made a powerful case for it in a Washington Post op-ed a month ago. Their research is -- first of all it is important to understand what their research finds, and what it doesn't find. They look at local area affects and they look at areas that are more affected by imports and track what happens to manufacturing jobs and thus what happens in the economy. That's an important part of the story. Their research -- and they'd be open about this, by research design can't track two other things. It doesn't track, as we import more, half of what we import, as I said, is an input into the production process. And so a lot of American manufacturing in the American economy benefits from that side of the equation. But it's not concentrated in a local area so it's not something that they can well identify. So they don't get the totality of the effect even on the manufacturing sector and they certainly don't purport to be measuring the overall costs and benefits. Nevertheless I think it is something that the economics profession takes more seriously than it took 15 years ago. I think it takes it more seriously because the composition of trade and who we're trading with is different than it was 15 years ago.

The question then is what does that mean that we should do? Well one thing we could do is sit around and wait for China to conclude more free trade agreements of its own with other countries, and to do that without the types of labor and environmental standards that I've been talking about. I think that would harm the U.S. economy. It would lead to trade diversion, it would lead us out of it. Or another option is to instead take the lead and try to shape the global rules about trade, make sure that given the openness of the U.S. economy, we are, as I was just talking about before,

having the strongest labor and environmental standards that we had in any agreement, addressing a range of other issues, like state owned enterprises, so that you're better, in effect managing the types of policies that David Autor proposed. And the last think is just the complementary set of policies that I was talking about, are quite important. And we shouldn't just think of those as TAA. We should think of them also really as the types of things we can do to take advantage of the opportunities that trade offers, so the infrastructure, the research, the education -- everything I had been describing in my remarks.

DR. BAILY: One question is, I don't think China is part of the TPP negotiations, even though it's the largest economy and the largest trader in Asia. Is that a concern, or is that just part of -- is that the right strategy?

DR. FURMAN: This is a high standards, high values trade agreement. And we're trying to work with countries who are going to be able to have the types of transparency, the types of national treatment, non-tariff barriers, labor rules, environmental rules -- a whole range of things that are up to the standards that we have to participate in the agreement. And that's something that we think the countries that we're working with right now are going to be able to achieve, and we're going to work with them to be able to achieve.

DR. BAILY: Do you hope that China will eventually join the TPP and be part of that process?

DR. FURMAN: We are focused on --

DR. BAILY: If you can't answer these questions, that's fine.

DR. FURMAN: No, we're focused on this set of countries right now, yes.

DR. BAILY: Okay. The secular stagnation issue, and I've been reading the blog of my new colleage, Ben Bernanke and Larry's answers to that, and I think Ben is right, and I think other people including I have said to Larry, you've got to take into

account the international connection here and that there are investment opportunities overseas and you can shift from a trade deficit to a trade surplus which generates demand. But as we look around the global economy today and we see what's happening in Europe, the emerging markets are weaker, even China is growing more slowly, is that a realistic scenario? It seems like the dollar has become increasingly overvalued and the idea of a trade surplus seems to be even further away. I mean when's the last time we had a trade surplus? Very briefly, perhaps in 1990, but we haven't had trade surplus in a long long time. So is that a realistic way out of secular stagnation for the United States?

DR. FURMAN: It's a matter of the direction you're moving, so our current account deficit has been cut from about six percent to about two percent, and now it's the smallest it's been since the late 1990's. So I think we in a lot of ways have been successful at rebalancing our economy. In part that's because of domestic choices we've made, reducing the deficit, expanding our production of petroleum, reducing our consumption of petroleum. In part that's because some of the movements that we've seen in the rest of the world and some of the rebalancing and progress elsewhere that I was talking about in my remarks. So I don't think the question is, can we have a trade surplus, can we have a trade deficit. The question is, will these policies help or hurt. And the argument I was making is that they will help. There's no doubt that the biggest influence on our exports is growth in the rest of the world. There's almost a perfect correlation between the growth and our trade weighted GDP of our trading partners and U.S. exports. So something like the Korean FTA -- exports have increased to Korea following the FTA. But the trade balance has worsened with Korea and that's a function of what's happened to Korea's economy in the last couple years. It doesn't tell you something about the FTA itself. So I think almost because of all the reasons you were saying Martin, that's almost more of an argument for the importance of this, not saying this will solve all our problems unless we invest in the right direction.

DR. BAILY: Right, right. How do you make trade a little bit more popular? I will take the liberty of reminiscing us to when I was in your job, as we were pushing to admit China to the WTO, and there was this, the meeting, the famous meeting in Seattle where the Boeing workers went out marching against globalization which was a little strange to me, given how many planes they sell overseas, but anyway. So I went out there. I was sort of the scout or whatever for Clinton coming out and they cancelled my speech because they said they couldn't guarantee my safety. And so I flew home with my tail --

DR. FURMAN: You're making me nervous here at Brookings. (laughter)

DR. BAILY: My tail between my legs. So clearly trade -- it's not just an academic argument. How can we make trade and trade agreements more understood, more popular? How do we deal with this popular opposition to trade and trade agreements?

DR. FURMAN: That's a tough question but I was going to answer, you come to Brookings --

DR. BAILY: (laughter)

DR. FURMAN: Explain it all and then everyone will know.

DR. BAILY: Way to go, yeah. I like that answer.

DR. FURMAN: So and for the 300 million Americans that weren't able to make it here today, this will be on the CEA website, so you can read it there.

DR. BAILY: And on Brookings. I don't look at other websites, more importantly.

DR. FURMAN: But no, I think it really is a matter of explaining, and it's also -- I think it really is important to do what you hear the President doing repeatedly, and what I tried to do today, which is to distinguish between the process of globalization, which has brought huge opportunities but it also has brought challenges from the way in

which we're managing that process of globalization, and the choices we're making with regard to it. And with any issue, you have to ask yourself what the alternative is, and the alternative to TPP is we'd have 1.4 percent tariffs on average, dealing with a bunch of countries that weren't required to have labor standards, weren't required to have environmental standards and could still maintain their non-tariff barrier. So a lot of it is how we are managing globalization, what are the alternatives and trying to really drive that home.

DR. BAILY: Now I'll look for some questions from the audience. We do have mikes. Please ask a question, don't make a speech and please wait for the mike. All right, so we'll start here.

DR. FURMAN: I also would like to encourage multi-part questions, because then I choose which part to answer and can ignore the others. (laughter)

DR. BAILY: Okay, again, so long as the -- well, why don't we start here. Yes, as long as there are not too many multi-part questions. And identify yourself.

MS. WERTHEIM: I'm Mitzi Wertheim with the Naval Postgraduate School. I just want to give a context which is the complexity of these issues are so enormous that just listening to it verbally is very hard to comprehend. So I'm a great believer in trying to tell your story for 11 year olds and using graphics, if you want the American public to understand it. Okay, you used a very important word called process, which the only place I think it's taught in the United States is when you study systems engineering. And I think one of the dilemmas we have is we don't understand how things work, so we don't know where to go and work. The other thing I want to ask you about is this whole business of productivity, and this drive for productivity which I understand at the very top level, but I remember when the decisions were made, I think it was back in the 1980's but maybe I'm wrong about that, about how we were going to become a service economy. And so as you improve a service economy, it seems that we live in a

world now where nobody has any time because they're in service jobs and they have to keep doing more and more and more to get better productivity. It's really shifted the economy and my question is, what do you do about that?

DR. BAILY: There you go. I'm dying to hear the answer to that question.

DR. FURMAN: And that's a very big question. And that's actually one of the challenges we have in productivity, is that service sectors tended to have lower productivity growth. And manufacturing, as we shift more towards that, where do we get that productivity growth? It's a big question, but I'll answer a part of it. And once again, whatever question you ask, the answer is going to be trade, and this one's no exception, because the United States has real comparative advantages in services. It's one of our really big strengths. It's also one --

DR. BAILY: Trade surpluses.

DR. FURMAN: And we have trade surplus in services. It's also one where we face much larger barriers to trade in services than we do in manufacturing because the WTO -- the GATT and the WTO concentrated on the manufacturing tariffs, not services which often have barriers that aren't tariffs themselves. And so both the trade and services agreement at the WTO, as well as TPP and TTIP are disproportionally without services and by expanding market scale, increasing competition, increasing innovation, all the things I was talking about, I think really would help productivity in that sector especially.

MS. WERTHEIM: At the high end?

DR. FURMAN: I think to some degree across the board.

DR. BAILY: Okay, so I denied you a question there, so if we could, gentleman on the left.

MR. CHECKER: Thank you very much, Larry Checker. I'm wondering what income inequality has to do, both with secular stagnation and global imbalance, and

if that wouldn't help both of those theories out a little, if we could just level off. I mean, when you see that corporations are buying back their stock rather than increasing wages and benefits, obviously people can't afford to buy their goods. And wouldn't some policy revolving around income and equality help?

DR. FURMAN: I think we care about income and equality because we care about how people are doing today, and because also income and equality if very closely correlated with mobility, and more inequality means less mobility, and makes a farce of the notion that we have equality of opportunity, when income is distributed so differently. We don't have equality of opportunity when you take steps to rectify that. I don't see exactly how it's related to secular stagnation and global imbalances.

DR. BAILY: Well if you give income to a lot of people --

DR. FURMAN: There's a little bit of the savings glut coming from, yeah -- so there's that relationship where you have a lot of savings and less consumption associated with high income, so I think it's probably part of it, but I don't think the reason you want to deal with inequality is to deal with global imbalances and the reason why you want to deal with equality is because you want to raise incomes here.

DR. BAILY: Question over there?

MR. HARRINGTON: Good morning. My name is Bill Harrington. I'm associated with the research entity called Wikirating, and I'm the structured finance expert for it. I've been a practitioner in the markets for derivative contracts more than 20 years. And my concern is the quality of data that the government and that the private sector has to actually assess certain aspects of the economy. So I'm not going to give you a multi-part question. I'm going to give you a multi-choice question. If the economics profession had developed a tool to adjust the national accounts to reflect the impact of derivative contracts which are in excess of 500 trillion notional on the U.S. economy, and this would be akin to say the adjustment to national accounts that medium income

economies use to reflect like the barter economy -- this would be the other side. Would that adjustment be zero percent? Which is to say that the derivative contracts are fairly valued -- would it be plus four percent to say that not only are the derivative contracts fairly valued, but they have some sort of catalytic property that promotes growth, or would it be minus four percent -- which is to say the valuation problems are distorting valuations of companies and potentially the national accounts, and maybe service of proxy for more bail out risk?

DR. FURMAN: So the United States has outstanding statistical agencies and outstanding statistics but as good as they are, the economy keeps getting more complicated and harder to track and you know, the budgets keep getting tighter. I think there's a range of issues. Personally I think some of those, with the Office of Financial Research is putting together a lot more financial data and using that to help monitor some of the risks in the economy. I would separate that from GDP though. If I have a dollar and I hand it to you and you hand it back to me and we hand it back and forth trillions of times, that doesn't expand the size of our economy. The economy is only if you actually make something and sell it to me or vice versa, so a lot of it is financial transactions -- your (inaudible) and GDP and --

DR. BAILY: They're intermediate goods essentially.

DR. FURMAN: Right.

DR. BAILY: So they may facilitate other production or not, depending on your view of how they work, but they wouldn't be counted directly. Yes, we have a question here.

SPEAKER: W from Bergen Howard. So this is probably not the biggest defense of TPP and the story's probably not going to sing to most people but I think it's pretty important. Could you discuss the way that TPP could be an agent of structural

change in other countries, and then the benefits that would then come back to the United States? I'm thinking of Japan in particular, but there are probably other countries as well.

DR. FURMAN: Yeah, I think your question implicitly had the answer in it, which is a lot of what we're dealing with in other countries are from our perspective, and the perspective of our exporters, are non-tariff barriers. From the perspective of those countries, there are often a lot of structural rigidities that protect one entrenched interest within the economy at the expense of the broader economy and by helping to negotiate those, in the case of Japan for example, it's strengthening the third hour of Prime Minister Abe. I think it goes with the grain of the types of reforms that he himself wants to do and is working very hard on and that together with, in the case of Japan, monetary and fiscal policy, the first two arrows are an important part of increasing its growth. And that matters not just for Japan, but also as I said, because the primary determinant of U.S. exports is the leveling growth of GDP in the rest of the world. So we want a stronger economy than our trading partner in addition to more economies in our trading.

DR. BAILY: Yes, question there and then one there, and then we'll be close to done.

MR. PRIVITERA: Thank you very much. Alex Privitera with AICGS. You provided the broad picture and the priorities that TPP and I guess you would make the same case for TTIP.

DR. FURMAN: Oh yes, absolutely.

MR. PRIVITERA: Provide. I wanted to focus for a moment on 2015 as a year. This is a long process. This is something that will not be solved in the next few months. Where do you see the biggest risks to global trade and therefore also for global growth and particularly U.S. growth in 2015, given what we have seen in the past few months? If you had to sort of draw a map, where would you see those flash points? Thank you.

DR. FURMAN: I think first of all I would start with the U.S. economy overall, has a strong trend, has strong momentum. It bounces around from quarter to quarter. The data for the first quarter has been weaker but most of the economic analysts have put a lot of weight on things like weather, the ports and other factors like that. But if you look at in particular, consumption and business investment, those are two of the more stable and inertial components of GDP and combined, they've had very strong growth. The rest of the world I think is -- the biggest headwind that the U.S. economy is facing right now and is likely to face over the course of the next year. You've seen some positive data surprises over the last couple months, especially for Europe. But those are surprises, that's relative to what was expected and expectations were quite low and we're coming in a little bit above those low expectations. So that growth in the rest of the world is something I think that is weighing on our exports and on our overall economy and that's why it's important both to work with the rest of the world to strengthen it and also important to make sure we're not doing things here like the sequester for example, that would move our domestic economy in the wrong (inaudible).

DR. BAILY: Do you think Russia's effected our economy through a sort of confidence effect, or is it just a political threat?

DR. FURMAN: I think Russia is primarily a geopolitical issue in terms of the direct links -- 0.1 percent of U.S. GDP is exports to Russia, so that's a trivial direct economic link. I think it does probably play to some degree into these broader confidence issues and that's why I think successfully resolving on national security issues can help our economy as well, so I see those two as complementary.

DR. BAILY: Okay, question over here.

MR. FARM: Thank you. Nick Farm. You spoke a lot about the competitive advantage that the U.S. will get from TPP and the other trade agreements, because of our open market. Can you flip the argument on the other side and discuss

some, what our partners think they will get in their benefit vis a vis the trade agreement, relative to the U.S.?

DR. FURMAN: Yeah. In the Petri, Plummer and Zhai study I talked about, quantified that benefit for each of the countries and their meaningful in the case of every one of the TPP countries. You know, often a small economy can benefit more because trade is a larger fraction of what they're dealing with than it is for the United States. A lot of countries benefit as we talked to in the context of Japan for example. And their non-tariff barriers aren't helping them. They're actually hurting them and they're there because a concentrated interest is defending them at the expense of their country and at the expense of our country, so a lot of the basic lesson of comparative advantage itself isn't, we win at your expense. It's we win together, we do what we're better at, you do what you're better at. So I gave the example of Intel and Samsung doing research on to some degree, different areas and specializing. So I think all of those cases for trade I was trying to make was very much a positive sum complementary case. I do think thought because the trade balance and these global imbalances are an important economic issue and I tried to make that clear, from thinking about that, which is not the only lens to think about trade for if we're thinking about that, that's where it's important that we're disproportionately reducing our barriers to export.

DR. BAILY: I think our time is up, and I want to thank you for a very substantive speech, for answering questions, which doesn't always happen. I mean that seriously. And thank you for coming here and giving us your time. So we appreciate it. Thank you. (applause) And now we have a changeover of panel. I'm going to turn it over to Homi to introduce and moderate the panel.

MR. KHARAS: Thank you Martin. My name is Homi Kharas. I'm a Senior Fellow in the Global Economy and Development Program here at Brookings, and I'm going to moderate this next session. So for the next hour and a quarter of so, we're

going to switch and talk really about long term growth and in particular, we're going to talk about two big drivers -- what's going to happen to productivity and what are the sources of underlying productivity growth on the one hand and on the other hand, how does all of that relate to the changing demographics of our world and specifically to what, in most countries is the problem of aging and a much older workforce. So we've got a great panel. What we're going to do is, each of the four panel members is going to come up and give a short presentation. Then we're going to have a panel discussion and then open it up to Q&A. So the first of our panel members who's going to present to us is Dr. Jaana Remes. Jaana is a Partner at the McKinsey Global Institute. All right -- we're first going to have James Manyika start. Luckily he is also a Director at the McKinsey Global Institute. He is also a Senior Partner at McKinsey and Company and very importantly for us, James is also on President Obama's Global Development Council and has served as the Vice Chairman of that Council. He has been a member of the National Innovation Advisory Board and for those of you who think that this is all just a job for economists, et cetera and all this stuff on productivity isn't really rocket science, he has been a visiting scientist at the NASA Jet Propulsion Laboratory and he holds a D.Phil from Oxford.

I'm actually going to introduce everybody so that I don't have to keep bouncing up and down. So after James will come Jaana Remes, who is a Partner at McKinsey Global Institute, author of a wonderful new report on global growth that will serve as the basis for the presentations from both James and Jaana, but in particular, anybody who has followed the McKinsey Global Institute work knows that if you want to think about what's happening to the world economy and big trends in the world economy, this is the go to place and resource, whether it's on topics of productivity or competitiveness, organization, what's going to happen to natural resources and climate change. This is the source of some of the best data actually that we have and the ability to synthesis it all together. So Jaana has been writing on these subjects for a very long

time and so I think brings not just this particular volume to the discussion but also this combination of all the other background work that she's been doing over the years.

After Jaana, hopefully, we will have Marco Annunziata -- yes, no change in order? Great. Just let me know, you know, if you want me to moderate these things. Marco is the chief economist for General Electric. When we think about productivity and about the frontiers of growth, we always think about how big companies are going to be pushing out the frontiers. But he's also a prizewinning author. He's written books on technology, on work and jobs, on connectedness, many of these issues on trade, how countries will actually come together and think about their comparative advantage, not just their own domestic economies, and he holds a Ph.D. from Princeton University in Economics. And then last but not least, we have Martin Baily. Martin is a Senior Fellow here at Brookings. He holds the Bernard Schwartz Chair on Economic Policy Development. He is a slightly more mature version of Jason Furman, having held the same position a few years earlier, much more experienced of course, Martin, and with many war stories under his belt. But he was also a principle at McKinsey and Company and at the Global Institute in Washington. He holds a Ph.D. in Economics from MIT. James.

DR. MANYIKA: Homi, thank you and good morning. Thank you to Brookings for hosting us this morning. I think as Jason put it, there's no other more important topic in economics than growth and I would add prosperity. And so one of the things that my colleague Jaana and I wanted to do is to share some perspectives from some of the research we've been doing. But in particular, talk about where we are, how we got here, and what we might do about what the future holds ahead of us.

So I'll bring up a brief history. The last 50 years have been pretty extraordinary. The global economy has expanded by six fold in the last 50 years. And it is actually important to particularly take note of two features of this growth. One is the

fact that we've expanded to the right, in other words 50 years ago the global economy had to cater for about two billion people. Now we've actually grown that to close to over six billion people, so that's extraordinary growth in terms of the people that the economy has to cater for. If you note to the north, going up the scale we've also increased GDP per capita quite extraordinarily, from where it used to be 50 years ago at roughly 20 thousand, now to about -- it's grown by about 2.4 percent. That's extraordinary growth in both directions. It's also important to know that the U.S. has actually led the way. So even though the U.S. 50 years ago is already at a high base in terms of GDP per capita, it actually further improved on that in the last 50 years, so that's worth noting. It's also important to note that China and India and Brazil were probably the big additions as we grew to the right, in terms of adding more people, who the economy had to cater for.

It's also quite useful to put this in a historical perspective. So the last 50 years are pretty extraordinary, and where we had far far higher growth rates than we had in previous periods. The chart here compares the twenty year period in 1700 and the 1900s and then the period just before 1950. And you can see how extraordinary the growth has been in the last 50 years.

The question now becomes, what happens next? And what does it look like going forward? But before we do that, it's also important to see what the elements have been that have driven the growth that we've seen in the last 50 years in particular. And as you can see from a classic growth decomposition, we've benefited in roughly equal measure from growth in labor supply and employment growth, as well as growth in productivity, roughly in equal measure. Much of the growth in employment growth was a result in increased fertility rates, the baby boomer generation, the demographic dividend; that drove a big part of the growth that we saw in employment growth. The growth in productivity mostly came from, as the global economy shifted from mostly agricultural economies to more industrialized economies, and increasingly also into the service

sector economy, and people moving into cities. So those two effects roughly in equal measure got us to where we are.

So as we think about what might happen next, we think it's quite important to examine both of these components and see what they hold for us as we look forward. The first thing we're going to make a point about is to note that in fact we may be running into some demographic headwinds. If you remember one of the two components of growth was growth in employment growth. And what this chart shows is basically how the global population's been growing over time and you can see there's been a slowdown in population growth. The light green shows growth in terms of the young and the elderly, the blue shows the aging of the working age population. What you'll notice is that between 1964 and 2014 we actually had a growth in working age populations that shows the overall global population, but that is starting to slow, if you look at what it might look like in 2064. So if you think about it in the previous period we'd benefitted from this roughly 1.7 percent growth in employment growth. If you project that forward just based on demographics that growth is going to look more like 0.3 percent. So that's a real dramatic slowdown. And it is actually interesting when you look at this from the point of view of the different countries. What this chart shows -- places here, both different individual countries but also groups of countries. So as you can see, much of the world, in terms of employment growth is going to basically -- the employment is going to peak in roughly 2050. The top line shows the growth in labor supply globally, and unfortunately the line falls exactly where that point is, which is roughly in 2050, is roughly when it peaks. And that's close to when it's going to peak in emerging countries. But if you look at the line below, where that little triangle is, shows roughly that in the advanced economies employment growth is mostly going to peak around about 2020 thereabouts, based on current trends. And you will see when that will happen in different countries. It has already happened by the way in some countries. You can see where

countries like Russia are for example. It will happen much much later for some countries for countries like India, based on the demographic shape of those countries, as well as in particular countries like Nigeria, which has very very very high fertility rates, and in fact by 2050 will actually be the third most populous country in the world. So as you can see the world is aging.

Now from a labor supply standpoint, the growth rate here looks like it's about 0.3 based on current trends and demographics, that's what you see over to the left. We can do something about this in terms of increasing participation rates and putting more people into the workforce. And that will get us something. What this shows roughly is we can get as much as -- we can improve the growth rate to roughly 0.6 percent, in particular, increasing the participation of women in the workforce, mostly outside of the (inaudible) economies, getting even more, some more men to participate in the economy who don't today. Looking at youth participation, but also looking at the older population. What you will see is that for the developed economies, the big boost such as it is will come from getting older workers to participate in the economy. In emerging economies the big boost comes from mostly getting women to participate more fully in the economy. But that at most will get us in the best case scenario, will get the growth rate for labor supply from roughly the 0.3 that we see to about 0.61 -- so not a huge amount in the grand scheme of things.

Let's look at the other piece which is productivity. Well productivity, even as high as it's been over the last 50 years as I said 1.8 percent of growth has varied quite significantly across different countries. As you will see the spectacular stars here, in the period we are looking at which is 1964 to today has mostly been South Korea and Japan. The advanced economies include the United States. These were already high productive economies, but even they grew quite a bit.

And then you see the emerging economies, the big growth in terms of productivities comes from countries like China and Turkey. It's also important to note that it still remains quite a striking observation that the advanced economies are still five times more productive than the emerging economies. As you see there's kind of a mixed picture here, but this is one of the things at least we've got to work with. If demographics are going to do are going to do what demographics are going to do, the other part that we can actually do something about is the productivity side of things.

So what could this look like going forward? As I said demography is demography and we can do some things about it but not a whole lot in terms of the labor supply. So we're really looking at productivity. So we've got a few scenarios here to contemplate, which mostly focus on what could happen with productivity. So the first scenario which is the first column here, assumes a growth rate in productivity of 1.2 percent. That growth rate is really what the growth rate was in the period up to 1964. So if you looked at these prior historical periods, 1900 to 1964 that's what the growth rate in productivity was.

The middle column is the productivity rate we've had globally in the last 50 years, the 1.8 percent. The productivity over to the right at 2.5 percent is the best case in terms of -- if you look at the most productive decade we've had is really the decade between 2004 and 2014. And that was the growth rate in productivity in the countries we're talking about, which is the 2.5. Well what's striking about this picture in any of these scenarios, is that in all of them this implies a reduction in GDP growth. Because demography is what it is, even at these different growth rates for productivity, we're going to see a reduction in GDP growth. We'll also see a reduction in GDP per capita growth which is particularly important on the basis that GDP per capita should translate ultimately into prosperity.

So this doesn't look very good, except in the one small (inaudible) case at least with GDP per capita, which is the extreme case which assumes we do the best we've ever done, in terms of productivity.

Let's go into a little more detail. So if we take the middle option, and see what does this look like globally -- so it shows you on the right, GDP growth historically has been 3.5 per cent, so GDP would then decline globally in these G19 plus Nigeria. We made up a group of countries here, with the G20 -- which is G19 plus Nigeria. The growth rate would decline to about 2.1 percent, which is a reduction in GDP of about 40 percent. Similarly you'll see a reduction in GDP per capita of about 19 percent. Now of course this will vary quite a bit across different kinds of countries because of their combination, the mix of their demography, the historical growth rates, and so forth. And what you'll see here is that for example for the United States, if you work through the similar math, and a similar calculation, the reduction in GDP growth would actually be about 34 percent, which is quite substantial. And you'll see that the countries that will be impacted by this the most are countries like Germany, as well as even Canada interestingly enough.

Now this theory is not just an advanced economy challenge, it also applies even in the emerging economies. As you can see even countries from Brazil to Mexico, and even China would see reductions in their GDP growth. The one difference is you can see obviously is the case of Nigeria, which is why I wanted to include it here. But that's mostly a function predominantly of its demographics, which effect the labor supply.

So the question is what do we do about this? So before we all get depressed and worried about what I just described here, my colleague Jaana is going to hopefully come with some good news, at least some promising news. (applause)

J: Thank you. It's a real pleasure to be here. And as James set it up, it is pretty clear that as we look ahead, global growth is going to be a question of productivity growth. And that's a little bit of a challenge for the economies, because we don't have a great way of predicting productivity. Alan Blinder famously said a few months ago that every swing in productivity growth in the past has come to us at a price. And in many ways, how we can start thinking about global growth when it's really going to depend on productivity growth which we traditionally have not been very good at doing. What can we say? We obviously don't have any better crystal ball than anyone else around. But what we do have is over two decades of studying productivity at the company, industry and country level across a broad range of countries in the globe.

So what we wanted to do in order to shed some fact based insights into the global growth and productivity challenges, is to be really looked at, what do we see happening at the productivity levels across different industries around the globe. And what do we see as opportunities to improve those? Obviously we didn't want to take a 50 year time perspective simply because of the fact that it is a too far, too long a distance to have basically counted on any facts. Decrease of freedom is too long, so we looked at the next ten years, talked with our colleagues who work with a lot of industries and companies around the globe. And assessed, what do we see as the prospects for productivity in the next ten years?

We studied five industries -- agriculture, food processing, automotive, retail, and healthcare. And what did we find? The good news is, is that we found plenty of opportunities to improve productivity. What we have here is -- I'm not going to go through every single problem, but the idea is, that when we looked at every industry, we saw opportunities, both on the left hand side of the chart you can see opportunities to close the gap to best performing industries and operations, and on the left hand side, opportunities to push different tier. Do better than even the best ones today. But let me

just illustrate a few examples, just to give you a flavor for the kinds of things we are talking about.

Agriculture, we all know that this is a big opportunity in the emerging markets, to continue the structural change to more productive jobs. But, if you look at the pushing the frontier, even in places like the US, technology today allows us to use sensors and be much more specific in how you apply different enablers to increase yields, by ten to twenty percent. So in fact agriculture is expected to be by far the largest end use market for jobs. So even if we think of agriculture where a lot of the change has already happened, it's actually on the frontier of many of the technologies.

Automotive, lots of program -- we hear a lot of the technological advancements on the right hand side of that end. An example of the left hand side would be China. There are more cars sold in China today than anywhere else in the world. And 36 percent of all workers, work in the sector in China. Yet there are 150 and more individual automotive companies, a landscape very similar to how the U.S. had in the early decades of automotive industry growth. So really there are big opportunities to consolidate, increase scale and improve productivity that can translate into real productivity growth, even in industries like automotive.

Retail -- a sector that actually was one of the key drivers of the real productivity boom in the U.S. in the late 1990s, a lot of that coming from really operational improvements throughout the value chain, and those opportunities remain both in developed economies and in emerging markets and in addition to that, we can continue to push the mix of operations towards more productive ones, in emerging markets largely moving from traditional to modern ones. For us here a lot it moving into online that can be 80 percent more productive in labor productivity terms than the brick and mortar.

And last but definitely not least is healthcare, an industry that is large below average productivity and below average productivity growth. And these are the

industries that are today creating -- healthcare and similar regulated and public sector industries tend to be the ones where employment is growing in developed markets, but productivity is not. And the good news is there is a lot to be done through the operations in many ways. And I think just to give one example, nurses time spent -- they spent roughly on average of a third of their time with direct patient care. Being able to move things away from them can make a big difference on how you actually for example, capture data and reduce transitions for example. And that's something that I think a lot of healthcare providers are working on.

So all of this just tells you that clearly we are not running out of opportunities to improve productivity, and the overall impact if you estimate it and we aggregate it up is that we could get four percent productivity growth globally if we tapped into the full potential of what we saw on the ground. That is actually more than enough to increase the productivity growth by 80 percent, which would be the fully needed amount that we would need to fully compensate for the demographic decline.

And perhaps the best news of that is that three quarters of that is catching up, basically adopting techniques that we already know how to do in other parts of the world. And that really is something that a lot of the debate is not talking about. It's a lot more talk about are we running out of opportunities. We don't think so. There is plenty of them. A lot of that is in the emerging world; 80 percent there is from catch up. But there are significant opportunities in the U.S. and other developed countries as well. Roughly half of the productivity opportunity is still moving the lower performing operations into closer to the best practice.

So three quarters come from catching up, the last quarter is then pushing the frontier. And this again, we are looking at opportunities that we see coming online in the next ten years and being released again economical. That obviously underestimates

the real opportunities that there are, because we can't really see what kind of technological innovations are on the line.

The fact that these opportunities are there, doesn't mean that they will be tapped into. Some of the things that we saw on the ground we had already seen ten or fifteen years ago when we first looked at many of them. The challenge really is, how do we make sure that the companies, that the industries, are going to go through those changes and transformations that are often hard to do. And here the challenge is that there is obviously no silver bullet. When we looked at what is keeping this from not happening we found a very broad range of things that matter. We categorized them into ten enablers in four categories that we have all seen many of these, but collectively these are the ones that will matter for global productivity growth going forward. For catching up we need to continue to increase transparency and competition to provide the incentives to improve, particularly in the service and regulated sectors where we haven't seen that in the past.

We need to continue to have incentives and the research capabilities to continue to push the frontier, something that made a big difference over the last 50 years. We need to work on the labor supply side. There are many opportunities of actually improving and speeding up women's labor force participation. I think there's a lot of change happening particularly with the elderly workers. And of course there's more we can do to make labor markets more flexible, particularly to help the transition from those jobs where the numbers are declining, to the new ones that are being created. And last promoting cross border economic flows, really a major driver of the last 50 years has been the reduction in trade barriers and foreign direct investment barriers that have helped integrate the global economy. I think we need to see much more of that, as we heard in the presentation with Jason, particularly in services.

So this all may seem like a lot of challenges for the government; this is not just the government's job. We actually looked at specifically what share of all of these productivity opportunities that we see today would require some changes in regulation of government actions. And roughly depending on where you're looking at it, it is roughly a third, much more in emerging markets where the regulatory constraints are often still higher than they are in the developed regions, where a lot of that change actually happened in the last 50 years. But there are significant barriers in the developed markets still, a little more than one tenth of the opportunities.

So there's a lot to be done, both by governments but also by companies, employers, and even consumers as we see, particularly the technology enabling different kinds of players to come into the market and change.

So that in essence is what our research found. We are surely not running out of opportunities to improve productivity, both from the catching up or the pushing the frontier perspective. The question really is, how do we make sure there is strong incentives for everyone playing a part in the economy to go after those opportunities. At the same time, it is pretty a tall order to be able to move across on so many fragmented opportunities, so I think we might want to take a moment and reflect on what is the kind of a debate we want to reflect on growth.

One question is what are the kinds of growth rates we should expect? There's nothing magical about the growth of the last 50 years, as James showed. What is it that we are expecting, what are the sustainability constraints of that growth? How equitable it is -- we know we are not going to see rise in the number of consumers or customers. So even after the very important considerations for equity, even just from purely growth perspective, making sure that incomes of individuals rise and particularly those who are most likely to spend them. That will make a big difference for growth. And last, how do we measure growth? How do we measure GDP through its livable life?

Across all of these I think we already are seeing a good robust debate starting, and we very much look forward to continue the debate, and working with our colleagues around the globe as well as the thought leaders around to hopefully be able to further not just the debate but also some of the productivity levers around the growth. Thank you.
(applause)

MR. ANNUNZIATA: Thanks very much and thanks to Brookings for having me here. It's a real honor and a great pleasure to be here to debate questions which are central to economics as we've already heard, but that are also really central to the company I work for in terms of determining our future. As you've heard by now we really have two different questions on the table today. One is how can we achieve stronger economic growth globally. And a very important point we've just heard from the McKinsey report is that a lot of it -- a lot of the strong economic growth can be achieved just by spreading more evenly the benefits of technologies which already exist through the catch up. And I think this is an extremely important message, though of course it will depend not just on policy actions but also on a whole range of economic reforms, investment infrastructure, it is not going to be easy or free.

The second question is, how can we achieve stronger growth, in countries like the U.S.? In countries which are already at the technological frontier, and in particular how can we achieve stronger growth by pushing the technology frontier further out? And I think these two questions are really interrelated because I believe the faster we can spread existing technologies across the world, the better our chance of pushing the technological frontier further out more quickly. Partly because by spreading technology more widely, globally at a faster pace, we will bring more people to push the technological frontier further out. And I think this is an additional argument as to why trade can accelerate innovation as Jason Furman arguing at the beginning.

So the way I see it is there is no doubt that the piece of technological innovation right now is accelerating rapidly. And what I find interesting is the acceleration is triggering a very schizophrenic reaction. So on the one hand, you have the secular stagnation idea of Larry Summers, and you have the thesis by Robert Gordon that U.S. growth as we know it is dead. And these are theories which are underlined by a very profound pessimism in our economic prospects and the power of technology. And yet on the other hand you have an equally deep fear that technology is soon going to create mass unemployment, increase income inequalities even more than where they already are, and possibly push us towards a dystopian future where artificial intelligence brings to rise a new generation of machines that will dominate and eventually replace us.

So on the one hand you have a view that says, you know, there's new ways of innovation we're seeing today, are really frivolous, very irrelevant. They don't even get close to approximating the transformation of power of the great inventions of the industrial revolution, like the steam engine, or like electricity. And on the other hand you have a view that says, these innovations are actually so powerful that pretty soon they will enable us to have the level of global economic output we have today, with virtually zero labor input.

And I think the fact that you have this schizophrenic reaction, in itself shows you that we are indeed beginning to experience a technological transformation which is deeply disruptive and transformative. And it is in itself a signal of the uncertainty that we face at this point. So as I mentioned, today if you look at this from an industrial prospective, the pace of the technological change is accelerating massively. At GE, we see very clearly in our core sectors, which range from aviation to energy generation, from transportation to healthcare.

And what is happening really is you're having the convergence of visual technology with physical, mechanical, industrial technologies. And this is gradually

transforming what we know as traditional industrial machines into interconnected devices similar to our smart phones. And therefore it's opening into industrial machines, new dimensions across which the functionality can be expanded and improved. It is a tremendous transformation. We at GE have been looking at this for a few years now, and we call this transformation the future of work. But we really see it is composed of three different and interdependent pillars.

The first one is what we've called the industrial internet, which is essentially the internet of things in industry. And it is industrial machines being equipped with electronic sensors and therefore generating industrial sized amounts of data, which are then processed through sophisticated analytics, yielding better insights on how we can use more efficiently both individual industrial machines, but also systems of machines -- whether it's an entire wind farm or the operation of an entire hospital. And this has enormous benefits, essentially what it brings you to is a move from a break and fix model, where you wait until the machine, whatever the industrial machine is, has something wrong with it, and then you go and fix it, to condition based preventative maintenance, where you know enough about the behavior of the machine that you can go and fix the problem before the problem actually manifests itself. And therefore, you achieve a very significant reduction in unplanned down time, and so no more holding of operations because something goes wrong. You get significant increases in efficiency, and very very significant declines in production costs and operation costs. So this is the first pillar.

The second pillar is advanced manufacturing. In advanced manufacturing, it is really a combination of different things. One is differing production processes, and the most well-known is 3D printing, or active manufacturing. But it's also new materials used in these new processes, and it is also a digital thread which links

together every element of an industry factory floor, and links the factory floor with a supply chain and with a distribution channel.

And what this does is, first of all, it shortens dramatically the cycle of design, prototype, produce. It makes the production faster, more flexible. It changes the nature of economies of scale, it moves towards democratization of manufacturing. Bottom line is it delivers a massive increase in speed and flexibility of how the industrial operations are organized and how they are operated.

The third element of this future of work framework is the global brain. And that is the distributed intelligence of human beings across the globe, connected by digital communication networks. And this is something that brings you outsourcing, open source innovation, and essentially turbo charges the pace of innovation.

And let me give you just one example of this, which to me is just astounding. At GE we pride ourselves in our ability to do innovation in house. We have a big research department. We think we have the best engineers and scientists in the world in our fields of operation. And two years ago we thought after much internal debate, what if we tried to do it differently? What if we tried to open up our innovation process? So we launched our jet engine bracket innovation challenge. What we did was, we partnered with one of these councils in platforms, and we went to the engineering community, and said, here is the blueprint of the jet engine bracket as it does it today. And that's an element that attaches to jet engine to the plane, so simple, but pretty essential. And we said, we challenge you to give us a design which is at least as robust, which is lighter, and which can be produced with 3D printing techniques.

We got a number of high quality designs being submitted, the winning design came from a young engineer from Indonesia, somebody who had absolutely no background in aviation at all. The design was more robust, it was 80 percent lighter, eight zero. So the aviation engineers were completely taken aback, and for us that was

really a sudden reality check, because all of the sudden, you realize, my God, this is really powerful and it is disruptive and we need to figure out how we use it, because if we don't, somebody else will.

So it really makes you realize how disruptive it is for companies and for countries alike. And now we have our CEO Jeff Immelt, who today says, "If you go to sleep as an industrial company, you will wake up a software company." And for us the bottom line is, we just don't get much sleep at all, and the reason is partly because there is too much to do to bring these innovations to life, but partly because we are deeply and painfully aware that this is disruptive, that we face a challenge that we cannot avoid, we cannot run away from, and we cannot afford to get wrong. And we are a pretty big strong company, which has been around for about 130 years.

So if we think this is disruptive, I would submit to you, it probably is. And it is disruptive because it works. Let me just give you a few examples, and they will come from the sectors that GE is involved in, so these are GE examples not because I want to make a sales pitch, but because these are the examples I'm most familiar with and so I'm most confident in the numbers. In power generation, we have new solutions based on the innovations I've just described that allow the wind turbines within a wind farm to change their operation in a coordinated way, so basically talking to each other, as the weather changes and the wind shifts, so that they can maximize the efficiency with which they expect energy from the wind flowing through the farm. And this results in a five percent increase in annual output and a 20 percent increase in profitability. In the rail transport industry, we have solutions that allow railway companies to move to condition based maintenance so they avoid failures, to have better monitoring of the half of the tracks and to have better planning of the flow of rail traffic across the networks. And what this brings you is an increase in the velocity of the network between 10 and 20 percent, and a 10 percent reduction in fuel consumption. Aviation -- similar story, similar

technologies allow you to have significant reductions in fuel burn, plus reductions in delays and cancellations. Healthcare, which as we showed earlier, is one of the sectors where I think the advances are most striking, but also most important to us all. And there we have solutions which are cloud based platforms that allow specialists to collaborate on the same clinical case, instantaneously, remotely, they can share exams, they can share diagnosis, deliver better healthcare faster. We have analytics that allow you to reduce the cumulative exposure to radiation that a patient has while still having sufficient high resolution images in the diagnostics reporting through. And as we go forward in the coming years, we will see more and more of this, because what you will see in the next few years, is the emergence of an industrial app economy, very similar to what we've seen happening on the Android and Apple platforms. You will see the faster development of applications for the industrial economy, again, increasing very rapidly the pace at which improvements and efficiency can be generated. So when I look at this, I think it's powerful. Is it powerful enough to change growth? I think yes, and the key word here is scale, because as this happens in industry, these solutions can be applied to the installed base of industrial assets, which is huge. And this is how they will start to have their impact reverberating throughout the economy, and by the way, also, blurring the lines between manufacturing and services as we traditionally think of them. So the questions before, as we think of the economy as divided between manufacturing and services, we have to change them, because manufacturing and services become more and more interlinked and indistinguishable. So I have no doubt that this is transformation because I can see at the micro level, but of course as an economist I'm also aware that we are not yet seeing it show up in the macro level statistics. However, and here you will have the pleasure of having two Robert Solow quotes in one three hour span. Robert Solow also said in 1987, with the computer evolution in full swing, but U.S. economy growth weak, productivity growth slow, Robert Solow said "you can see the computer

evolution everywhere except in the productivity statistics". And a few years later, productivity growth doubled and stayed at the higher level for about a decade. So we have to be careful not to speak too soon. It takes a little bit of time for these innovations to feed through the industrial system. And I think today we are in a very similar situation as we were when Robert Solow spoke, and with the difference that once productivity accelerates, I think because it fits through industry, it will stay at the higher level for longer. So I tend to worry more about what do we need to do to make sure that innovation can continue and can spread its affects throughout the economy. And I see really three priorities.

The first one for me is education. We need to make sure that people come out of the education system with the right skills. For me by the way, that means very simply starting with increasing the overall level of the STEM literacy. We need to treat STEM literacy the way we thought of traditional literacy decades ago. But also we need to make sure that workers have the possibility to continue to learn and adapt throughout their careers. And I think all these required better coordination communication between the education system and industry and it also requires the education system to make greater use of the new technologies that are around.

The second priority for me is openness. And here I would support very strongly what you heard from Jason Furman in the beginning in terms of the importance of trade, but we need flexibility in the economy. We need openness in the flow of data, ideas and people, workers.

And the third priority is cybersecurity. This new way of innovation is opening industry up to new vulnerabilities. They have to be addressed, but it's important that we address them in a way that relies and favors common standards and common platforms, avoiding the risk, that we end up with a balkanization of the internet and the industrial internet.

So to conclude, I think the human ingenuity is already poised to deliver the benefits of stronger productivity growth and stronger economic growth. It actually strikes me that even those who believe that technology will be so strong that it wipes us out, in a paradoxical twist of logics, seem to completely underestimate the power of the very people who are creating these waves of innovation. So I think we can be optimistic, but we really need to focus on the hard work ahead, the conditions we need to put in place for these innovations to deliver its benefits in the U.S. and globally. Thank you very much. (applause)

DR. BAILY: So it's my job to talk real quickly, because we're a little behind on our schedule. Every slide I prepared is a gem of course. (laughter) But I may skip over a couple. They are available for you if I don't talk about them specifically. Okay, so let me start. This is a chart of productivity. It's output per hour in the non-farm business sectors. It varies a little bit with compared to what James and Jaana were talking about which was a GDP base measure. So this is just -- it takes out the farm sector. It takes out the non-business sector.

So productivity growth in the United States slowed sharply around 2005, you could argue 2004, 2005, but it does seem to have slowed before the great recession, so that's -- not everyone agrees on that but I think the evidence is that it actually started slowing before the great recession started. And it was a pretty dramatic decline, from 2.8 to 1.6. And that has a lot of implications for living standards, for prosperity, for how the budget goes on.

Now if you look back a little bit further in time, and I think was also mentioned, we've seen these sort of waves of fast and slower productivity growth. We had really fast growth after World War II until the early 1970's and (inaudible) and others have extended that back, so we had pretty fast growth prior to that also. So we've had a lot of rapid productivity growth during the sort of industrial commercial revolution that

lasted all the way until the early 1970's. Then growth slowed down from 1972 to 1974, 22 years. Again, it did happen, that was a difficult decade. We had slow growth in living standards. We had a lot of inflation and a lot of ups and downs, recessions in the economy. So that was a difficult period again with productivity growth at 1.5. Then as Marco said, we speeded up for about ten years.

I put here, this was my co-author Barry Bosworth's sentence, that it's an information technology internet led productivity revival. Some other folks at McKinsey have pointed out that there were also some other things going on, the spread of big box stores in retail and other areas where increasing competition pushed companies to be more productive. So I don't think it was all IT, but obviously IT was an important enabler, and actually the production of information technology contributed to the rise in productivity growth over that period. Then we've had another period of slow growth from about 2005 to the present, which as I say here, seems to pre-date the crisis.

Now one of the things that I want to draw attention to because it's not been generally agreed, particularly in this town, there's a lot of debate about it and I'm not going to go into all the caveats, although they are important. Increases in labor productivity or decreases in labor productivity translate into what happens to real wages or real compensation. So this chart demonstrates that so you can measure real wages by a number of variety of ways, looking at different price deflaters, taking account of benefits or not benefits, and yet it comes through very clearly, whichever measure you use, that when productivity growth is rapid, wages grow more rapidly or compensation grows more rapidly. So that's a really important reason to be concerned about productivity, to look for ways to increase productivity. And the argument you sometimes hear, that productivity has become disconnected, doesn't matter. We don't find that to be correct.

This next chart is one that I borrowed from Gary Burtless. It may be a little complicated to read but the message I think is fairly simple. And that is in terms of schooling, the United States labor force has actually increased the amount of schooling that it's had. We've seen a substantial reduction in those people with a less than high school or a high school education, about flat in terms of those with some college, and a pretty steady increase in the number of people that have gotten B.A.'s. So you hear a lot of talk and I include myself in this -- that talk about problems in the labor force, reasons why productivity may be slow if we don't have the right skills, that people are not taking the right courses in college or in high school. And those may all be true, but if we just look at the question, are we actually providing more education or are people taking more education, the answer is yes, and that doesn't appear to have slowed down particularly.

I'll probably skip a little bit through here quickly. There are two productivity concepts. One is labor productivity which has been the focus here. The other is total factor productivity. The advantage there is that you sort of separate out the contribution of capital accumulation. You separate that out from something which is called TFP, which is loosely speaking, a measure of technical change, but also, not just gee-whiz technologies, but better ways of organizing businesses, a lot of things get dumped into that bucket. But it's interesting to note, and this is the sort of bottom line of this job, is that during the period of the surge in productivity growth, the ten year, that a decade long increase, it was both TFP and capital accumulation. And those two go together. It's not a coincidence. Obviously the more capital accumulation you get, that increases labor productivity, there's more automation, more tools for workers to work with and so that contributed to their productivity. I think it's also the case that when you have a lot of TFP growth, a lot of improvement, innovation taking place, that encourages investment. So that's a key issue I think when we think about secular stagnation. If we

can get TFP going, if we can get that beneficial cycle of investment and innovation taking place, then both of them contribute and help each other in terms of getting growth.

I'm going to skip over this in the interest of time. I think you know the answer that CBO has been revising down. It's estimates of GDP growth, potential GDP growth, which has a big effect on its budget estimate, so again, that's sort of one of the consequences of slow growth, if we don't turn it around, if we don't do the things that Jaana's been telling us we need to do in the United States to improve productivity, but continue to go slow, then we're going to get impacts on the budget.

I'm close to finished, but it's not my fault we're running late, so I'm not going to take the entire burden here. So what are the explanations for slow growth? And we've touched on these. Marco touched on these. One view is that we've taken the low hanging fruit. There are no innovations out there. And I think in fairness to say Bob Gordon, he agrees that there's innovation. It's just that, he says, as Marco says I think, that it's sort of trivial, as people are looking at their cell phones, it's not the same kind of innovation that we had in the 1950's, 1960's, where it generated big investments, it generated a whole new opportunity for labor to work in more productive jobs. So that's I think what they're saying, is that the nature of innovation has changed, and maybe overall has slowed down.

Now lots of people are more optimistic. Marco is. I am. I think James and I have written together on this, saying that innovation is actually rapid. I was just at a venture capital conference in California that Brookings co-hosted and I heard the phrase, that innovation is taking place at the fastest pace it ever has. And so, it seems that these folks and I agree, it just doesn't -- the Gordon Kahn hypothesis just doesn't seem to quite make sense. There's a lot going on. Maybe we're not taking advantage of it. Maybe it's not translating into output per hour, but there's no question there's a lot of this innovation. And Eric and his co-author do take the view that Marco too I think, that it's a matter of

time. We have to wait for this to flow through. There's some evidence for that. I'm not totally convinced by that argument.

The third explanation I have up here is that a lot of this stuff is not being measured. And I give a couple of examples here that things are counted as intermediate goods. So a lot of what -- so Google search for example -- I don't know how I'd function without Google search. But it doesn't by and large get counted as a final good, because it's paid for through advertising and therefore it's paid for by businesses and therefore it goes into the national accounts as an intermediate good. The NBA and the National Football League are largely intermediate goods, except for the tickets that they sell in the stadiums. So there's a lot of strange ways we measure things that may not be capturing some of this innovation. Of course to the extent that search or other applications do improve business practices, that will get into productivity.

One of the things that's not on this list that I think may be even more important, is healthcare. Healthcare is a troubled industry, in the sense that it hasn't organized itself in a way to be maximally productive, but it's still very innovative. There's a huge amount of innovation going on there -- treatments, medical devices, new drugs -- all of that stuff. It's not counted very well. I won't say it's not counted at all, but it's really not counted very well, and there are sort of pilot programs to try to improve that measurement. And it's such a big part of the economy as Jaana said, 17 or so percent of GDP. So I think if we want to capture some of the innovation that's taking place, we need to change the way we measure output in sectors like education and healthcare. I don't think that's the whole explanation for the slow down. I don't think there was some sudden collapse in the way we measured innovation after 1972 or after 2005, but I think it is something we need to get on top of.

The fourth one is that the great recession clobbered the economy and of course it did, but did a club a long run in productivity growth? And I think the argument

there is much weaker. Past recessions did not do that, didn't change the trend that much, even going back to the great depression. And as we mentioned earlier, if the slow down started before the great recession, again, that makes the argument that it maybe wasn't the recession. So the recession obviously was bad news. It was terrible stuff for the economy. It was still kind of getting back on our feet. It probably has had at least a temporary -- temporary over five to ten years -- depressing effect on productivity, but the case that it's the permanent -- any kind of permanent setback, I think is weaker.

I'm going to skip over startup companies and gazelles. Many of you know the literature on that. People who like John Halter who are at Maryland, but certainly to the extent that those companies are a source of employment and productivity growth, we're not getting as many of those.

And then I'm going to finish with one of my favorites, although it's very unproven, and it links back to some of the earlier comments, which is that the nature of the innovation, and again what Marco described in some of the exciting things he was talking about here. If you replace workers on a production line, if you make your manufacturing more efficient, or if you make your supply chain more efficient, and you end up not needing as much labor, those are productivity increases. We should welcome those. But if unfortunately the people that are displaced, or the people that would have taken those jobs, young people that go somewhere else -- if they go to dead end jobs, with no training, no productivity growth, then you're diluting the effect of the innovation, because it's not being spread broadly, it's being concentrated in the parts of the economy that can take advantage of this. And we know there is a split in the labor force too, between those workers that have the skills with their educational skills, or whether they have skills they've acquired on the job, that can take advantage of the technologies and those that cannot. Okay, I've run through my time, and let's do a little on the panel. Thank you. (applause) Can everyone come up?

MR. KHARAS: So we don't have too much time for the Q&A but I'm going to borrow Martin's time for introducing Chairman Greenspan because my guess is that people --

DR. BAILY: We all know who he is, right.

MR. KHARAS: We all do know who he is, so that's going to save us five minutes. Look we've talked a lot about global aggregates and how the world is going, et cetera, but there's also something about how this applies to individual countries. And one of the things that interested me in the McKinsey report was actually the allocation of the outlook across countries. And so I want to start with Jaana and really start with your China India comparison. So you still have China basically with very rapid GDP per capita growth rates over the next 50 years, and India basically no change compared to the past, so no Modi effect, no acceleration of productivity growth. And in fact, your ordering, if you will, of developing countries is very similar to what it was in the past. Latin America fairly stagnant, not doing too much. Mexico, which you know extremely well, really not doing very well. And then China, South Korea, Indonesia, sort of the stars of Asia and India, or a bit less. Do you want to say a few words about that?

MS. REMES: You are entirely right, it is by definition, defined by past productivity growth rates. So in the data that we show, we basically assumed that assuming you can sustain the productivity growth rate of the past 50 years, this is what you would see. So in essence we didn't make predictions on what the productivity growth rate would be in each of these countries. I think that's something that we can do, we can do it with different assumptions et cetera. The answer would be dramatically different. It is extremely difficult to sustain productivity growth rate of five percent a year. It's more than five percent a year, as China has done for the last 50 years or full 100 years. I think there's no question about that, however it was more of, if you want an example that illustrates what the impact would be simply because a lot of people tend to

do predictions based on -- this how they have done in the past, let's just assume and extrapolate it further. So it was a way for us to anchor the impact of the change in the demographics, to some kind of a figure, so please don't read anything more than historical past to that, it is not our forecast of the future, it is just a way to illustrate the demographic impact to the trends we have seen in the past.

MR. KHARAS: Okay, so James, let me come to you, I mean a lot of this analysis on the supply side. I mean you look at sectors, you look at individual countries, you look at labor and capital, and productivity growth. But, you know, before we did have a question about the demand side, and many people are saying what really drives GDP and drives the economy is the demand side. Who is going to be buying all of these things, especially if we get into Marco's world where it is all produced for us, by somebody who presumably owns these robots and we're not going to run the robots. So how do you bring that into the picture?

DR. MANYIKA: Well, a couple things, first of all, the aggregate demand plays a very very important role in the sense that, if you don't have aggregate demand, in other words, if you don't have consumers and people who actually can consume the outputs of the economies, you actually won't have GDP growth. So that's the case. The good news is that globally we've actually had increase in prosperity over the last decade or two. Think about the number of people that countries like China and India have bought into the consumption economy if you like, who now have enough consumptive power to consume a larger basket of goods. So that's been a big big effect, I mean China has brought -- has doubled its GDP per capita in about 12 years basically, in the last decade or so. India has done the same. So in that global sense I think that there is consumption -- the demand will be there. The question is, in particular economies, and the U.S. is one of those, if we don't actually find a way to improve the ability of households and consumers to consume more, either through increasing their income or

wages in some fashion, we will feel the pain of that. So somehow we do need to solve, I think what Henry Ford and others solved in previous decades, which is how do you make sure that -- I mean, the nice thing about capitalism, capitalism can only survive if there are consumers for the things that capitalism produces. So there has to be enough ability to consume the product and outputs of these economies. So I agree with you. I agree that demand is a very important part. And it's the reason why these questions about inequality are very very important, but I think they're in a particular sense, in terms of the ability for households and individuals to make progress and be more upwardly mobile enough to be able to consume what they need to consume to survive.

MR. KHARAS: So a quick follow up, when you go to your clients, and venture capitalists, et cetera, what do they talk about? Do they talk about the techie things, or all the cool new toys they're developing, or do they talk about inequality and the demand side and how are we ever going to make money off this?

DR. MANYIKA: Actually they talk about both. They actually talk about both, and I think that in the last six months to a year in particular, you'd be surprised the number of conversations that most technology innovators and leaders of these companies have actually spent in dialogues and discussions about how do we increase upward mobility. I happen to be involved in an initiative called the Mocal (phonetic 2:00:30:2) initiative, that's looking at how do we reinvigorate the American dream. And half the participants- - private sector participants in that group, are all the leaders of these technology companies in the private sector. So this is the real conversation.

MR. KHARAS: So it's great to hear the private sector doing that.

MR. ANNUNZIATA: Let me jump in and comment on something briefly James just said. It is extremely important on the issue of inequality, we tend to focus on inequality from a national perspective, no matter which nation you are in. What James just pointed out, is in fact that inequality on a global scale, has declined dramatically,

while at the same as inequality within nations, within many nations, has increased. So we need to keep it into account because it is important for demand but also because it is crucial that we learn how to address economic inequality within countries, but we have to do it in a way that does not backfire, on global inequality -- on inequality income at the global levels. We have to be careful to combine the two.

MR. KHARAS: Marco you were clearly cast into the optimistic camp, so are you ready here to say that in two years' time we will start to see the impact of all of this innovation showing up in macro productivity statistics?

MR. ANNUNZIATA: It has been pointed out that it would be a fool's errand to give you a two year horizon when it shows up. (laughter) Am I confident that within, first of all, am I confident that within five years you really start seeing the transformation of the industrial sector in a way which will be obvious to everyone, not just people who work in industry today -- you will see it in the newspapers. Yes. Will it show up in greater productivity growth on say a five to ten year horizon? Definitely, yes. On that I am confident.

MR. KHARAS: Okay, and then you think that's going to be true everywhere in the world? I mean you have manufacturing all over the world. And a lot of this discussion was about catch up in other places. What kind of differences do you see in your plants in different places?

MR. ANNUNZIATA: So we see differences which are very very significant in productivity across our industrial plants. We will have operations in about a hundred and fifty countries in the world. So we really see it all over the place. And the differences are very clear. The differences we see highlight the need for different countries to do more for productivity to accelerate. You know one interesting case -- we tend to think of some of the changes, the policy changes, which are needed in emerging markets perhaps because they are the most glaring, but you have very important

structural changes in some of the advanced economies. I will give you just one example again looking backwards. When Martin showed the acceleration of productivity growth in the U.S. between 1994 and 2005 you saw some acceleration productivity growth in other countries across the world -- advanced and emerging. But some of them experienced very little. Europe was a case in point. And so a lot it has to do with how flexible the economy is, but also how companies can adapt. There are studies from the period that show the European operations of U.S. companies experienced much faster productivity increases than the local European companies. So it's not forgiven -- you can't take it for granted, there are things that need to be done by countries, the priorities differ from country to country; it will definitely not be even the way in which these benefits accrue.

MR. KHARAS: So Martin, your charts largely focused on the U.S., but did you think that this same kind of story that you've talked about is also true in Europe and Japan? Are you as optimistic about for Europe and Japan in productivity growth in these places as you were for the U.S.?

DR. BAILY: Well I don't know if I was terribly optimistic. I've written several things, and obviously I'm influenced by my co-authors, because when I write with James, I write a very optimistic view on U.S. productivity and when I write with my colleague Barry Bosworth, it becomes much more tempered and not quite so optimistic. You have to sort of compromise your positions to your co-authors. So yes, I'm fairly optimistic that the U.S. will start to take advantage of the things that Marco describes. I think there is a tremendous pace of innovation going on. But I did raise the red flag, which is that what are we going to do with a lot of the workers that don't have that much skill? Are they going to be stuck in service jobs, low productivity service jobs? U.S. companies are actually very good at taking advantage of the workforce that's there. So they build their business model so if there are a lot of cheap workers around, they keep the stores open a long time. The restaurants stay open until 11 o'clock at night or even

all night in some cases. So we're very good at taking advantage of cheap labor and using it to contribute to overall productivity. And it does generate jobs. It's not that this is such a bad thing, but I think if we really want to take advantage of the innovation space that's happening, we need to make sure that the spread -- the benefits of innovation are spread more evenly across the workforce.

Now I'm not answering your question, so let me quickly try to turn to Europe. There are so many difficulties in Europe right now that it's hard to be sure of what's the underlying supply side trend that is taking place. I think probably there has been a lot of job destruction in the periphery, and a lot of elimination of low productivity companies. So I think in principal, there's a base there for future growth. But the difficulty of dealing with misaligned price levels in the absence of adjustable currency, the fact that some of those countries have not taken the steps that they need to make to make their economies more flexible. Just the general debt and mess that they've gotten into makes it hard for me to see whether the benefits from those productivity advances are going to take place or not.

I wrote a book about Europe when I was across the street at the Peterson Institute and it was a fairly optimistic book too, and actually Europe had grown pretty strongly during the period where the U.S. grew strongly. At this point, it's hard to pierce the veil and see what's going to happen.

DR. MANYIKA: Well I was going to jump in and give you at least two interesting maybe polar opposites. I worry about Japan, partly because there's been a decade or more of stagnant productivity growth. I mean outside of -- if you go outside of the manufacturing sector to the rest of economy, productivity growth has stagnated and struggled quite a lot. So I worry about that. On the other side to your earlier question about India, I'm actually optimistic about India. Mostly because you're starting to see some interesting reforms, you're starting to see a lot of embracing of what technology can

potentially do to that economy. And you still have an attractive demographic profile, which India ultimately could benefit from. And as India continues to shift more of its informal economy to the formal sector, I think that will also lead to productivity benefits. Because we know that as economies shift, from more informal economies to more formal economies, productivity goes up. So that's an example of a country, a large country where I think I'm very optimistic about.

MR. ANNUNZIATA: In thirty seconds, just on the point that Martin raised on skills, something I think is underestimated by -- you see it in industrial sectors is you still need somebody with a medium level of skills to go out and repair a gas turbine rigid engine. But now you can send a technician in the field with more powerful instrument and that's the equivalent of an iPad. And that makes the worker much more productive. Some of these innovations will actually augment the productivity at different levels of the skill distribution, might mitigate the divergence we're see now.

MR. KHARAS: Yep, great. Okay, let me open it up for one or two questions from the audience. Let's wait for the mike please.

MS. STERN: Thank you for your comments. I'm Paula Stern. I used to chair the U.S. International Trade Commission and continue to be very concerned and involved in competitiveness issues and innovation.

MR. KHARAS: Welcome.

MS. STERN: Thank you very much Martin. And my question really reflects one of my clients, which is the National Center for Women and Information Technology. And I noted that in this very rich discussion, women was not really talked about except once. And yet when we talk about the bottlenecks from a policy point of view from productivity, it is, it seems to me the lack of skilled labor, as was pointed out. Women, it seems to me, have not participated in information technology, and in fact are participating in a declining fashion. And so there's an enormous opportunity here, if we

would just measure it and talk about it. And I would just urge you, when you talk about demography, or if you talk about skilled labor. If you look at both the opportunities and the bottlenecks that can be removed, think about the women's piece here. Not only here in the United States but overseas. So what we don't measure, we don't change, and the five categories of technology -- of industries that you pointed out Jaana, IT wasn't in there. Information Technology wasn't even in there for the future. And so I wonder how your McKinsey going forward is going to capture that, or are we going to talk about this issue only as Martin did, from the TFP point of view. So if you would talk about the measurements both in terms of demography and how we break out and change what we're measuring, both from IT and the women's point of view, I would appreciate it. And I think we'd get a lot less schizophrenia about technology, by the way, if we had more women participating in creating the technology. I don't think we'd get the blow back.

MR. KHARAS: Thank you.

DR. MANYIKA: Just a couple quick responses. Technology as an industry is very very important, in fact we've done lots of other studies where we've looked at the impact of technology, so that was not a deliberate -- we did not deliberately leave it out. We think that it's an important part of the technology story, we just didn't focus on it today. Second, I did mention women, if you remember in the conversation about how do we improve labor participation rates, one of the big factors in that is improving the participation of women in the economy. And I think it's particularly interesting when you look at the United States in particular, if you look at both the undergraduate, in terms of the graduating rates at the undergraduate level as well as the graduate level, women are actually graduating faster and in much larger numbers in general. And then in IT you're starting to see lots of initiatives now where the issues were, at the entry level, companies are starting to do something about that, and starting to highlight that. So I think your point about having more gender desegregated data is

really really important, particularly in these industries that are going to make a big difference to the productivity potential of the economy. So I couldn't agree more.

MR. KHARAS: We're going to take one more question, and then the panel members can answer both. The gentleman in the aisle.

MR. ALTMAN: Hi I am Fred Altman and my question is on the social impact of all the increase in productivity. Particularly at the high end, I think a large amount of the conflict between conservatives and liberals really is on how much to accept and how resistant you are to the changes in the current economy. And obviously things like cell phones have changed things immensely, and with other changes though, increase even more, which may lead to more disruption. I just wonder if you're considering that.

MR. KHARAS: Okay so why don't we just have last thoughts. Martin, any last thoughts?

DR. BAILY: Well let me respond to that, I think in terms of inequality, I think inequality is a serious problem. I don't myself care that much if somebody goes off and founds Google and makes a billion dollars and becomes one of the top 1.01 percent. I think that's not a loss to me or to the rest of the society. I think what's the bigger problem is if you have a large fraction of the workforce, of the families, that do not have adequate skills, whatever those skills are to participate effectively in today's economy and therefore are really feeling left behind and being left behind. That's the biggest problem.

MR. KHARAS: Jaana.

MS. REMES: Quick thought on women. It is by far the biggest opportunity in emerging markets, Latin America for example, some of the policies are changing that, in Brazil simply putting more money into the women's side has translated into a net positive impact of women's entry. That will continue to be a big opportunity

locally, as well as globally. That is an opportunity for global companies too. On both women as well as on the change, one of the things we should not forget at one part -- a big part of the miracle of the last 50 years has been the fact that there are new kinds of jobs being created. The speed of transformation is speeding up, and that can potentially be a continuing opportunity for us, as long as we keep our minds open. So just think about it, in the last 25 years a third of all jobs created in the net new jobs created in the U.S. have been in occupations that didn't exist, or barely existed 25 years ago. So that was basically everything from obviously computer engineers, systems engineers, but also fitness instructors, medical technicians, particularly in the service side a lot of those have been women intensive. So in many ways looking at those differently and understanding that the job creation and the change is the one that will fundamentally change how the picture will look like 25 years from now. I think it is very important, rather than looking back where the jobs came in the past.

MR. ANNUNZIATA: Very briefly on the less optimistic note of the challenges, so while I'm optimistic on the ultimate benefits of these innovations, I said it is disruptive. By being disruptive it creates challenges and difficult conditions for companies and for individuals in the interim, and that cannot be underestimated. And for that we need a better education system focused more on the STEM and problem solving. We need a social safety net, and we need more efforts by companies on on-the-job training. That is essential in itself but also to permit innovation to continue.

MR. KHARAS: James, last word?

DR. MANYIKA: I think it's actually important to recognize that on-the-job training has actually been declining, both by the private sector, but also institutions in general. So I think it's important to keep that in mind. But also it's important to recognize that our educational systems may not have kept up with all the different traits and skills that are going to be important to participate. Some of these don't even have credentials

that exist yet. So we need to think about how do we incorporate and pay attention to those as well.

MR. KHARAS: Okay, thank you all very much, please join me in thanking our panel. (applause)

DR. BAILY: So is this mike on? Thank you. So we're very privileged again to welcome Alan Greenspan. He's a very distinguished person as some of you may know. He's a very accomplished musician, plays the clarinet and saxophone. (laughter) He played with Stan Getz and he studied at Julliard, so I've never heard him play unfortunately, but maybe one of these days. And by the way, he was Chairman of the Council of Economic Advisors under President Ford and served as Chairman of the Federal Reserve Board from August 1987 until January of 2006, guiding the economy to the longest peace time expansion in history. Since the Fed, he formed Greenspan Associates and he wrote a best-selling memoir called The Age of Turbulence. So he has some interesting ideas about how we might improve economic growth, and so Alan, thank you. I'll turn it over to you.

MR. GREENSPAN: Thank you very much. I'm always glad to be back here. I was here a couple of weeks ago on a wholly different subject. But in any event, I have a series of charts here where I try to explain, what I think is going on in the world because productivity is at the key issue in all of our societies and what is remarkable is what is going on in the United States is actually being replicated to a significant extent around the globe. This is what I think is the most interesting chart in the sense that this is output per hour annually going back to 1889. And it's a remarkably stable growth pattern until we get to the very end, and indeed if we took 15 year moving averages, we would find that the average annual increase goes between maximum of 3.2 percent and a minimum of 1.1 percent. In short, it's a very narrow range. And what it is telling us is productivity is a very slow process which continuously evolves over a significant period of

time, reflecting certain stabilities and propensities in human nature. This is fundamentally an issue of time preference and a number of other characteristics that we deal with all the time.

But what's important here is that you can barely see significant differences going on as we go up until we get to 2005 plus. This is a monthly data, which we put together on real output per hour, and remember, this is non-foreign business. It doesn't really matter on this chart, but I might add parenthetically that it matters basically significantly in the early years where there's a goodly part of the growth in national productivity over the decades. There's been a shift from agriculture to non-agriculture. Here that is no longer relevant but as you can see, we get up still doing reasonably well until we run into 2008, 2009. Now that bulge that occurred immediately after the 2008 crisis, is essentially the result of productivity accelerating significantly because business was trying to cut back costs in every way they could. And because what had been built up in the years immediately preceding, when we were in effectively a boom, what we saw was a very major increase in capital investment for expansion purposes but cost savings was not really a significant part of capital investment projects in those early years. What this essentially shows is that we are digging into the unexploited backlog of lower rates of return, cost savings projects. And that is, you can see, showing a very sharp increase in productivity from 2009 to January 2010. But since then, it's been flat. And it's been flat right through -- I have an estimate of March 2015. We know pretty well what the denominator of output per man hour is going to be, published by the Bureau of Labor Statistics for March and those are data which are directly calculated from the numbers which were released last week in the payroll series. But the GDP is also slowing down very dramatically. One estimate amongst those who try to replicate what the GDP will be by using the same techniques that the Bureau of Economic Analyses uses in getting estimates for the first quarter which are around one percent at the old rate, significantly

slow down with no evidence or increases apparent in the data, although I must say that data we saw this morning though a little helpful (inaudible) mortgage credit was moving up finally, but that's a wholly different subject. But there's some evidence of a pickup but really very little, even when we adjust for weather in the data, we're still getting flat productivity. The question is, why?

If you look back historically at the data that essentially moves output per man hour, there are two components. One is innovation or applied technology. And the other is the capital stock. I could get much closer numbers here if I were trying to use three or four variables, but overall, this is the key statistic which I think moves productivity. And what we see here is definite slowing down for reasons I will get to. Next chart.

The major problem in the actual amount of capital investment or gross domestic capital investment is the fact that we've had a dramatic decline in gross domestic savings. And the reason for that I will get to in a minute, but the relationship between gross domestic savings and gross domestic investment is basically the current account balance. And that creates an opening up where even though gross domestic savings has gone down, gross domestic investment has held up in most recent period a little bit. Let's go to the next graph.

This is essentially the net, instead of gross domestic settings, this is net. And this is after depreciation, and what this shows is basically that the growth and the capital stock, which would be the net changes or the red line, is falling fairly significantly for a number of years, and if it weren't for the fact that we are importing foreign savings, and indeed building up a debt to foreigners which now approximates five trillion dollars after being a surplus country for so many decades after World War II, in any event, what this designates is that we've come back from the bottom of 2009, but we're still disturbingly close to zero meaning zero change.

I might just say parenthetically that the big surge in employment that we've seen is being taken as an unmitigated positive factor in the short term. It is not. Remember it is the denominator of output per hour, and the GDP has slowed down very dramatically, so what we're getting is this very extraordinary rise in employment until the last month, is essentially a big increase in the denominator. And what this is saying is that we are creating more and more jobs but at the margin producing less and less and that is clearly not something which (inaudible) well into the future. Next.

This is the key chart. I don't quite fully understand what it's doing but I've worked on it for quite a long time. And what it shows is that the red line, gross domestic savings, which is I mentioned before, is going down, and government social benefit payments, which is social security, Medicare, Medicaid, veterans' benefits, and the whole category of entitlements, which the Department of Commerce calculates that way -- what is very difficult to get around is the fact that the top line is the sum of the two. And there is no evident trend going back after Medicaid and I should say Medicare and Medicaid come into play significantly in 1965 and finally become big numbers in the early 1970's. Since then we've had a remarkably narrow pace of the sum of the two. If you take that literally, necessarily means if it was an exact flat number, it would essentially mean that every increase, every dollar increase in benefits is taking the gross domestic savings rate down by one dollar which as I've mentioned before, is the basic cause of the problem as to why gross domestic investment has slowed down and therefore, why we've had a significant slowing down in productivity. Now I won't go through the macro-econometrics of this but there are some very interesting relationships you can see for example, without any -- that there is a definite negative correlation between social benefits and gross domestic settings, between the blue line and the red line. And it's continued for decades. And so the question is, where does it come from? Well, let's go on to the next one.

Let me just say very quickly, what is at issue here is we've got a social benefits entitlement system which is politically unmovable. In 1935, Franklin Roosevelt signed a Social Security bill and constructed a system of defined benefits in which the individuals who had put part of their salary into social security, an employer would, and the interest would be created as a consequence of that, and therefore all of the recipients of social security were told and believed and to this day, believe that all of the money that's in the trust fund is all that is required to pay future benefits, and therefore, they have earned the monies and there's a consequence of that. It's basically not an issue of whether it's charity or anything else. It's an entitlement because it's their money. The only problem is that the actuaries of the Social Security Trust Fund and the Medicare Part A Trust Fund don't agree with that. What they say in effect is, that what we have got here is not even a pay as you go basis, which isn't even working, but we're very far in underfunding, both on a Medicare and Social Security and the reason that this is a critical problem is the politics of it are immovable. I have a chart. I didn't bring it along, but it's very interesting to see that you would think that it would be in Democratic administrations that social benefits would expand, and they would contract in Republican -- the other way around. And the reason it is, is that every politician Republican or Democrat believes that if you touch third rail, which is what social benefits are considered, and you're running for office, you lose. And I once asked Richard Nixon, why was it that in effect, the Republicans especially, the Nixon administration, pushing benefits so significantly, he says, if we don't do it, the Democrats will. And this tells you something about the American political system which we've got to change. I don't know how we do that, but I do know that we're on a track now that we're eating up our seed corn in the sense, we cannot have continuous expansion in entitlements and continuous reduction in gross domestic savings, because at the end of the day, the level of economic activity basically comes to a halt. And we cannot fund all the social benefits that we've promised. So

there is my positive story, which I don't know the answer to. But I do know that something has got to give, and (inaudible). (applause)

SPEAKER: Thank you.

MR. GREENSPAN: I can raise a number of other issues, but I thought you (inaudible)

DR. BAILY: So when Jason Furman was here and I talked to him, I challenged him a little bit on some of his statement, so I'm going to do the same to you.

MR. GREENSPAN: Please do.

DR. BAILY: So your argument as I understand it is that social welfare benefits, social security, and Medicare have expanded and that's sort of eroded national savings, I guess partly directly through budget deficits, but maybe through the behavior of individuals that no longer have to save as much.

MR. GREENSPAN: It's basically dollar for dollar cyclically adjusted federal and state and local deficits.

DR. BAILY: So it's expanding that and that undermines the gross and net saving of the economy, which undermines in turn investments and that's holding back productivity, so that's sort of the argument.

MR. GREENSPAN: That's my story.

DR. BAILY: Right.

MR. GREENSPAN: Put it more exactly, that's what the data shows.

DR. BAILY: Yes, but, the data also seem to indicate that companies have a lot of cash around and that, I just already mentioned this, but I'll mention it to you. I was in California last week at a venture capital conference and the people who manage investment funds were saying it's a strange situation they're in because there are trillions of dollars out there in the global economy looking for places to invest. So yes, okay, we're not a big saving economy here, and our national saving is going down, and you

described the reasons for that. But isn't there plenty of money out there for investment if there are investment opportunities? Is it really the case that lack of money is what's preventing greater investment from taking place?

MR. GREENSPAN: I could have brought another set of charts which would address this subject.

DR. BAILY: (laughter)

MR. GREENSPAN: But you have to think in terms of the relationship between business or more explicitly corporate cash flow and capital investment. And I have a specific chart which I find very useful, which designates the ratio, I should say, the proportion of cash flow, liquid cash flow obviously, that corporations choose to invest in illiquid long term assets. And what the data show is that that number, that ratio, at the height of the crisis recently, fell to the lowest peace time level since 1938. Now what that meant of necessity is that if you're down below 1.0, you're obviously building up cash. In other words, you're deleveraging. And one of the aspects of the deleverage, which could be debt as well, is a very significant build up in cash balances, both here and abroad of U.S. Corporations. Now those monies are built up not out there looking for investments, they can't find investments to invest the cash flow in and that's the reason why that is building up. If they had investments, the ratio would not be as it still is, still under 1.0, it would be up greater than 1.0, it would be 1.2 or 1.3, as it often is in periods of prosperity. So this is not liquid -- the huge liquid assets are a symptom of the fact that they're still being held in liquid form because the corporate sector is frightened about the long term future or more exactly from the issue of uncertainty has become so pervasive. And one way of looking for GDP is that all of the decline in gross domestic product that has occurred since the 2008 crisis is in long lived assets, assets with a maturity of greater than 20 years. This is buildings, mainly non-residential but residential, and you can see the pulling back in the data. And even in the -- for example, even in the residential area,

there has been a dramatic shift from where we were in the earlier part, say 2001 to 2005, when all of the household formation was going into single family, owner occupied residences. Now they're liquidating -- the actual proportion of single family, owner occupied residences is going down. And we're seeing the proportion of home ownership has (inaudible) has been down very sharply and is continuing to fall. This says that people are so frightened about the long term that they don't want to buy homes which commit them to the longer term. And corporations don't want to build factories and other long lived assets because of the uncertainty they have about the future, because of the taxes, the climate problems, and everything else that's creating uncertainty in this environment which is very significant.

DR. BAILY: Okay, so let's press on that a little bit. I'll leave aside the housing one and let's focus on the business investment, since we were talking about business productivity. So there's too much uncertainty. Companies don't want to commit to long lived assets, big heavy assets that lock them in and so you listed taxes, environmental, maybe there's other ones, but let's start with taxes.

MR. GREENSPAN: Global warming is another one.

DR. BAILY: Global warming, okay. But let's start with taxes. If there could be a bipartisan agreement to reform corporate taxes, do you think that would help investment here in the United States?

MR. GREENSPAN: Anything which reduces the degree of uncertainty, or more exactly -- let me take you back to, which I can go from (inaudible) I'm sure, is before I got into government, I was heavily involved in corporate investment projects and the like and I would sit in in a meeting and it was always very obvious, whereas when a product manager produced a particular facility or a particular idea, and they'd come up with an expected rate of return on it as say, 20 percent after tax, which is terrific. And then, Chief Executive Officer would say, Joe, that's very interesting. What's the low

possibility? And he says, well, it could be a loss of 10 percent. Next case. The variance of forward returns is the critical determinant of capital investment. And right now we've got such a huge variance measured in many different ways. For example, the term structure of interest rates, which is a good way of looking at it because it is, as you go from five year to 30 year bonds, for example, it goes up very sharply. And that is essentially saying that the discounting that is going on for incomes produced by assets in the very distant future is being extremely heavily discounted, in fact, at its peak, I think in 2010, 2011, (audio skip) read between the 30 year U.S. Treasury Bond and the five year note was the greatest in American history, going all the way back as far as we can take the data.

DR. BAILY: Let me switch back to your other point which is that the benefits are eroding budgets and eroding saving, so how do we need to tackle that? If we raise taxes and balance the budget, which happened in 2000, as you know, would that work or is it just the amount of these benefits that's at work. Do we need to cut benefits or could we do it by just balancing the budget with higher taxes?

MR. GREENSPAN: Well, you're not going to be able to do it by one or the other.

DR. BAILY: Maybe both?

MR. GREENSPAN: Look, I always thought that the Simpson Bowles solution to this was the ideal sensible solution.

DR. BAILY: Bipartisan.

MR. GREENSPAN: Which was, well it was not only bipartisan but they recognized that it was a huge tax expenditures in the system which is a subsidy which I shouldn't think anybody should be -- corporate welfare is no better than any other welfare that you're going to consider in the negative terms. And we didn't accept that. And I

think that if you ask me where do we go -- I think we go back to Simpson Bowles and start again.

DR. BAILY: I want to take some questions from the audience. There's a question there that the young woman in the orange shirt. Would you identify yourself and let's try to keep it reasonably short.

MS. LEE: I'm Jennifer Lee with Hong Kong Phoenix TV. I have a question regarding the global recovery. Is the Federal Reserve expected to raise the interest rate this year? Other central banks are still strengthening their accommodative efforts. Do you think what this divergence might bring to the global recovery? And also are you concerned that China economy is slowed down might pose risk to the global recovery? Thank you.

DR. BAILY: I guess we knew we were going to have questions about monetary policy at some point, so.

MR. GREENSPAN: I'm going to answer this (inaudible) about China without getting into monetary policy.

DR. BAILY: (laughter)

MR. GREENSPAN: I think China's a very significant problem. As you know, the state council brought down the expected long term growth rate to seven percent this year, and are projecting it to six percent within a decade. What we're seeing here is one fascinating part which has got to do with productivity in a way. If you look at the productivity in China up until very recently, it's been growing at nine percent plus per year. And when you looked at how that was being done, it was basically largely borrowing technology from the developed world and applying it very effectively and it's been an extraordinary run except until fairly recently, because one thing that has bothered me in recent years is, there have been numerable surveys indicating, for example, Reuters, Thompson Reuters does an annual survey of the most innovative

international companies and the recent surveys, 40 of the hundred were American companies. Zero were Chinese. Now that is not to say that the technology is not evolving. I think it's beginning finally to evolve, but innovation is very difficult to create in a society which isn't open. China is gradually opening up, but it's still the centrally Communist single party control. And you cannot have the innovation. By definition, it is something that no one has figured out before. If they figured it out before, it is not innovation. And there's a tendency when you're in that state where there are rigid issues of how much freedom of action you can take, you don't think in terms outside the conventional wisdom. My view is that one of the reasons why, when all the skilled people leave China and they end up in the United States, they do extraordinarily well. The issue here is political. And I think that there's an obviously -- fairness of it, I don't know, I've spoken to numbers of Chinese Prime Ministers and the Presidents and they recognize what the issue is but it's very difficult to get around. I think that what we're seeing now is that as the gap between the productivity levels of China and the United States are beginning to narrow, projecting forward as you get, unless you're innovative, unless they're essentially internal -- whether there is productivity from more than that is being borrowed from others, then there is an upper limit to how far technology curves.

DR. BAILY: But the gap is still extremely wide, right? So in a way it's surprising that, to me, that it's slowing down. Maybe it's because they have to move to transform their service sector rather than manufacturing.

MR. GREENSPAN: Well I don't know what the answer is, but we know at some point --

DR. BAILY: Yes.

MR. GREENSPAN: That unless there is indigenous technology and innovation, that the upper limit is the level of technology in the Western world. And there's no question that they're closing in on the United States at a fairly rapid pace. You

know, per capita, their GDP is 7000 dollars in China. That is -- 7000 dollars is not negligible. You --

DR. BAILY: It's not 50,000, but it's not negligible.

MR. GREENSPAN: And they're moving at a pace that's got to slow down, and the way you can see that is obviously in the huge expansion in the shadow banking area, which I think is very nervous making. And so I'm not altogether confident that China's going to be able to get through this financial problem and that's a --

DR. BAILY: Okay, we're going to run out of time a little bit here. Okay we'll take a question here.

MS. WERTHEIM: I'm Mitzi Wertheim, with the Naval Post Graduate School. I want to ask about infrastructure and one of the things that certainly worries me about the United States is we don't seem to want to pay taxes to pay for things that we need to basically allow us to continue to grow and deliver. So our whole question of transportation, from my perspective, is a disaster. We don't seem to want to pay to improve our educational system. How does that fit into the way in which you look at the U.S. and our ability to compete on a global market?

MR. GREENSPAN: Well one issue that we have is that all of our buffers against the -- hold off -- that's getting into a very broad issue. Let me take a step back. We've got a significant percent of problems in our infrastructure. You don't need anybody to tell you anything. If you're driving on the highways, how many holes you end up in is an indication of how bad things are. But it's true our buildings are aging, the whole infrastructure is aging. It's not only bridges and the like, it's the -- Drew in economic analysis, actually does a capital stock analysis, actually does the determining where the agings are, and they are very significant, including in the military. Our military -- we still have B52's out there which original design was 1952 and the H models which was the latest ones that are still out there are 1964. Our ships are getting old. Everything is

getting old. So it's the military, it's the non-military. Everything is aging. Why? Because we are not putting capital investment in place or allowing our maintenance funds to run down and it is essentially the issue that I'm raising. It's a terrible choice that we've got to make. Do we want entitlement programs at the level that we now have them, or do we want something else? We cannot have both. Double entry bookkeeping cannot be avoided. Yes, I agree with you, we can't allow this to continue to erode because consequences are going to be extraordinary.

I always thought for example that Japan did something very interesting after their 1920 earthquake. They really began to rebuild their buildings with much greater alloy steels and much more extensive inputs. And we are lucky to do that sort of thing, in other words, to put money aside in infrastructure and be in a position where we are not subject to the vagaries of axing it. We cannot -- remember, infrastructure does not produce anything obviously, or we don't have enough stand by type of things. We don't stockpile a number of materials. We should be stockpiling rare ores now. We don't. Why? Because nobody wants to put up the money. That's going to come back and haunt us at some point.

SPEAKER: (inaudible)

MR. GREENSPAN: My problem is I can't make 51 year olds (inaudible) (laughter) Frankly, I don't know the answer.

DR. BAILY: Okay, we'll take another question with -- probably it will be the last one. Yes?

MR. CHECKO: Thank you. Larry Checko. You said, Mr. Greenspan, that one of our biggest problems was the entitlement programs, which to me, common sensibly, has been exacerbated by the great recession. Lots of people lost their jobs. Lots of people needed extra income. There was more disability payments paid out, more bad backs created over the last five years than you could imagine. With all due respect, I

think a lot of this came from very low interest rates held over for a very long time. And it's absolutely astounding to me that the Fed missed all the red flags that went up for all the years that they were going up. Everything from housing prices going up 10, 15, 25 percent a year, while wages remained flat, terrible terrible mortgage products being produced and people not being held accountable for selling them, the SEC failed us, I mean, where does -- if this happened -- I guess what I'm saying is if this happens again, we can kiss what's left of the American middle class good-bye. And I hope the Fed sees this. Thank you.

MR. GREENSPAN: Well, nobody caught the 2008 crisis. Look at the forecasting models. The Fed has got the most sophisticated up to date forecasting models. It failed to capture the September 15th, 2008 crisis, even weeks before. JP Morgan has a weekly forecasting model which it produces data for a huge number of entries, especially the United States, but pretty much across the world. It, as of days before Lehman went into bankruptcy, it had the economy going -- the global economy -- going straight up. Goldman Sachs -- everybody did it and the question is why.

SPEAKER: (inaudible)

MR. GREENSPAN: I wrote a book in an endeavor to answer that question. And not that I wish to sell the book here, but the answer to your issue is, in other words -- I was as wrong on forecasting as everybody else was. But the question of why did we all miss it, I think is because we did not look to some of the fundamental aspects of human nature, which are real constants in this and I'm in the process of evolving a model which endeavors to merge, so called behavioral economics and classical economics and it does explain what's happening, but it also says that certain things are e-determinate, that you cannot forecast it. And the trouble with this forecasting is that the worst thing you can do to any forecaster is collect his past.

DR. BAILY: It's 12 noon. I think we can agree that Alan, you are in very fine form in your speech and your answer to questions. So I'd like to thank you very much for being here and for your time. (applause) Thank you everybody.

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I, Carleton J. Anderson, III do hereby certify that the forgoing electronic file when originally transmitted was reduced to text at my direction; that said transcript is a true record of the proceedings therein referenced; that I am neither counsel for, related to, nor employed by any of the parties to the action in which these proceedings were taken; and, furthermore, that I am neither a relative or employee of any attorney or counsel employed by the parties hereto, nor financially or otherwise interested in the outcome of this action.

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