THE BROOKINGS INSTITUTION

SAUL/ZILKHA ROOM

ADVANCING U.S. INNOVATION BY REFORMING PATENT AND R&D POLICY

A HAMILTON PROJECT POLICY FORUM

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Roundtable Discussion: Best Practices for Strengthening R&D Pipelines:

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P R O C E E D I N G S

SECRETARY RUBIN: Good afternoon. I'm Bob Rubin and welcome to our Hamilton Project discussion: "Advancing U.S. Innovation by Reforming Patents and R&D Policy."

We will turn very shortly to the beginning of our program, which is a fireside chat. Before that, let me make a few comments to set the stage for this discussion.

I think this broad-based agreement across party lines, across policy lines, a strong economic growth and widespread economic wellbeing, the two interdependent objectives presumably of economic policy depend very heavily on productivity growth.

Productivity growth in turn, as all of us know, is well known to the policy community depends heavily on robust innovation, which means new products, new processes, and new technologies.

The United States has a dynamic and entrepreneurial culture. That is certainly fundamental requisite for innovation, bet innovation also requires policies, policies that stimulate and incentivize innovation, policies that are conducive to

innovation, and policies that provide the necessary underpinnings --

That includes a whole host of areas that we're not going to be discussing today, but let me just briefly mention them, such as flexible labor and capital markets, regulatory regime that is based on cost benefit analysis but also meets our regulatory needs, a greatly improved multi-facetted human capital agenda, appropriate tax incentives where externalities are involved, and much else.

We at the Hamilton Project have over the 12 years of our existence, convened discussions on all of these subjects multiple times, but the program today is going to be focused on much more specific areas.

One will be the many issues, legislative and administrative around patents and then various other issues will come up, including this very interesting subject of what can we learn from the pharmaceutical industry with respect to innovation in other areas particularly applied to innovation and energy.

We all know that our political system has very unfortunately been largely disfunctional for a long period of time. The consequence is that while we

have tremendous long-term strengths, we should be successful as an economy of the long term. It is requisite -- that is to say the realization of that potential is requisite on many (inaudible) consequential policy challenges, and predominantly those have not been met for a long time.

But innovation is one area where there is widespread bipartisan agreement. Therefore, it seems to me at least, seems to us, create the potential for administrative and legislative action.

Therefore, it seems to all of us, in the various capacities that we occupy, should urge our elected officials to focus on innovation and its requisites -- as I said a moment ago, that is one of those unusual areas where at the federal level we should be able to move forward.

Moreover in some of these areas, the states can be very useful. So there too we should be involved in the Hamilton Project, we are involved, in talking with state governments about what they can do to spur innovation.

Let me mention one more item, if I may. There's a document in your materials, the facts

relating to patents and innovation. It is really worthwhile reading. There's a lot of interesting material in there, but let me just point out one in particular, and I think it's Fact 7, if I remember correctly.

It makes the point that immigration, immigrants, have been disproportionately, very disproportionately constructed in this country and active in patent applications. It's just one more example of how immigration has contributed in a very positive way to our economy.

The program participants, the discussants, and the papers' authors are described in your materials, and I will not cite from their resumes, but as you can see they are a truly outstanding group. We are very grateful to them for joining us today and for helping all of us think through these very important issues.

Let me close on one totally different point, but it's been on my mind lately. The discussions we're going to have today seem to exemplify a point about independent policy organizations like Brookings.

We are here today, the Hamilton Project.

We're housed at Brookings as you know, but we're self-governed and self-funded and others, AI and others, that are serious minded and really committed to serious purpose about policy and policy -- development policy deliberation.

It is true that probably at this point in time relevant little is going to be accomplished at the federal level in most areas, but it still seems to me that kind of work can have some effect.

It can certainly also have effect in the states and it is very important in creating intellectual work product for when -- well, for those politicians who are committed to governance and for when we once again, hopefully, reestablish effective governance.

The way to attach that proposition is just think of the counterfactual. What if we had the political environment that we've had really for quite an extended period of time and we didn't have these independent policy organizations to keep alive series of purpose.

With that, let me recognize the terrific Hamilton Project team, Jay Shambaugh, former member of

the CA, now our director and intellectual leader; Christian McIntosh, our exceedingly effective managing director; Brian Nunn, our deeply knowledgeable and thoughtful policy director; and our talented staff, without whom none of what we do could be done.

With that, I will turn the program over to Greg Ip, the highly respected chief economics commentator of The Wall Street Journal, and Kevin Hassett, chairman of the president's Council of Economic Advisers.

Kevin, we are really delighted that you are joining today's discussion.

So Greg -- well, Greg disappeared. Oh, no, he says he's here. Kevin was hiding from me.

(Talk over)

SECRETARY RUBIN: Greg just has to assert himself...

MR. IP: You're going to be sorry you said that. No, I'm going to be sorry you said that.

Thanks very much for joining us, Kevin. So to paraphrase Bob Solo, you see innovation everywhere today on the smartphones and in the headlines. You see it everywhere except in productivity statistics.

It's been a rough decade for productivity growth.

What's going on here, does this country have an innovation problem and why does that matter?

MR. HASSETT: Thanks. Before I answer that, I just want to thank the Hamilton Project and Brookings for having me here, especially Secretary Rubin for your thought leadership. I think right back in the beginning of 2006, I remember maybe the second or third Hamilton Project event was about patents and your vision of creating an organization within an organization that is filled with just real policy proposals created by the smartest people that you can find has been just -- it's been proven in practice by output of the Hamilton Project. It's just been fantastic.

I can tell you that there's probably not been a Hamilton Project paper I haven't read and haven't referred back to, so thank you for your leadership.

MR. IP: Be careful Bob's call --

(Laughter)

MR. HASSETT: Yeah, that's right. You do need to do a study on corporate taxes and wages. I

will go look it up.

Anyway, back to productivity, I think, in fact, it's another thing that Brookings has really been a leader in, that there have been so many conferences in the past few years that have informed my thinking on productivity growth.

I think that really quickly my summary of what I've learned from papers that have been produced within these halls or solicited by these halls is that there's the sort of Eric Brindelson argument that because neuronats and machine learning and everything are advancing so rapidly that we ought to innovate faster.

Then there's the Bob Gordon point that, well, nothing will ever be as good as air conditioning in terms of how much it will help productivity.

I think what I've learned from all the Brookings papers I've read on this is that their debate is a little bit of a non sequitur, that if you look at productivity and equality, it's going up a lot, and that the innovativeness of the most productive firms is sort of consistent with Brindelson's view of what ought to be going on.

But the difference these days is that the innovation -- the productivity gains from innovation are not defusing down at the rate that they used to and that the challenge for policymakers -- I guess at CEA, I provide objective advice to policymakers at the very least.

I don't think of myself as a policymaker, but policymakers need to think about why has the diffusion slowed, what can we do to address it, and I think that the link that I find most compelling is that in order to get from innovation to growth and to productivity, then you need entrepreneurs.

If we look at the data, the thing that's really most striking about recent years is that entrepreneurship has really fallen off.

The Economic Innovation Group did a study of it that suggested that Millennials are the least entrepreneurial generation that we've seen in U.S. history.

So I think that as we think about how to get better that -- innovation is happening, it's just not diffusing and maybe we can take that as an opportunity.

SPEAKER: So a huge part of the policy effort of this administration and this Congress right now is in tax reform, which of course is a specialty of yours.

To what extent can tax reform, especially the one that seems to be taking shape right now, actually help the innovative process, if at all, is there a link between the tax system and innovation?

MR. HASSETT: I think the news was breaking just as I was walking in, that they've announced that they've sort of agreed to something in conference that looks like will become law.

I think there is a link between tax reform and innovation. I think to think about how that link works, we could go back to -- back when I was in grad school, one of my professors was Dave Cass and Cass and Koopman's had been leaders in the '60s in the development of the neoclassical growth model, which showed that if you have more capital investment, more labor than you get growth in the short run, but in the long run basically growth was exogenous.

Then just as I kind of left graduate school --

(Talk over)

MR. HASSETT: ...this stuff is just given to us from the heavens.

But then there were a bunch of empirical patterns, so it's kind of one of the advantages that you and I both have recognized for aging, right, is that we actually remember how the -- how literature got started because of the puzzles.

I think sometimes we forget the puzzle, but the puzzle that started the endogenous growth literature was that, especially capital spending relative to GDP, your investment relative to GDP, seemed to affect long-run growth more than was consistent with the neoclassical growth model.

Therefore, there's an interaction between higher capital spending, which we think will come from this bill, and things like total factor productivity growth.

That literature has certainly evolved a lot, but the basic puzzle started from the fact that productivity growth, even total factor productivity growth, seemed to interrelate with investment.

We can go into that literature work.

There's sort of three strands of it, but there's one that tries to model innovation by looking at investment in R&D. I think that that's one that's the most promising.

MR. IP: To sort of cut to the chase, so the brute force mechanism of this tax reform on growth is that you lower the cost of capital, there's more capital spending, higher capital stock, how does that translate into innovation? I mean, maybe we just get bigger locomotives, deeper mind, but not necessarily more innovation.

MR. HASSETT: Right. Well, I think that it can lead to more innovation if it increases the rate of return on innovation, so there will be more investment in that. I think that's probably the biggest thing, but it can also lead to more innovation if it helps us with that problem.

I think if you look at the individual side, it might have some promise to of the sort of disappearance of the entrepreneur, because we've got to have people take the innovation and turn it into something that's a business.

I think one of the problems with

entrepreneurship too might be that -- that if you're a young smart person, if you invest in professional skills, then you get in this day and age pretty high income that's not that risky.

So that bundle is a lot more attractive to a lot of the most talented people these days than becoming an entrepreneur where you get a risky income and maybe it's a lot higher. I think things like marginal tax rates might help with that.

MR. IP: Just a reminder from the audience in about five, ten minutes we'll take some questions and there are staff members with cards that they will give to you.

You can write them down and then the cards can be passed up to me. If you're watching this on live stream, you can Tweet a question to @hamiltonproject.

So it's definitely the case that a higher return should create more investment and innovative activity, but it's been well established that the return to society go well beyond just what any individual company's going to get, so we've long recognized that there should be public incentives like

direct federal financing of R&D.

Now, this is before your arrival, but the first Trump budget proposed cutting several important types of federal R&D. For example, NIH would be cut 22 percent, the Office of Science in the Department of Energy would be cut something like 17 percent.

In the event a lot of those cuts do not grow through in the appropriation's process, but how do you reconcile --

MR. HASSETT: I think most all of them didn't go through.

MR. IP: Oh, is that right, okay.

How do you reconcile this proposed reduction in direct (inaudible) contribution to R&D and the widespread recognition that R&D is important and research is important?

MR. HASSETT: Well, I think that -- first of all if you look at the attitudes toward research of the certain people who control different areas in the government sector that they've done a pretty good job, I think, of moving government R&D back in the food chain, so going back to really basic research.

I think that there's this view that maybe we

can spend too much time researching things that maybe private firms can better do, because it's like near the end of the chain of discovery and there's a refocusing right now on high-value added research.

As an economist, I can say that my read of the literature is that the social return to basic research is enormously high and that that suggests that the government should engage in it and also that the government should subsidize it at the corporate level too, because the social return for their research won't all be captured by the private firm.

I think the latest research suggests that the social return to research at the corporate level is about double the private return would suggest that there's ample room to make sure we're a good place to do research.

MR. IP: Is there a sense that the federal government's support for R&D has not been efficient, that it gets -- it can get more bang for its buck?

MR. HASSETT: Yeah, that's certainly the sense that I have when the president's budget was put together. I think guys like Reed and Chris in the Office of Innovation were really looking at what we're

doing in trying to think about how we can spend it better.

I think that the fact that there's an Office of Innovation in the White House, I think emphasizes how important we think that is.

MR. IP: When you go into the -- as Bob was saying earlier in his introductory remarks, one of the facts the Hamilton Project lays out for us is the striking contribution of immigrants to the R&D -- to the innovative process, whether it's as entrepreneurs, whether as people who develop the knowledge that leads to patents and so on.

There is a perception out there that there is a tension between that recognized role of energetic immigrants contributing to our entrepreneurial process and this administration's efforts to reduce immigration, both legal and illegal.

Can you talk about how the administration address that's tension?

MR. HASSETT: Sure. I don't view it as being a serious tension. I think that the literature is clear that immigrants tend to be very entrepreneurial, there's a very logical reason to

expect why that would be.

Imagine if all of a sudden everybody in this room we had -- pick some random country where you don't speak the language and we had to go live there, then we would be very frightened of that.

So the people who have the courage to move to another land and try it make a life for themselves tend to be talented and risk loving and they're exactly the kind of people you would want to have come to your country, and it's very much in the evidence that they're twice as likely to be entrepreneurs, immigrants, as native-born Americans.

At the same time, there's a lot of parts of our immigration policy that haven't been working very well and our borders haven't been very secure. I'm not an expert on border security, but I'm glad there are people that are who are doing that.

Before I entered the White House, I wrote an article a few years back. It would be very easy to find. The people that -- the Senate confirmation people were very good at finding this article before my period where I basically just speculated that because we've done such a bad job of enforcing the

law -- the rule of law in our country, that there's sort of a paradox about America that immigration is very, very contentious politically here, so it's an extremely hot button issue, much more so than you see in other countries.

Yet even immigration of illegals, plus legals relative to the workforce, is one of the lowest in the OECD. I think Japan and France are the two that are about where we are and everybody else is way above. Of course, with Europe, it's a little -- because the mobility, it's a little hard to look at that statistic.

I think immigration policy in the U.S. has been so terrible. It's so contentious in part, because we haven't started by getting the sort of enforcement part right.

I'm very hopeful, and I'm looking at what's going on in the White House, that they'll get that right and then they can move on to things like working toward getting a more rationale immigration policy, getting the right kind of workers into our country.

MR. IP: Wouldn't it be the case that reducing the level of legal immigration, as for

example Senator Cotton and Senator Perdue have proposed in the Senate, largely by reducing the family reunification portion of that, just as a mechanical sense would reduce the inflow of immigrants in the future, would that have some impact on our growth and especially our innovative effort?

MR. HASSETT: I think that if we get immigration right, then -- and make sure that it's serving the purposes of the vision of our country of our Founders and the citizens of our country today, then it will be very easy to expand it once we get it right.

MR. IP: Let's talk about one of the subjects that we'll hear about later today, and that's patents. In fact, you studied patents a lot in your life prior -- you studied a lot of stuff in your life prior to coming to the Council of Economic Advisers, but this was a special area of interest to yours.

There seems to be a consensus that the patent system in this country does not work very well. Do you agree and what can the federal government do to make it work better if we want more innovation?

MR. HASSETT: Right. So, yes, the patent

issue is crucial, because the empirical link between patents and economic growth and patents and productivity growth is pretty strong.

I think that, going all the way back to maybe 2006 Hamilton Project, there's been the sort of problem that sometimes it's almost like every patent gets accepted and then there's all these patents out there and then everybody is suing everybody else and it makes it very hard.

One of the things that I think I've been convinced by the work of this group about is that it's hard especially for the little guy with a good idea, because that person won't necessarily have the resources and the lawyers to defend their property right against the other guys who send in patent applications pretty close once they saw the guy's idea.

So I think there's a lot of room for patent reform and I'm happy that it's on the agenda here today.

MR. IP: One more time, if you have a question, just put up your hand and we will come to you and get a card. Just a couple more questions and

we'll get to those. I know your time is valuable, so I don't want to delay the Q&A too much.

MR. HASSETT: Actually your time, since we're paying my salary.

(Talk over)

MR. IP: Let's talk a little bit about regulation. This administration has been a very big push to try and reduce regulations from the premise that that's been a burden on growth.

Do you think there are specific areas where regulation has impaired innovation and growth in this country and what are those areas and how do we fix that without sacrificing safety and consumer welfare, all this stuff that we --

MR. HASSETT: Yes, safety and consumer welfare regulation is extremely important. Then I think what we've sort of done this year is take time out and there have been very, very few economically significant new regulations this year.

One of the things that I've found from our study of this is that it's sort of surprising how much new regulations what a tax they are on the economy.

Because if all of a sudden you and I are

running a business and there's this new regulation, then we have to hire a zillion lawyers to figure out how is that going to affect what we're doing. I think the positive affect of the pause is sort of bigger than I expected, but I think --

MR. IP: In what sense is it bigger than you expected?

MR. HASSETT: I think it's one reason why sentiment and growth are looking good, it has to be. Because there's a lot of ambitious analysis going on at OMB and elsewhere to deregulate. They're going to have a progress report coming out, there's always one in December coming out, really soon where they're going to list their accomplishments, and there are many.

But they did start in the beginning of the year and those things would be just washing through right now.

I think it must be the case that at least animal spirits created by a pause in regulation have been significant factor driving the growth up above three percent, like it is right now.

I think the way to think about it

economically is just that regulation is a fixed cost, that figuring out what am I going to do about this, what am I going to do about that, and that fixed cost is an obstacle to entrepreneurship.

Even like outside the business sector a while ago, some friends of mine and I saw a need for a nonprofit to support youth sports in parts of town where there weren't a lot of dads that were organizing little leagues and stuff like that.

We started a foundation called the Urban Baseball Foundation to do that and just it was a nightmare to get through all the regulators and all the tax people. I just can't tell you how long it took. None of us were taking a salary and were putting our own money in it --

MR. IP: Federal regulators?

MR. HASSETT: Yeah, because the tax-free status and stuff was pretty hard to get as well.

Anyway, I think that red tape and all that is a serious deal, and it's not just me. If you look at the OECD, pillars for economic growth, then one of the key ones that they mentioned is the deregulation can lead to economic growth.

If you look at the OECD rankings of how high the costs are of regulation, the U.S. is really right near the bottom. So we can get very significant growth effects from deregulation if we could just approach the level of regulation that they have in say the Netherlands.

MR. IP: Interesting. Can I get questions now. While I'm waiting for those, one last thing. So the subject near and dear to the hearts of many people in this room is higher education and they're looking with certain degree of anxiety at the tax reform, which will take away some of the tax break for higher education, for example, deductibility on some forms of debt, taxes on endowments at certain institutions.

Given that we're looking to the higher education system often to generate the STEM graduates and the knowledge base that propels growth, is that part of the tax reform potentially negative for growth and innovation going forward?

MR. HASSETT: I don't think it is. I think that, again, it's -- part of the STEM problem is not necessarily the opportunity isn't there for people to get STEM education, it's the people choose not to do

it.

I think rewarding higher salaries with higher after-tax income will certainly have a big impact on people's decisions to do things like engineering.

It's interesting again if you look at the latest literature, it's clear that we do need a lot more STEM people, that engineering -- the engineering share of the workforce in manufacturing companies is really highly correlated with their place in the productivity distribution.

MR. IP: Way more questions than we have time, which is too bad. These are actually very good questions.

Very important, what are the policies and ways especially for the federal government to address the needs of workers and communities that are themselves in some sense on the losing end of innovation as we replace their skills and their industries with improving and better -- and new technology?

MR. HASSETT: Well, I think that one of the things that was in the Senate bill -- and I've not

seen the final, I know there's just an outline that's been agreed to now -- is a kind of enterprise zone on steroids that is something that Jared Bernstein and I a while ago wrote about.

But I think, first of all, by having a lower corporate rate, firms are going to want to locate plants back here. With the unemployment rate so low, they're going to want to locate those plants in places that have a lot of available workers.

I think that we put that thought on steroids a little bit in the Senate bill at least with really expanded enterprise zone that will encourage people to locate their activity in more distressed communities.

MR. IP: On tax reform: After the bill is signed by the president, do you think large high tech companies, like Apple and Google, will bring their large overseas profits back to the United States and, if so, where does that cash flow end up going, will it stimulate investment in R&D or will it simply go to like paying for dividends and (inaudible) purchases?

MR. HASSETT: First of all as Secretary Rubin will tell you, that if a large mature business returns capital to society, then that is

capital that can go to young entrepreneurial folks. So I don't think we should pillary firms if they increase their dividends as a part of this tax plan, but I think that we should contrast what's going on in the bill now with what happened the last time we had a dividend repatriation holiday.

Back then we gave a kind of lump sum tax refund to people who had a lot of cash offshore. They brought it home and the Congressional Research Service tells us that -- I think it was the GAO, it's one of the two --

(Talk over)

MR. HASSETT: But they showed us that it basically went right into dividends and there was no capital spending effect whatsoever of the repatriation holiday.

I think that that's fully consistent with the models that we at CEA use to model this tax reform, because we didn't change the marginal corporate tax rate. We didn't do anything to make people want to invest in plant equipment here in the U.S., we just gave them the lump sum tax holiday and they did what we would expect.

But I think the difference is that people will want to locate activity here more now, because the rate is so low and there's still going to be an issue with transfer pricing with the really, really big firms. But I think that at the margin, we should expect a lot more capital spending in the U.S., because of the bill and the repatriation part of it can help finance it, which is important because I think there are a lot of -- there's a range of model estimates of what can happen to the economy, because of this tax bill, and the models that find smaller effects tend to do so, because there's a lot of crowding out because the firms want to invest more, but they don't have the money, because people don't save more and then the interest rate just goes up and you don't get much more investment.

But there's all this cash offshore, there's all this transfer of pricing and profits overseas. The speech I gave at the Tax Policy Center a while ago I showed that the increase in investment we expect to see is something that can happen almost entirely within the current account, because there is all this money that's being transferred priced to foreign

subsidiaries that if they stop that, that they can use that money to finance investment and it doesn't require a higher saving rate.

MR. IP: So when you see -- when we see announcements of companies saying, well, we're going to start increasing share repurchases in part because of the tax reform, is that a sign that it's working or that it's not working as advertised.

MR. HASSETT: I think that repurchases and dividends could go up in part because they can now get the money home and return it to domestic investors and then those investors will recycle the money and put it into perhaps more entrepreneurial firms. So it's kind of removing the lock in effect, so it should be a good sign I guess.

But the sign that we really need to see in order to know that it's working as intended is that capital spending goes up as a shared GDP next year.

MR. IP: In other words, you shouldn't focus too much on looking at how one specific company rearranges its financing and --

MR. HASSETT: That's what I think, but I do think that it will be completely fair if next December

we're on this stage and you say capital spending was down a little bit this year, isn't that the opposite of what you said; then I would have to say, yeah, that's not what we expected at all.

MR. IP: They're totally loving us, Kevin, they're giving us five more minutes.

How can we make patenting, and I'm going to add here innovation and STEM, more accessible to women and racial or ethnic minorities, we need to -- we need everyone around the table to innovate? Women are listed as innovators on fewer than 20 percent of patents.

MR. HASSETT: I think that access to the capital to go to college and so on is something that can help with that but also fixing schools, with the minority part of it, that the STEM education in many schools in America is really unacceptable. I think that Secretary DeVos has got a lot of ideas about that.

MR. IP: Given the importance of structures to growth fixed investment, is capital deepening possible without land use reform, is zoning -- for example, zoning, is there any way for the federal

government to help?

I'm going to actually add to that question, what's the justification for allowing accelerated expensing of equipment but not structures?

MR. HASSETT: So there's a technical answer to that, which --

(Talk over)

MR. HASSETT: No, no, but it's just the way that depreciation enters in the user cost of capital is in the present value of appreciation deductions. For something like a building that's depreciated over more than 30 years, then the present value is way less than one.

That present value to depreciation deductions hits the statutory and corporate tax rate and the user cost formula. By cutting the corporate rate from 35 to 20, then it turns out that the user cost effect on structures is bigger than it is for equipment, even though we're getting equipment expensing treatment.

So there really is a big incentive for more structures investment in this tax plan, because of that. So then the question is where do they locate

those structures and zoning is a big part of it. It's something that other CEAs have written about.

But to the extent that the dynamic that we expect to see, which is firms want to locate activity in places where there are a lot of available workers, then I think the zoning constraint will be a smaller one, but it's certainly a big deal in places like San Francisco and Denver.

MR. IP: Last question: What is the federal government going do to make sure that we remain internationally competitive, and I'm going to add a little bit to that, because obviously the administration they left the Trans-Pacific Partnership discussions.

The administration has been very critical of things like NAFTA, the Korean Agreement, the World Trade Organization, maintain -- held the possibility that we will leave some of these organizations.

There's a concern, especially in the business community, that will hurt us competitively by reducing our access to other markets, what's your response to that set of concerns and how does this administration plan to raise our competitive position

vis a vis our trading partners.

MR. HASSETT: Well, sure. Just a reminder of what an honor it is to have the role of chairman of CEA. One of the roles that the chairman of the CEA has is to be the chair of the Economic Policy Committee for the OECD and to chair those meetings twice a year.

I was just with DJ, someone I stole from Brookings to the CEA. DJ and I were just at the EPC meeting in Paris and we can both tell you that many of our friends at the OECD meeting had the same question.

I think that for competitiveness the tax component is certainly part of it, but there's also a sense that every president, the Congress I know has served over the years that they have that there's a lot of asymmetry in our trade deals and trade deals can be made a lot better.

I have not talked to people in the White House, I've not heard someone say free trade is bad. I've heard people say that our deals are asymmetric, that they disadvantage the U.S. Really if you look at the details of those deals, who could argue with that.

I can remember once I was on television with

Austin Goldsby and Austin said an economist free trade deal is one line since we got free trade, but the free trade deals that we look at have thousands and thousands of pages. He was explaining President Obama's policy on free trade.

I think if you look at the negotiations that are going on, I'm very hopeful that they'll reach a positive outcome that's better for America and improves our competitiveness, because there are so many asymmetries in the deals.

MR. IP: Kevin, thanks very much for coming and talking with --

MR. HASSETT: Thanks for having me.

(Recess)

MR. SHAMBAUGH: Thanks everyone for being here. We're now going to start with our second part of the event, our first panel here, which is on "Best Practices for Strengthening R&D Pipelines".

So as Bob mentioned at the start, we're thinking this event is broadly about innovation and things that can drive innovation living standards, but we're going to try to drill down on a couple specific areas here.

We have a terrific panel here. We have starting from farthest, we have Josh Graff Zivin, who is co-author on a new Hamilton Project policy proposal that he's going to talk about at the start of the panel.

It's one of the three little booklets that were handed out to you as you came in. It's policy proposal on Promoting Energy Innovation with Lessons from Drug Development, and Josh is a professor and associate dean of faculty affairs at University of California at san Diego.

We've also got Ryan Umstattd, who's the acting director for commercializing at the Advance Research Projects at Agency Energy or ARP AE as it's more commonly known.

We also have Richard Moscicki, who is the chief medical officer and executive vice president for science and regulatory at PhRMA, the pharmaceutical industry association.

So just to set the stage very briefly, as Bob mentioned at the start I think we're well aware that innovation is a huge part of the growth in living standards over time.

So if you look across countries, it is not just the capital stock or even human capital stock or labor that really separate living standards, but differences in what we as an economist often call total factor productivity or the efficiency with which we combine all those inputs that becomes a huge difference to our living standards across countries and also for any given country over time.

In particular for countries what we think of as the frontier. For them it's innovation and technology growth, total factor productivity growth that is a huge portion of what drives living standards over longer stretches of time.

We'll try to think here a little bit about on the one hand why it's so important, but also what are some of the barriers that we face when we think about innovation.

In the document that Bob mentioned, the third piece we've handed out to you, besides the two policy proposals, it's a document about 11 facts on innovation and patents.

Beyond trying to think through some of the core features about innovation and patents, it also

looks -- (inaudible) about some of the barriers we face to them, whether it's declining federal R&D spending, whether it's the long lag from patent to profit, things like this that may make it harder to get the economy to generate this innovation.

What we're trying to do here is think about a particular industry to think about energy innovation. So there are really two reasons to do that, one, is just to take a specific example. Problems in innovation vary by sector and we can take one and try to learn some lessons. In this case, especially learn lessons from one sector over to another, but also because energy innovation has some special characteristics about it. It's not just that it's a key input in the economy, but something that we probably won't touch as much on here, but it's an important underlying factor. It's the fact that they're generally unpriced externalities in energy production.

So we've got between pollution and carbon, there are reasons that we really worry about how efficiently we make our energy. So that becomes an additional reason to try to make sure that we're

getting all the energy innovation that we can to make sure that clean energy is being developed and the inputs into energy are being done as efficiently as possible.

So with that stage setting, I would like to toss it over to Josh to kind of walk us through his proposal and then we'll come back to the panel.

MR. ZIVIN: I'm not sure which mike I'm using, so I'll stand in front of this one and keep this one on my lapel. Thanks, Jay.

I just want to first acknowledge that this is -- the report that you all have in your folder is joint work. At least one of my coauthors down in Goldstein is sitting here in the front row, so she's here for moral support, so thanks, Anna.

I have five minutes to cover a lot of ground and so I'm going gloss over a lot of things and try to maybe make three big picture points that we can elaborate on in our panel discussion as it progresses.

The idea here is to capitalize on what we know from biomedical innovation, the successes of biomedical innovation, in particular pharmaceutical innovation, and think about what we might take from

that experience and poor it over what lessons we might draw for the energy sector.

I'm going to classify -- and there are lots of commonalities between energy and biomedical, there are also lots of differences.

I'm going to emphasize the commonalities here to talk about three distinct avenues that I think are worth thinking through, and they're going to fall into kind of three broad categories: One is in essence the production of knowledge, the second is the investment in that production of knowledge, and the third is the incentive to create that knowledge.

So on the production side, one of the things that has been breathtaking at least to me as a scholar by medical innovation over the course of my, what I like to think of, as my relatively young short career so far, what we've witnessed in the past ten, arguably 20 years is explosive growth in something called contract research organizations and biomedicine.

That is the idea that when you're developing a new biomedical product, you need to put that product through its paces, through its testing, and that that testing is frankly quite expensive.

And for very large pharmaceutical companies, there are resources to do some of that testing if not all of that testing in-house, but for the smaller organizations that was always going to be an obstacle, how are we going to actually run -- provide the infrastructure, the simple infrastructure, to run those tests.

So what I want you to have in mind here is that we're not -- we think about energy innovation, we're not thinking about app development, we're not thinking about software engineering in which the beta testing, the development, and all that can happen in a dorm room or garage or maybe in an office park.

In energy, like in biomedicine, we're talking about very large infrastructure that's required to do this testing. So one of the things that's noteworthy here in the energy sector that has shown great -- has provided great help in the biomedical innovation is the absence of these institutions that can provide as it were shovel ready infrastructure to help develop tests, refine products that require large infrastructure.

So one of the ideas that we put forth in our

proposal, and I won't elaborate here, is that there may be a role for the national laboratories and to a lesser degree for universities to provide some of that shared infrastructure so that that infrastructure is available so that it's not only the largest companies that have the wherewithal to do that necessary testing but also provides lots of opportunities for those smaller entrepreneurs to get in the mix.

On the investment side, one of the clear lessons we've learned from pharmaceuticals is that we have a very clear if not always perfect regulatory process in which drugs go through a very standardized evaluation process.

They go through a stage-gating, if you will, in which the promise of a particular product is evaluated at various stages. We have no parallel process at least in any broad sense in the energy sector.

I've got my two-minute warning. I'm not going to elaborate too much more on that, but I would argue that that stage-gating is particularly important as we think about private investment, that evaluation of product, systematic evaluation of products, is what

allows external bodies to decide whether a product is promising and how and when to invest in it, and that infrastructure is, I would, say patchy in the energy sector.

Lastly, I want to argue in particular for direct financial incentives, and I'm picking on a particular piece of the energy sector here. There's lots of players in energy and I'm thinking in particular about electricity and electricity generation and distribution.

One of the things that's absolutely true when you think about electricity in particular is that it is delivered by, for the most part, regulated electric highly regulated utilities, electric utilities, which have at best stultifying incentives to do any innovation whatsoever.

That's partly about the way in which we remunerate them, partly a legacy of the ways in which we've decided that that energy should be publicly provided, and partly a result of, I think, not sufficient creative thinking on how to get utilities from moving them away from simply delivering services to being part of the ecosystem of folks that are

experimenting in this very real living laboratory where the infrastructure is already there to provide a backbone for that experimentation to get them and incentivize them to do so.

It is interesting to note that several states are moving in this direction. New York is really the leader. Of course I'm from California, so we have to tout California as well, but there is much more work to be done both at the state level and at the federal level, and I think that's a promising place to move.

Let me offer one concluding remark that I'm a little embarrassed to say. I didn't quite recognize, despite working in this area for many, many years and writing this paper over many, many months, I didn't quite realize until two days ago, and I think one of the things that's important and interesting to recognize here is that it's not an apples-to-apples comparison when we think about pharmaceutical innovation versus the energy sector.

Energy is broad and complex and embodied in so many products. If you wanted a fair comparison, you would compare energy innovation to health

innovation. I think we would then be saying many of the very same things, because health innovation we don't regulate gym memberships, nutrition, and all kinds of things that matter for health in the same way we regulate and incentivize pharmaceuticals.

One of the lessons that I draw away from that observation is simply the thing that we tell all of our graduate students, which is take a big problem, carve it into something more bite size and manageable, and then iterate from that size up.

So one of the things that pharmaceutical -- the pharmaceutical sector has done very well, the infrastructure and ecosystem around innovation and pharmaceuticals is to carve out a piece that could be governed by some unifying structure.

I think that's going to be the key to our success as we build out more and more innovation infrastructure in the energy sector. Thanks.

MR. SHAMBAUGH: Thanks, Josh.

So, Ryan, I'd like to start with you. First before I do, let me just remind everyone, as Greg noted during the last conversation, you either have notecards or notecards will be coming around. If

you've got questions, you can write your question on there and they'll come up to me at some point during this conversation. So please, fill those out as we go.

So, Ryan, could you give us your perspective kind of from where you sit at ARP AE a little bit on the energy innovation pipeline functions right now and some of the issues that you see with it.

In particular, if you've got any thoughts on some of the things in the proposal about kind of the technical standards or kind of stage-gates or things like that and how that becomes an important issue that you face in your work.

MR. UMSTATTD: Thank you, Jay. Again, thanks to you and the Hamilton Project for inviting me to be a part of the discussion today. I really appreciate that.

Just to help provide a little bit of context for my remarks today, I wanted to give you the 30 seconds on what is ARP AE. We're a federal funding agency. We provide resources both in dollars in terms of active management of projects and programs in energy technology.

The reason we do that is because basically we're chartered with maintaining our technology in terms of technological lead as well as we want to help maintain our energy in economic security as well.

We do that by identifying potentially high risk energy technology areas, where if we can help with an investment of dollars as well as expertise, we can help de-risk the technology aspect, then that might help lead to greater energy innovations, again with the goal of either improving our efficiency, reducing our emissions, or reducing our energy imports.

So that's what we do as an agency and I work at the agency leading our tech-to-market team, where we take these technologies and try to help prepare them to be market facing once they're done with their ARP AE support.

With regard to the energy R&D -- that whole ecosystem and how you start from early stage to late, one of the things that I think is really important to point out is that there's very few energy organizations left, whether you're a corporate or strategic, that can actually take something from an

early stage R&D up through prototype, up through demonstration, up to manufacturing and scale up, and put it on the market. There's very few organizations that can do that organically, so you're going to have to have transition partners and stakeholders to work with.

To do that, you're going to have to have clear demarcations where before you can transfer to a partner, they're going to have to understand what the level of risk is involved for them. So I do think that having stage-gates is going to be critical.

Whether it's something like the technology readiness levels that we've seen NASA apply as well as DoD and some other organizations, those might be helpful for those demarcations of, okay, we've bought down a certain level of risk. But certainly in our interactions with the private investment community, they love to see opportunities where you can show that you've had a step change in the valuation of your technology or your company, so that's going to be absolutely critical.

When you work in a hardware-based technology like energy, it turns out that the early stage R&D

isn't usually the most expensive part of the step, so you have to have though demarcations well justified if here's the technology risk that we've bought down with this particular project, so that you can encourage those other funding mechanisms to open up their coffers and say, okay, we understand where you are now and we're willing to take on some risk ourselves. So I do think that will be extremely helpful.

I'll close with a comment on something else I've seen very successful in terms of not just giving projects momentum but helping carry that momentum forward and that is a concept of cost sharing or co-funding.

So when you can -- it gets a little messy. But when you can mix together public and private sources of funding on a project, it creates a more gradual handoff or transition instead of throwing something over the fence and hoping that the next transition partner catches it.

So we've seen that be very beneficial. Both the public and the private partners benefit from each other. For example, the government process for due diligence when it comes to technology and we evaluate

proposals before we choose which ones to fund, I think that industry benefits a lot when we've already done some due diligence for them on that front.

We in the government side benefit greatly from the entrepreneurial expertise that our industry and private funding partners can bring to it.

So, again, those are all aspects that I've come to appreciate working at ARP AE with the teams that we're helping support.

MR. SHAMBAUGH: So, Richard, we're in some sense holding -- PhRMA here is saying like -- PhRMA has figured this out to some extent. At the very least if you look at the literature typically, you see R&D spending is a share of revenue or things like that for PhRMA is really quite large, then you look in the energy industry and it's nowhere near as large.

So I think in some sense that's the idea. There's something here that is enabling PhRMA firms to spend a lot on R&D and generate a pipeline with a lot of innovation.

Where do you see that coming from?

MR. MOSCICKI: Well, let me make a few broad strokes around pharmaceutical R&D to start with and

I'm delighted that we're holding it up as an example of real success.

In fact, it has been a success. If you even just look at the impact recently, we're talking about a situation where cancer deaths have decreased by 25 percent, Hepatitis C is now curable, and all of the subsequent complications of Hepatitis C are dramatically going to be decreased. We have 500 treatments for rare diseases. I mean, that's unheard of if we thought about it 20 years ago. Even death from heart disease has declined by about 35 percent since the year 2000.

This has been driven by pharmaceutical R&D and innovation in that space, but the future is still full of need. So, we need this robust R&D pipeline.

For example Alzheimer's is looming over our society in a way that will be devastating if we can't find better answers.

So to illustrate the robust nature of the PhRMA R&D pipeline, you can look at the fact that there is 7,000 active INDs today handled by FDA -- or filed with the FDA.

What supports all of this is a complex and

large ecosystem that Josh referred to, and it has grown up organically around this, but it is highly interdependent.

I've seen attempts to describe it in slides, you know, graphs that sort of look like a complex electrical circuit going in many different directions with many different parts. All of it plays a very important role, I think, in the success of the R&D pipeline.

Let me just name a few of the elements in that ecosystem, so it really begins at the proximal end of investment, the life blood of that ecosystem. I'll come back to that later, because I think that's an important driving force to this.

It's an ecosystem that depends on both academia government and industry to play an important role. On the academic and NIH side, you have basic science breakthroughs, the war on cancer, the war on HIV had tremendous spinout in terms of the technical aspects that became very important to the kind of cures I just talked about before.

You have the pharmaceutical companies, large ones, medium sized ones, and you have the small

biotech companies each playing a very important role in that niche, industry also doing its own discovery work and moving on through medicinal chemistry, translational science, clinical research, and you have the CROs who play a big role in this now and are capable of providing all of those kind of services that Josh referred to.

You have the academic investigators, you have the regulatory oversight, and the role of Congress itself too playing an important role in how it provides more investment and oversight into this area.

The regulatory oversight I sort of think of in this ecosystem like the engineer and the locomotive trying to actually steer this in the best possible way for the best possible outcome so that, in fact, it does create a certain degree of assuredness to the ultimate consumer, the patient, that the product is in fact what it purports ultimately to be.

You still also have the sales and distribution piece, and I'll come back to that, because revenue is key, that is why there is investment. That is -- and has to do with that being

a successful effort.

I'm going to skip over a few of -- the rest of this, but there is also ultimately in this ecosystem the role of competition in order to also control pricing, and the role of generics and bio-similars where, in fact, there is this life cycle where the innovation has only a certain period. But to ultimately control costs, we do have the competitive generic industry which now constitutes 90 percent of the prescriptions in America.

So all of this is expensive, though, this ecosystem, and we spend around $80 billion per year in this ecosystem and industry probably even greater share than that funned by government in this setting, and that's driven by a very high cost of development.

We talk about figures, whether it's right or wrong, you can argue, but when we try to talk about a figure of 2.6 billion per successful product and 10 to 15 years of development, I'll just note that that's half the patent life generally that is eaten up just in the development period for these products.

So it's not really an efficient system, even though we think of it as highly successful. It has a

very high rate of attrition. Only about one out of ten products that enter clinical trials, in fact, will make it all the way to approval and to patients. In fact, that creates an incredibly high cost of failure in this system.

Then even on approval, not all products are profitable. In fact, I saw a figure where only about two out of ten actually get a revenue that exceeds the cost of R&D for those.

CROs are in the midst of this and they -- they actually -- I was trying to get a figure of how important a role they play. So if we look at 80 billion on one hand, I saw one figure that the CRO industry expects about 34 billion in revenue. So it gives you kind of a perspective of the role that they do play in all of this.

There is a tool that I haven't mentioned that brings together all these different elements of government academia and industry, and that's the Public Private Partnership. That might be another tool to consider at some point in time and how to make -- how to jump start.

We have found in the pharmaceutical R&D

space that this is often a tool that can help us get past some really difficult points where any one single company alone or academic institution alone really can't quite jump over it.

So what drives this engine of innovation, partly of course it's the mission. The fact that many people involved in this ecosystem are looking to add benefit in the relief of human suffering and life-and-death situations, and that plays a strong role.

But I really believe that the driving engine ultimately for this innovation is the creation of high value medicines at the end of this. That pull-through incentive is what allows investors to put that kind of funding into driving this ultimately forward.

Now, realizing that high value does require market driven environment, which today is somewhat under attack. It may be this high value that I would just offer could be a primary difference with the energy sector.

Where on one hand here you have high value, at least for period of time, whereas there you're thrown into a commodity situation where no matter how

you innovate, the reward systems may not be there for the right ability to drive that forward.

MR. SHAMBAUGH: Just because we've got a wide ranging audience, do you want to explain what a CRO is.

MR. MOSCICKI: Contract research organization. I think Josh spoken -- I think everybody heard Josh talk about it.

MR. SHAMBAUGH: I just wanted to make sure.

Josh, I wonder if I can come back to you with one issue. We're in Washington and in Washington there's often a tendency to say, well, you know who could do that is the federal government could do that. Then on the other hand, as economists we're often put in the position of saying why wouldn't the market just do that for you.

I'm wondering if you could think of some of the things you're suggesting here, so whether it's creating standards or having some (inaudible) standards or for that matter using the labs to be these contract research organizations, right, whereas in PhRMA they're not. They've got a $34 billion revenue treatment that they're happy to take, so why

government or why pieces government and why not just say if this was actually worthwhile, the market would already be doing it?

MR. ZIVIN: So that's a great question. Let me say I won't narrow my question just to those two points on why government...

First on the standard setting, I actually don't think is has to be government. It has to be a credible third party. It's often the case that -- so it has to be a credible third party that can certify where we're at in the process and that can be held to a standard in which investors will trust that standard and invest on it.

It may be that the government is in the best position to be that standard setter, but it doesn't have to be government. I don't think that that is necessarily a role for government.

On the CRO side, one thing to keep in mind here is -- what I glossed over is, yes, they require big infrastructures, but the infrastructures they require are very different.

What these clinical research organizations -- or contract research organizations

are doing is they're providing human patients for clinical trials and in some cases, some specialized equipment and statistical support.

On energy side, the infrastructure part of this is not human, it's physical and it's at a scale that doesn't look like the biomedical side. So it doesn't have to be the labs, but it's sort of hard to imagine who is in a position to provide that physical infrastructure.

The role I think -- if we think narrowly about what we're asking the government to do in this case, we're not asking the government to build the labs, the labs exist.

What we're asking the government to do is to think creatively about how to loosen the restrictions on the kinds of activities that can happen inside the labs.

This may even be a fundraising opportunity for the laboratories, because there may be organizations on the outside willing to pay for those services. The issue is that physical capital costs are very, very large.

The last thing I want to say, and I don't

want to belabor it, because I think it's a little off point, but I think it's important vis a vis the commodities point, which is it depends on what we're asking the energy sector to provide.

Are we asking the energy sector to provide the same old vanilla energy but just at lower cost or are we asking the energy sector to provide energy with lower externalities, emissions profiles and greenhouse gas emissions.

If we're asking the energy sector to provide some of the latter, then we need to de-commodify the electricity market and that is a role for government.

I don't know which government is going to step up and do it, but it's a role for government to step in and delineate the differences between, quote/unquote, clean electronics and dirty electronics.

MR. SHAMBAUGH: Ryan, I'm wondering if you could -- if we're thinking some of the things we can learn from PhRMA, also focus on some of the differences, so Josh mentioned some of these -- health is a lot bigger than PhRMA. Energy is this wide ranging sector.

So I'm curious if there are other ways you think of what we can and what we can't learn and maybe the answer to part of it is just on this last point raised about commodity in energy versus PhRMA, but I'm wondering if you could pick up on that.

MR. UMSTATTD: Sure. Yeah, I'd like to -- I think I can build a little bit on some of those ideas and that is that the -- I'm not an electricity market expert by any way, shape, or form. I'm in early stage R&D for most of my life.

But when you look at the market today and deregulation, it's quite complex. It's done differently in each region, but they are starting to value things more than just sense per kilowatt hour, dollars per gallon. It's not just a commodity's market. To keep the grid running, you've got ancillary services. You need to have spinning reserve and operational reserve and frequency management.

As we start to value those things, then perhaps there can be an opportunity for a very innovative energy technology that does more than just puts electrons on your outlet.

So it's about being able to put real value

on things like the resilience of the grid. Those are again opportunities where we might be able to break away from just a plain commodity's market.

MR. SHAMBAUGH: Richard, is that helpful to PhRMA there and one of the other pieces of this proposal that Josh and his coauthors have is think about ways in which you may need the government involved on the incentive side sometimes.

So we can do things with standards, we can do things with testing, but at the end of the day in some cases, you also need to get the incentives right. So you talk about high value drugs pull through being really important there.

But then there's also the case in the pharmaceutical industry that there are some cases where you want something, but it's not going to have a high value pull through for one reason or another, whether it's on the vaccine side or whether it's an orphan drug or things like that.

I'm wondering if you think there are lessons there that you could apply, especially in these cases where unless you've priced the externalities, you may want to set up incentives differently.

MR. MOSCICKI: Well, I think that's a great point. So on the push-through side, there is de-risking the pathway.

So as I said, the attrition rate is high, the risks are high, particularly for true innovation. It's one thing if you're doing a need-to drug or generic, the risk is low. But when you are truly innovative in this space, risk is great and so you need that reward in front of you in order to take that level of risk.

But, in fact, if that reward is lower, than you should lower the risk. I think this is where FDA, for example, has played an important role or has provided expedited pathways as one way to try and lower risk.

There have been things like the Gains Act to help address our big issue of antimicrobial resistance where, in fact, the market does struggle to provide the kind of incentive for this.

Again, it sort of falls back on this idea of finding pathways, regulatory pathways, that are of lower risk level in order to justify your investment.

MR. SHAMBAUGH: So I just want to remind

people that the notecards should be coming around. I think they're coming up to me fairly soon. So if you've got questions, make sure to have written those out and I'll take a look at those any moment. I don't actually see anyone walking around right now, but I'm sure they have.

I'd like to broaden the conversation, this is really in some sense for any of you, as we think about not just specifically PhRMA or not just specifically energy but maybe within those context, this where your expertise is, are -- what do you see as some of the biggest barriers to innovation that you worry about?

When you look across the U.S. economy and it's something that we as economists talk about a lot, we see productivity growth as down. It makes one say is it that, as Greg said, I see innovation everywhere but in the productivity numbers.

Is there something they're worried about that we're not delivering this innovation into the economy, is it we're not coming up with the ideas, we're not getting them into the economy, where is it that you're worried you see barriers in either PhRMA

or in energy that's getting us this innovations that so important?

MR. UMSTATTD: I'll jump in. From the perspective of someone who's been engaged with lots of different R&D agencies through the many years and that is that the stovepipes of early stage and applied research and later prototype development demonstration, those can be prisons and valleys of death.

So anything we can do to smooth those transitions -- I talked a little earlier about it takes a whole group of stakeholders to move something from early stage all the way out to market.

One of the things that we found working in our early stage is that it's still important, as an experiment within our agency, to get these researchers to do some work outside of the lab to compliment the work inside the lab.

What I mean by that is when you're done with the project that we're helping you work on, you need to understand there's lots of different ways to maintain momentum of that new technology.

If you have success in the lab, you might be

interested in, say, licensing that technology, you might have an entrepreneurial graduate student who says I'm going to create a spinoff company and try to get private funds, you might have a well-established company or a strategic partner that actually wants to pull you in, or perhaps there's still more research and development that needs to be done and you need to look for a sponsor for that research and development.

But you need to understand what those pathways are and start investigating them while you're doing the work in the lab. We try to work with our teams to help them understand that they need to understand what's it going to take to get from technology to market. They need to have thought through who's their transition partner, what are the potential transition partners, how should they be treating intellectual property as a prelude to the follow-on conversation here today.

You need to understand how are you going to capture value and protect it as in your intellectual property strategy. You might even want some early thoughts on if this works in the lab, how am I going to manufacture it, how am I going to scale it up to

the point where I can actually make significant units.

If you've thought through those things, you're much more likely to attract the attention of those follow-on partners. Those are the stakeholders that might be willing to help carry you through the next phase after you're done with us.

MR. MOSCICKI: On the PhRMA side, I think there's still the great element of serendipity in science. Now, serendipity is often aided by funding. So the more that -- there is sometimes funding in the basic science.

I said in my opening comments, but, for example, I do believe the war on cancer provided the kind of breakthrough thinking that has led to many of the great advances in cancer in the last ten years. I think the same thing came out of the war on HIV in terms of antiviral technologies that could translate into things like the cure for Hep C.

So I do think that still basic science plays a very important role in innovation. It's not the be all and end all. I think the care and feeding of the ecosystem is important, and keeping the rewards open is important.

As I mentioned too, we can worry about the attack that's coming on that very short period and small part of the pharmaceutical market that bears innovation costs.

MR. ZIVIN: Just to follow on that point. I think all of us who work in the technology space and innovation space, I think we have a tendency to over-linearize the process. So we think there's the basic part, then there's this part, and there's that part and it's compartmentalized and it follows a very logical trajectory.

There is a lot of meandering in this process, just to fix ideas just think about -- so we have some work on the NIH funding process. Fifty percent of all products that can be tied to NIH funding directly or indirectly are in disease areas outside the initial disease area under investigation, and that's already in a pretty narrow space.

That tells you something about the lack of predictability of trajectory there. I think what it means to me as an economist is that there's just always unnecessarily going to be a part of the innovation process where the rents are no appropriable

by private actors, they're simply not.

We can call that basic science or we can call it something else, there is a role to be played by someone who is willing to bear that risk.

I think the risk point is an important one, because basic science is risky. It's the most risky think you can do, because it's a fishing expedition. So we need resilient institutions, governmental or otherwise, that can -- ex-post can fail and ex-post feel good about that failure, because that is a sign of appropriate risk -- it can be a sign of appropriate risk taking.

I fear we live in a political, and I don't mean just in a Washington, D.C., political, sociopolitical environment in which failure is really not -- while I live in California where everyone talks about fail fast and often, even in that culture that seems to be more of a mantra than a way of living.

We need to find a way to institutionally wrap our heads around appropriate risk taking if we're going to push the innovation frontier forward.

MR. MOSCICKI: I think, in fact, that led to the rise of the biotech industry in the PhRMA sector.

To a large degree for very large pharmaceutical companies, the enormous cost of taking a product forward into a very high risk area was daunting.

So there was an era of me toos that came out of that, because that was less risky. But as everyone decided, in fact, that's not where real value is generated. Real value is in true innovation.

The risk levels rose, but it was much easier for a small biotech company to fail than for Merck to fail. So that really took those companies, willingly accepted that kind of level of risk, and it almost was their raise on DETRA.

MR. SHAMBAUGH: So we've got some great questions here from the audience, so I'm going try to tick through a few of them. So one question here is: Aside from quickening the process, how do we encourage investments and technologies that have a serious lag between the initial funding and commercialization?

So this is something we can talk about a little bit here that very much fits in both industries where you've got this incredible lag sometimes.

One option is we'll try to get there faster, but what else can we do if we just accept, look, it's

going to take a while to know we have something whether it's because of safety or whether -- or whatever else to where we feel confident that we can commercialize it; what are the key steps we need to be thinking about to make sure these innovations actually happen and don't die in the valley -- I forget if it's the valley of death of ideas or something, I've forgotten?

MR. MOSCICKI: Well, I think it's this balance in the PhRMA side of identifying failure early. When you know you're really going to fail, you don't keep plugging away at it and wasting your resources.

But more importantly, it's really the staying power of the investment that can see it through to a longer period of time.

Often I think one of the big problems for the biotech industry is that it's funded through Venture Capital to a very large degree where the horizon on an investment is often short and (inaudible) in a period of two or three years when you got a product that's going to take ten years.

So I think it's having the kind of staying

power of sustained investment becomes really important.

MR. ZIVIN: A couple of thoughts on that from my perspective and that is to increase the confidence of these investors and carry them along with you, there's lots of things you can do.

One is we touched upon earlier, so I won't belabor that, and that is discrete points in time where you de-risked and you have a step change in your valuation, that encourages investors because once set of investors can get out and your next set can come in.

One other option again, energy technology, PhRMA, it's a long hard slog to get from early stage to a product. So if you can perhaps have side markets or side applications that might generate an early revenue stream, then perhaps you can have investors that will ride with you for a longer period of time.

As am example, let me give you a way far out there example. Let's say we had a working concept for a fusion energy reactor core today, it's still going to take a long time before you can build a power plant around that and sell electrons on the grid, but maybe

you can generate neutrons from that fusion source and those neutrons can be used for medical applications, for materials testing.

So there's a chance here that you might be working on an energy technology that's going to take a long time, but if you can have early applications that are consistent with the overall direction you're headed, then you could have an early revenue stream, settle the investors a little bit better so they're not so concerned about it taking longer to get there, and the last thing is just getting investors with a different mindset.

We tend to think of Venture Capitalists as this homogenous pile of dollars and mind frame and it's not. There are subsets of Venture out there that are mission investors, that are philanthropic, and they're in there for -- out of values as well as values.

So if they can see it as a success that they've created a change in the energy technology landscape even before they've got a revenue stream, then maybe they're okay with that.

So it's also about finding that right set of

investor values and principals consistent with the technology you're developing.

SPEAKER: I don't have much to add, but I would just say I think we actually have financial markets that work pretty well for long-term investing.

One of the things that's unique about the technology space is that we have this huge regulatory and policy uncertainty about when this thing is delivered 30 years from now, what the -- what's going to define the market for it.

So that is something we can very deliberately act on now by at least (inaudible) as a regulator and as a social and policy community making entities what it is we want that to look like and what it is -- the environment in which it's going to be -- what the demand side of that market is going to look like when and if the product is delivered.

MR. SHAMBAUGH: So I got a number of questions here actually that circle around some similar questions, primarily around the using the labs point.

So just for my words, so if we're going to try to use the national labs as contract research

organizations, some of the questions are for example so they pointing out that some of the labs have user facilities already and so to what extent are we just saying we want to do more of that or are there specific changes.

And others asking is it a question of changing the way they use the fees, because there's some -- nonprofits can use them in a non-fee capacity and for profits might in a different.

So how is it more specifically -- I know there's more in the proposal, but for the audience, how specifically are you thinking this could work?

Then I'd be interested in, Ryan and Richard, how they see the feasibility of using the labs in this way.

MR. ZIVIN: So I absolutely agree, there are interesting versions of this going on in a variety of the labs. I can't speak to all of them, but I can certainly speak to a few that I know reasonably well. I won't now in the interest of time.

I think the issue really is -- is two part -- is maybe three parts. So when using -- the contract research organizations provide physical

infrastructure, it may provide intellectual capital, and then there's a question of remuneration in some form or another.

In so far as providing human capital, that's basically government employees that are being taken away from presumably something else they would be doing.

So there needs to some model for how they're compensated for that and whether they're literally compensated for the hourly wage that they've provided or whether there's some model for co-invention and revenue sharing are open questions.

I think there are what I would call many experiments going on in a variety of labs, in a variety of capacities. I don't think we've coalesced around a vision for how these services should work at the labs.

I think we have a reasonable understanding of how it works when you want to use physical infrastructure. I think the model for how you use intellectual infrastructure is much cloudier.

I think at least the folks that I've talked to in the limited lab interaction I've had, there are

lots folks within the labs who have a lack of clarity in terms of what they can and cannot do in their job capacity.

So it may be that all of the infrastructure is there and all the possibilities are there and all we need is clarity, I suspect that's not probably quite the case.

I think the short answer is we need to be more systematic about it. I think in that process of being more systematic, we should certainly draw upon all the lessons we've learned from the individual experiences at the various labs who have been engaged in this to varying degrees.

MR. MOSCICKI: I think in the PhRMA space, contract research organizations are highly service oriented, so that's probably not exactly the equivalent of what you have in the national labs. They are built for purpose.

So they there to do what the people coming to them want them to do and they provide services now everywhere from very early toxicology, to medicinal chemistry, to formulation work. All of these kinds of early services are available as well as clinical

research support.

I think most pharmaceutical companies use them today for their Phase 1 human normal volunteer trials, because it's just too difficult for any one company to try to create the level of infrastructure for such normal volunteer studies.

So I guess developing the service-oriented component and -- again, if the rewards are high, then in our entrepreneurial world you would think that people would begin to form these kind of fit-for-purposes services for the energy industry that might really fill that niche in a way that that niche itches, I guess.

MR. UMSTATTD: I'll add to that as well. So while ARP AE isn't involved in oversight or management of our national laboratory system, we do interface with them quite regularly. They are a valuable partner, they're outstanding resource.

On a lot of the technologies that we fund, the vast majority of those teams include at least one representative from a national lab, so well spring of excellent technology and ideas and expertise.

They have of course played a role in

supporting research that's been started elsewhere. We have Cooperative Research and Development Agreements that industry can enter with the labs.

But I would caution that as we look for can the laboratories play a bigger and broader role in providing resources on a regular basis to industry.

We would just have to do that with some sort of awareness of -- if you're running a government owned or contractor operated facility, the more money that flows in from outside government sources, the less influence there really is for the government over what actually is being done in these labs, so kind of harkening back to the manpower. The people they'll answer to who's paying their paycheck versus who's actually in their management structure.

So we just have to do that judiciously and understanding where the government may be stepping back and away from trying to direct what's being done with the funds, because there's so much funds flowing from external to the labs.

MR. SHAMBAUGH: One of the other questions that came up a couple times here is thinking more broadly about the federal role on the just actual

straight-up funding side.

So we can talk about setting the rules of the road and all these other things, but then there's also just here's some cash to do R&D -- or not, (inaudible) but just doing it.

So how do we think about the decline in federal funding for R&D and how big a role it's had shaping these innovation pipelines?

MR. UMSTATTD: I'll say that I'm not going to advocate for more or less R&D funding, because what to me is really exciting about an organization working where I work now is our model.

I feel liken if other countries are going to start spending a greater share of their R&D in energy development and things like that, what if the U.S. can actually change the model for how we oversee and manage those R&D dollars.

What if there's something special about making the laboratory people that are typically Ph.D. scientists think a little bit outside of their lab and have to worry about, wait, who would actually buy this if this succeeds.

So I'm excited by the opportunity to work on

that model and see if we can actually generate better results that get to market faster because of the model of the funding agency, regardless of how many dollars are actually coming our way.

MR. ZIVIN: I would just say on the -- on the NIH biomedical side, which is the side I've done the most research on, our work suggests that the returns on investment from the NIH are net positive purely in commercializable product, if you trace them properly.

One thing that's interesting that comes out that work, not just our work, others have shown this as well, is as budgets contract, the things that get left off in terms of financing are the riskiest projects and that's very logical from an institutional perspective. But if what you think you're trying to buy with basic government financed R&D dollars is risky basic science, then the fact that you're moving -- as you slash budgets, you move to inherently more conservative research developments, that troubles me.

Because it suggests that the things we're dropping off on the margin are the things that are

most valuable to invest in as a public institution.

MR. MOSCICKI: From the PhRMA side, I guess I come back to still encouraging government funding of basic research, such as at the NIH.

I might take it a step further, funding translational research too. For a long time that sort of fell out of academic favor, but I think now specifically targeting bringing back and offering rewards for the development of transitional research is really a key bridge that needs to be developed to get from basic science, to get to real products for patients. So that's I think an important area for increased funding from the government.

I think the other side is to -- if the market situation doesn't itself provide adequate pull through, is the idea of creating other kind of incentive rewards or awards, so I don't think it would work in energy, but I don't know it well enough to say that such as exclusivity, whether it's data exclusivity or whether it's market exclusivity has played a very important role.

I think it's probably the biggest reason we have really 500 orphan drug today as with the Orphan

Drug Act and the kind of seven-year exclusivity that that provided, but there are other ways.

If you really want new antimicrobials but you're not willing necessarily to do something to create a market for those, and maybe you shouldn't, but what if you had a $500 million award for a new antimicrobial that you could put on the shelf and have in case you really needed it some day for that flesh-eating bacteria that is sweeping through the country.

MR. SHAMBAUGH: Well, on that last note of flesh-eating bacteria, I've been flashed the time is up sign. If I don't pay attention to it, it probably seems right that anyone would, so I guess I'll pay attention to it.

With that just thank Josh and his coauthors for a really interesting proposal and thank Ryan and Richard for their comments here as well.

We'll have a short break and then we'll resume with panel on patenting. Thank you.

(Recessed)

MR. LEE: Hi, everybody, I'm Tim Lee. I'm a Tech Policy reporter at Ars Technica, where I cover

patents, among other tech policy issues.

I'm delighted to moderate the panel on Melissa Wasserman's paper about decreasing the incentives for the patent office to grant invalid patents.

The patent issues that I write a lot about are often about patent controls and about the validity of software patents, and those issues I think can have a hot button flavor with a lot of people getting angry about things on one side or the other.

I really like this paper, because it has some more pragmatic procedural changes. It seems like there's some clear (inaudible) incentives within the patent system and patent office that could potentially be better aligned and allow I think what everybody wants, at least in theory, which is a high rate of granting valid patents and a lower rate of granting invalid patents.

So Melissa Wasserman is a law professor at the University of Texas, Austin, and she's done several papers with her coauthor Michael Frakes, and this latest one is a summary of her research in this area and she has three I think really interesting

proposals for getting the patent office and the people who -- giving the patent office both the time and incentives to really look at patents thoroughly and reject patents that are not valid, so go ahead and take it away.

MS. WASSERMAN: So what I'm presenting or summarizing today was coauthored with Michael Frakes who is a law professor at Duke University.

So the United States Patent & Trademark Office's primary task is to review inventions to determine whether they merit the grant of a patent.

The agency seeks to provide both timely and high quality review of patent applications; however, it's becoming increasingly difficult for the agency to accomplish this mission.

The patent office which processes over half a million applications each year routinely faces budgetary shortfalls, high examiner turnover, and a crushing backlog of patent applications.

So it's not too surprising given this environment that the agency at times will make a mistake and allow invalid patents to issue. So these are patents that fail to meet the legal patentability

standards.

So invalid patents unnecessarily reduce consumer welfare. They can stun productive research and discourage innovation. Despite the general agreement that the patent office is granting too many invalid patents, the policy discussion has really until recently not been informed by compelling empirical evidence regarding particular features at the agency that may, in fact, induce the agency toward granting patents.

So without sound guidance as to which features of the patent process may actually be leading to the granting of invalid patents, policymakers are less trying to fix the patent system without understanding the root causes of its disfunction, so we hope this is about ready to change.

Recent empirical (inaudible) a range of empirical techniques to show a causal connection between certain features of the agency and its granting practices.

Our proposal draws heavily upon these recent empirical analysis to recommend three changes designed to eliminate structural features of the patent system

that bias the agency towards granting patents of questionable validity.

So the first thing we propose is that the patent's office fee schedule should be restructured to minimize the risk that the agency's revenues will be insufficient to cover its operational costs and also to diminish the agency's financial incentives to grant patents when its revenues fall short.

So the overwhelming majority of the patent's office cost are attributed to reviewing and examining patent applications. To help cover these expenses, the agency charges the examination fees to applicants. However, these fees fail to cover half the cost incurred to the agency to review applications.

So the agency is heavily dependent upon two additional fees that it only receives if it grants patents to make up for this deficiency, and that's issuance fees which are paid at the time the patent is granted and renewal fees that are paid periodically over the lifetime of an issued patent so that it will remain enforceable.

So combined with the examination fees, this makes up the vast majority, over 85 percent, of the

agency's budget. So one immediate concern with this back-end fee structure is that it creates a risk that the agency's fee income will not cover its operational expenses.

So, for example, any unexpected dips in renewal fee income means the agency's going to be facing a budgetary shortfall. So an equally troubling problem, though, is that this back-end fee structure creates a strong incentive for the agency to grant patents.

This is particularly true when the agency is experiencing a budgetary shortfall, because in essence it can generate revenue by granting additional patents and collecting that issuance fee and renewal fees in the future.

Now, specifically what we propose is that the agency increase its examination fees to equal its examination costs, while abolishing issuance fees. So if examination fees are set to cover the costs, the financial risk facing the agency would be significantly reduced.

Because the empirical evidence suggests the agency only acts on this incentive to grant additional

patents to raise revenue when its financially constrained, we think the bias towards granting patents to generate more revenue will also be extinguished.

Our second proposal for the agency is to limit something called repeat applications. So unlike its foreign counterparts, the U.S. Patent & Trademark Office can never truly rid itself by rejecting an application.

Rejected applicants can always restart the process by choosing to start or file something called a repeat application. The consequences of this action can be overwhelming for the agency, which is stated that repeat filings have a crippling effect on their ability to examine applications. Over 40 percent of the agency's crushing backlog of applications constitute these repeat filings.

So the patent office does collect fees when repeat applications are filed, but, again, these fees are insufficient to cover the examination costs. So if the agency finds itself in a place where it under financial strain, repeat applications just can compound these financial lows.

So unfortunately one effective strategy with combating this backlog of applications would be to grant more patents even if they're invalid, because that's the only way that the agency can truly rid itself of the application for it to go away.

So our third proposal is to increase the amount of time allocated to patent examiners. So patent examiners now on average spend about 19 hours reviewing a patent application.

Because patent applications are presumed to meet the legal standards when they're filed if an examiner does not spell out or set out the reasons why you need to reject the application, she must grant it.

So if examiners are not given enough time to do a prior arts search, they may be in a position to allow patents they would have rejected if they had been given sufficient time to vet the application.

An empirical analysis demonstrates that an individual examiner's grant rate rises dramatically when they experience promotions that bring with them a reduction in the time to review applications.

So, for example, as an examiner moves up the general schedule scale, so they go from a GS-7 all the

way up to a GS-14, this progression is associated with about half of their examination time being cut in half and what we see is their grant rates increase by as much as 13 to 29 percent.

So this pattern suggests that time allocations are binding on examiners and be inducing them to allow patents of questionable validity and because this appears to be more binding for experienced examiners, we propose that their time allocations be particularly increased.

So I just want to close by saying the patent office has the legal authority to adopt many of our proposals, although some will require Congressional action.

I also want to say we acknowledge that many of the features of the patent office that we address involve a broader range of considerations beyond the patent office's incentive to grant patents.

So, for instance, the agency's optimal fee schedule need to take into account both the agency's incentives as well as applicant incentives. We attempt to sort of balance this complexity in our proposals as well.

MR. LEE: Thank you. So related to that kind of broader question, one of the big concerns I think a lot of people are going to have with a proposal like this is that the patent office currently offers a graduated fee schedule with large companies paying significantly higher fees than small companies and individuals.

I know you have some details in your paper about how to deal with that, but I wanted to turn to Lisa Cook who is a professor of economics and international relations at Michigan State.

I know this is something that kind of access to the patent office is something you've written about. I was looking through your research and you looked particularly at the relationship between the patent office and African-Americans going all the way back to the pre Civil War era.

I'm interested in your thoughts about how a proposal like this might affect the access of African-American individuals and individuals more generally who don't have a lot of money, who aren't part of the big company, their ability to apply for patents and obtain patents.

MS. COOK: So I think it's an interesting question. It's not something I've looked at closely, so most of the work that is solely on African-Americans has been historical.

Most of the work that I do now is with respect to African-Americans and women and the relationship between diverse teams and GDP.

So I think that it is critical that we make sure that there is access at the beginning, because as we know, patenting is a small slice of inventive activity.

The way we can take advantage of the literature that suggests that diverse teams are more productive. Just to give you one example of this is my coauthor and I, (inaudible) found that co-ed patent teams are more productive than single sex teams, either single sex male or single sex female.

So I think there's some room for greater efficiency at the beginning of the process to raise patent quality if you have more women participating, more underrepresented minorities participating.

There's several ways to possibly achieve that with respect to access, access at the beginning,

so figuring out as the learning analytics literature is trying to do at the University of Michigan and Michigan State, at the big ten universities, how women learn.

It may sound derogatory, but actually it is a thing. We find that different learning styles are more conducive to women learning STEM. There is one paper that shows that GDP per capita can be lifted by 2.7 percent if more women got more BAs in STEM degrees. What we show is that if more women and African-Americans participated, GDP could be as high as five percent higher.

So what we need to do is to figure out given these fairly significant increases we could have is figure out how to do this either with respect to policy or with respect to firms. Firms are the most prevalent place that engineers, inventors s show up.

So there are policy and practices that could be put in place to make sure that they don't leave, because this is something that is a common feature for women and for African-Americans is that they leave STEM fields, they leave STEM occupations.

If we want to get greater diversity, if

firms want to make money, if diverse teams are more productive, then we need to figure out how that can happen. Firms need to just say or stakeholders in firms need to say, we're profit maximizing; therefore, we should maximize diversity of these teams. With respect to the federal government, there are other things that can be done like enforcement of workplace environment policies and practices, but that's something that firms can do, that educational institutions can do as well.

But I think it all start at the very beginning, education and training, to provide access to people who would like to be inventors, who would like to be a part of the inventive process.

MR. LEE: Melissa Wasserman, can you -- let me ask you to go a little deeper in terms of this question of access to the patent office for people who don't have a lot of money.

I believe the current system, the small business, pay half the normal fee and then if you're a micro organization, it's a quarter of the regular fee, which is designed -- the proposal in this paper, would that preserve that kind of structure, fee structure?

MS. WASSERMAN: Yes, let me just say a couple things. So one of the things to keep in mind is that the U.S. Patent Office has higher fees than many of its foreign counterparts, including Europe and Japan, for example, if you're trying to get 20 patent claims through.

So one concern you could say with the proposal is that we are suggesting for small entities that that fee be brought up to cost. So one concern would be is that going to increase the access they have.

So there have been some studies that have looked at if you raise cost, what kind of -- what kind of associations you have with the decrease in filings. It's found to relatively an elastic and part of that may be related to fact that most of the costs associated with getting a patent application as related to attorney fees, not the fees associated with filing.

If we did see some decrease in filing, that might be good to the extent that these are the lower quality ones that they're sort of prescreening out to file.

But our proposal does suggest that these small entities could get sort of a rebate back. It would just come from the renewal fees that would be paid to the Patent & Trademark Office.

What it really does is shift the risk that if there's not enough fees to cover the costs instead of that falling on the PTO, which is how it does now, the rebate that small entities may get would be not 50 percent, might be 40 percent that year.

But even then if that's still concerning we think to sort of small businesses given how innovative they are, we think just increasing the examination fees for large entities would go a long way.

Eighty percent of the applications filed at the PTO are large entities, so that would help really bring financial stability to the agency and also substantially decrease any financial incentives they may have to grant patents when they're facing a budgetary shortfall.

MR. LEE: So let me ask Ed Black who is CEO of the CCIA, which is an industry group that represents computer and communication companies. It kind of goes to the real world (inaudible) here.

Obviously there's potential mission line incentives, there may be too many patents being granted. Do you see the effect on that on the companies you represent or the industry more broadly and what does that look like?

MR. BLACK: Well, certainly it's a massive impact. I mean, step back for a second. The patent system is designed to really promote progress science (inaudible) in essence to help society by letting information flow. Good ideas is being created and disseminated in the design that facilitate both the intake of the idea and the dissemination.

So we want to look -- we look at the patent system as to how well is it performing that basic function. When you have high-quality patents, the litigation rules, the examination rules, everything worked pretty well and it lines up with it being an asset to the process of innovation.

But once you start introducing substantial numbers of bad patents, so weak patents, however we want to describe them, the system malfunctions. It screws up the dynamics at every stage of the process.

So we're very, very concerned about trying

to -- at the front end, trying to prevent bad patents. If the system then nevertheless produces them, to have a system at the end which is another double check, a second look.

The dollars involved are massive. I don't think anybody will not have maybe heard about some of the lawsuits between some of the bigger companies, we're talking frankly just in terms of what's on the table in terms of lawsuit has made $30 billion. But you add in legal fees, you add in the cost of the companies in a variety of ways, about 20 years ago one of my eye opening -- I went to Silicone Valley and I visited some companies about a whole range of issues.

A company, which I think I remember was xx Intell, one of their deputy general counsels took me up to take a look at his operation and he introduced me to people around the room -- lawyer, engineer, lawyer, engineer.

The engineers were people who were taken off of important research projects to support the legal team in dealing with both applying patents and scoping out what was the patent liability issue that they would face, and it was -- even way back then, it was a

tremendous cost.

Now, a big company, it can be a big cost, they have a huge amount of risk. But for smaller companies, that can be crushing.

There's a huge cloud that hangs over a lot of startup potential and Venture Capital people that if a bigger company is going to an area and that will -- that we know there are a lot of patents out that could infringe -- that you could be infringing on if you enter this area of manufacture, it's like we don't want the risk. It's just not worth the hassle.

We've seen too many examples of companies that were in fact fairly innovative in dynamic, some legacy status players were threatened by it and they sometimes went out of business, sometimes they shriveled up, but they definitely lost the edge that they had.

One that made -- hit the press back a number of years ago was Vonage. Vonage basically the VOIP, early leader in it, legacy phone companies basically -- they all joined up and went after Vonage on patent basis. Regardless of that (inaudible), I think those cases (inaudible) were maybe not.

Well, but even regardless, it was good example of what happens when deep-pocketed players or just people with good lawyers want to target somebody who does have either a deep pocket themselves or has a competitive product which could jeopardize and destabilize a status quo marketplace.

So the impact on the companies that financially is immediate and a risk of liability, the impact on terms of their R&D, and currently their decisions, strategic decisions, of what markets and new products to develop, those are all costs that are very substantial.

I think many companies woke up to the fact when they started seeing verdicts that were a billion dollars or lawsuits for a couple billion dollars that it could -- what that could do to them, they realized that there was a risk level.

One other element I would simply point out is that a lot of the suits who were in technology companies. But when you really have a broad patent, a patent which doesn't have good boundaries, you could use it against a mom and pop barbershop who sends out -- uses internet process that somebody claimed a

patent for to notify customers.

The retail industry got into this a number of years ago that they were being hit and restaurant industry, because they were getting hit by patent lawsuits for doing common sense everyday things which had somehow manged to get a patent and were basically being extorted.

Now, that became known as the patent troll problem for both tech industry as well as the non-tech.

We also have the bullying -- I kind of related to it, the bullying patent where there may not be companies that are -- their companies that basically don't make anything and they just license products and then you've got ones who frankly -- the really bad category I think is go after the restaurants with defenseless people who have nothing to fight back with, any resources.

So while I focused mainly on the tech industry and its harmfulness to innovation, the truth is it is a significant problem overall. And if you can deal with patent quality, you have dealt with not all of the problem but a lot of it. Front end and

back end, both important.

MR. LEE: So we have a question from the audience about the evidence. For this theory that U.S. PTO becomes more generous, if they have revenue problems, I believe the Hamilton Project did ask the patent office to send a representative and they were not able to do so.

If we talk to them, they would not say that, yes, we are deliberately lowering patent quality to increase revenues.

I'm wondering if you could talk a little bit about what's the kind of evidence that that is in fact happening, and if they're not doing that deliberately what kind of process -- what's your kind of model for how this -- how a revenue share (inaudible) leads in a practical way to lower patent standards?

MS. WASSERMAN: So that was based on we had -- what we looked at was an empirical study that looked at changes and sort of the agency's financial needs.

So we know how many applications are being filed, we know what their budgetary stream is, and we would know how much money they need in order to

process all the applications that they are -- that are coming in, so we were able to sort of construct an index of the agency's financial health over time.

What we looked at was the agency would have -- we hypothesized that when they're financially constrained, they'll have an incentive to grant additional patents in order to generate more revenue, but it's not uniform across all patents.

So, for example, there are -- you are charged the same amount of renewal fees, regardless of what technology you're in, but some technologies renew at a much higher rate than others.

So we thought the agency would likely target those sort of groups of technologies that have the higher renewal rate, because they're more likely to get additional funds. We also thought that there's a difference, we just said, between large and small entities.

So when they're financially constrained, will they target those technologies that are targeted by larger entities because they're also likely to get more revenue for that additional patent grant.

So we use this as sort of quasi natural

experiment where we insert this treatment and control group and what we saw was during these times of financial strain, they were differentially granting higher for these treatment relative to the control.

Now, a big question we have there is what's the mechanism. If the agency -- for us talking to the agency, they definitely know, for example, they have to be at a certain grant rate to be in the block. They just know that on average typically they need to be at this certain grant rate or they're not going to be taking enough money in.

Now, what we would need for our theory is a much more differentiated or more targeted sort of granting process. You can imagine at least two different mechanisms, one would be sort of a top down where the director is actually applying sort of incentive to grant more in certain areas than others.

A second could be more driven by examiners, and we thought we might see it more with senior examiners who have been along for a while and may sort of internalize what a budgetary shortfall would mean for them. Overtime would be cut, they wouldn't be hiring as much, something along those lines.

We did try to do a little bit in some other papers to sort of get on -- to get to see if we saw this sort of mechanism. We looked at arguments that had more senior examiners in them to see if they had a stronger effect, and we saw some of that. Which suggests that it might be examiner driven, although, they're not mutually exclusive.

MR. LEE: So here's a question that I think either Melissa Wasserman or Lisa Cook might have thoughts on.

How many collecting demographic on patent filers at the NPTO affect the granting process, what if that data was stored separately for applications so examiners couldn't discriminate?

Do either of you have thoughts on that?

MS. COOK: I've thought about it a little bit. I think that it's a good idea and a bad idea. So it caused me a lot of heart ache when I was trying to put these data together ten years ago when there was a Google patent that I had to match -- I had to figure out who the African-Americans were in the data set and it was not -- it wasn't easy at all.

The good thing was they couldn't necessarily

be discriminated against. What I found was that saying in the 1920s when segregation was -- when Jim Crow laws were taken off, African-Americans hid behind these patents. So they were able to keep inventing, because nobody knew their race.

So this was a protective mechanism at some time, but I would say that we have some good techniques to try to identify people these days, so I'm not sure that we need to collect them. The probabilities are going to be small with respect to identifying people.

So I'm not sure that we really need to do that these days, but other people might have other ideas. We have the ability to identify people using other means, so I'm not sure it's so necessary for the U.S. PTO to collect those data directly.

MR. LEE: Do you know if there's data currently about -- is there evidence of differential grant rates based on race or gender?

MS.COOK: No, not that I know of. I wasn't able to detect that in the data, the patent application times, patent grant times were roughly the same for the historical data series that I had, so I

couldn't find it.

Early in history, yes. But I think that that stopped with them adhering to -- and when I say early, like the 1820s. So I think that that practice stopped, but they can look at your address.

There are other ways to get at who people are by looking at an address, especially if it's an individual inventor who is not patenting with a firm, because then the address becomes ambiguous, whether it's that person's residential address, and can you use residential discrimination or residential segregation to figure out who's where.

MR. LEE: For people who don't know the patent process very well, in most cases the examiner never meets the applicant, it's all paper kind of process?

MS.COOK: Right.

MR. LEE: I got a couple questions about the small entity question and about whether if the -- if raising the fees would help lower the invalidity rate, is one factor there that -- is there a differential -- do small organizations tend to apply for more invalid patents?

MS. WASSERMAN: Well, I think that overall the grant rate for small entities is lower than the grant rate for large entities. The thought process is not -- I don't think anyone suggests the agency is biased against small entities, it's more of probably early screening effect.

For a patent to get from a large entity, you're going to have patent counsel screening and doing a better (inaudible) screening process. The other issue also could be small entities may not have access to as effective counsel as well.

I know the patent office has some programs to help small entities get patents. This is something that they're very aware of and there are some avenues that you can utilize that large entities don't have available to them.

MS.COOK: In fact, the U.S. PTO has had me at two of these forums in Dallas and in Pittsburgh and they invite small entrepreneurs to these forums to help them apply and to get access and to figure out where there may be access issues to -- so they're gathering information and they're giving information.

MS. WASSERMAN: Yeah, and I would also say

kudos to the PTO with respect to data more recently. They've made big efforts to put out a lot of patent data and a lot more information has come out in the last five years that have allowed a lot of more -- it's sort of like booming now, I feel like, this research in this particular area and that's been fantastic to see.

MR. LEE: So, Ed Black, you were talking about the kind of burden of invalid patents on innovators who are not the patent holder.

Do you have any thoughts from talking to people in industry and inventors how significant the increase would be as a practical matter? Do you think a lot of companies would be dissuaded from filing valid patents as a result of the kind of reform that she's talking about?

MR. BLACK: Well, I don't know how much empirical research has been done, but there have been some folks who have gone out and done some interviews in the Venture Capital world.

I believe I saw a number that said a very high, like eight out of ten Venture Capitalists pretty much said they had encountered situations where in

fact they didn't want to invest because the risk was substantially high, that they would have problems, and that they backed away.

Overall it's difficult to know when you're doing the Venture Capital world, you will also have the question of how much legal counsel does either party have early in the process.

In other words, if it's more (inaudible) have they already looked at the issue or did Venture Capital (inaudible) they have a legal team that early looked at that or is that at a later stage would they get more deeply involved as things evolve.

I suppose the liability issue as a deterrent is one that I think is one of the more significant and dangerous things for a society that wants to innovative.

It's hard to evaluate a dollar impact in any short-term way, but the societal implications I think are great.

MR. LEE: What about the cost of obtaining patents, I assume many of the companies are also on that side of it.

Is there a point at which fees will become

too high and you would have a lot of legitimate patents that aren't getting granted because companies are not willing to pay those fees on the front end or -- and the levels we're talking about are still nonsignificant?

MR. BLACK: I'm not sure I think that's a huge high risk. The truth is patents are generally -- if a good patent system is good for society, I think we'll find a way to deal with that.

What the study shows is time compensation or funding for the entity to the numbers is dangerous. So whether you -- what you do in terms of fees high and low is significant and one of the remedies is obviously raise fees, but that is to break the tie with funding extra patents.

There may be other ways we provide funding. I don't want to get into detail funding over the years, there's been fights in different ways.

I think the risk of good patents -- the big cost is not the fee. It is the lawyers, it is the background, it is getting ready to do the patent. Those are relatively static costs that are not going to be affected by this.

MS. WASSERMAN: Just to clarify too, just to give you some numbers. It's about 1,600 for examination and search fees that they -- the U.S. PTO for a large entity, it's about 5,000 for Europe for the same number of claims.

Even though we're suggesting doubling the examination search fees, we are also suggesting eliminating the issuance fee, which is I think about 1,100 right now.

What we're trying to do is spread some of that cost more up front, but you could structure in such a way that the overall fee is sort of associated with applications would remain relatively the same, we're just shifting more of it up front to help decrease the financial incentives possibly to grant patents.

MR. LEE: I wonder if you could go a little deeper on the question of examiner time. I think this was the piece of -- the paper I was most -- I thought was the newest to me, like I heard the other two arguments and they kind of made sense, but this was something I hadn't really heard about.

Talk to me about what it's like to be a

patent examiner then what you see over the career cycle. It's interesting they kind of get more stringent and then they get a promotion and suddenly get less stringent. Tell me about the findings you found there.

MS. WASSERMAN: Yes. So we said examiners on average get 19 hours. This is to read the application, to write their office action, which is outlining the reasons why it should be rejected, to respond to what the lawyer argues for why it should be accepted, to do their final office action, and sometimes it also involves like a telephone interview, so it's not a lot of time that -- what they spend.

What happens, and it makes sense, as examiners get promoted up the GS scale, they probably get better at doing their job and they can do it with less time, that I think generally makes sense.

Our concern is that that scale of which their time gets cut as they get promoted may be too aggressive. There may be some amount of time that an examiner needs to do a good prior arts search and that they're just scaling it too aggressively. So that when you get hired as a GS-7, you have twice as much

time as by the time you get to be a GS-14. Our data sort of demonstrates and shows some evidence that that is in fact what may be occurring.

So once thing that we could think about with the time allocations -- so what happens is if you pull a GS-13 examiner, you're going to have a higher likelihood to get your patent granted, because they have much higher grant rates than a GS-7, a lower examiner.

So there's these inadequacies about this concern that whether a patent gets granted or not may involve on the happenstance of what random examiner gets assigned to your application.

Because generally, the application comes in, gets assigned to an art unit, and then it's randomly assigned to an examiner within that.

So you can imagine sort of rethinking the time allocations to make that more equitable, so they can shift the time allocation so that your grant rate stays relatively stable as you get promoted.

But I do also want to be clear that we're sympathetic with the PTO that obviously there's a tradeoff between throughput, the number of

applications the office can process, and the time that they give each examiner to review.

It's natural. The backlog is a very easy to identify, easy to see number that they're constantly combating with, and patent quality is something much amorphous and much more difficult to measure.

We think there's some reasons to believe that the agency may be emphasizing too much backlog throughput at the expense of quality. So we're sort of pushing the agency to reconsider that.

It's our understanding the agency's been very receptive to that in our sort of end talks about possibly changing some of the time allocations.

MR. LEE: So let me ask you to think bigger here, so you've been pretty careful here to kind of stick to what the evidence shows.

It obviously makes no sense to have the kind of grant rate depend on the seniority of the examiner on the way here.

One possible interpretation of this would be actually the correct number of hours is not within that margin. It may be if we had two or three or five or ten times as many hours per examiner, obviously

that would cost more, but maybe the kind of optimal patent policy would actually involve a lot more examination.

What's your thoughts on that. Do you think this is evidence that actually we should be giving a lot more time?

MS. WASSERMAN: I think one thing that complicates matters obviously -- it's not just the PTO, you also have the courts involved.

At some point if we think there are very few patents that have economic significance after so much time, we would want to limit how much we do up front and we would just rely on the courts to take out invalid patents.

This is also somewhat complicated by something called PTAB, which is this new adjudicatory body at the Patent & Trademark Office that can also review grants and validate them.

So we did a little work on this as well where we looked at just litigation costs associated with invalid patents and that if we increased the time allocations and we calculated how many fewer invalid patents would be issued and hence litigated, and our

results suggested that we have quite a bit of wiggle room to put some more money up front, that it's not superefficient to be relying on the courts to the extent we are right now, because litigation costs are so expensive.

But the hard part is -- obviously is we don't know what the magic number should be. We just think that we could put more up front than we are right now.

MR. LEE: One other thing that comes to mind here is that the courts have a presumption that once the patent is approved that the examiner did his due diligence and, therefore, the Court should defer to that to a certain point.

Do you think this has any bearing on the presumption -- the presumption would be a little bit weaker if we had evidence that had the examiner spent more time, they actually would have found prior art or other issues?

MS. WASSERMAN: It's interesting, because there was a Supreme Court case on this about prior art that was brought before if the examiner hadn't reviewed it should there still be a presumption of

validity and the Supreme Court said yes. So that's kind of past or we'd have to have some sort of legislative override on that.

We've had this sort of presumption of validity for a very long time. PTAB, for example, which is the adjudicatory body at the agency doesn't have that and patents are being invalidated arguably at a higher rate there for multitude of reasons.

So I think it would make sense to possibly eliminate that for prior art that the examiner didn't consider, but I feel like I lost that. The Supreme Court has already spoken.

MR. BLACK: In terms of the cost, I think you made reference to it again. The impact on industry of bad patents is a massive number. The cost of operating the PTO in an efficient way with extra resources is so de minimus compared to that number, and that's (inaudible).

I'm not sure I should say this, but one really bat patent can cause more damage than a hundred good ones can cause benefit. So if the system is screwed up, it really can cause tremendous damage.

Every little piece, every tool we can use to

try to make it work better to produce high quality patents only is well worth the effort.

MR. LEE: I'm wondering, one of the last thing in here, it says, presumption of the patent needs to be self-funding, maybe that's wrong.

If there is large externalities, maybe -- obviously (inaudible) it's easy to throw money around.

Theoretically, you can imagine Congress saying we want twice as much money going to examination and we're just going to write a check, because of the gains from having few or bad patents are so high?

MS. WASSERMAN: Did you want to comment before --

MS. COOK: I just wanted to ask, so examiners are not penalized for having invalidated patents, this doesn't go in their record.

MS. WASSERMAN: Right.

MS.COOK: So that's an incentive that could change?

MS. WASSERMAN: Yes, that's an incentive that could change. There's actually very few applications of examiners that are pulled every year

to do a quality check, because it's so expensive to review them.

Where production, how many they get processed, is very -- every single one of those is counted towards their performance review.

So there are ways you could imagine to bring in this -- now, to be fair to examiners, obviously sometimes it's invalidated not for their fault. The law changes, it's impossible. They're not given enough time. They may not be table to find the prior art that defendants could along those lines.

I'm sorry, I forgot what your --

MR. LEE: I was just asking whether --

MS. WASSERMAN: Whether they should be user fee funded. So historically the agency wasn't user fee funned, it was funded off of tax revenue and then it changed to user fee funding.

I would be very surprised if it changed back as this is sort of not on the budget when it comes in through user fees.

But it is -- you raise a great point, because in many ways the fee structure that might optimize patent applicant incentives is diverging from

one that optimizes agency incentives.

To the extent we cannot manage both of those, we might want to do some decoupling of having just pure user fee funded structure.

So one of the ways we try and get at that is we want to keep renewal fees, because they perform this valuable function of effectively shortening the lifetime of the patent. If you don't pay them, they get sucked into the public domain.

But maybe the PTO doesn't automatically get to keep all of those. That gets earmarked into another fund or it's rebated back to small entity.

But I think you hit a great point about the user fee, I'm just not super optimistic in this political environment...

MR. BLACK: I remember a period when, in fact, a lot of people in the industry pushed to get out of the government appropriation funding because it so underfunded they wanted more examiners.

Their feeling was (inaudible), but I'm not sure whether maybe it wasn't -- it shouldn't have been a better recognition of the danger of linking it to, therefore, quantity and issuance.

More than I think we have now, there has been over the years a philosophy that patent equals innovation, and the quantity is more important than quality. Those two premises are tremendously damaging when put together.

MR. LEE: I think that's all the time we have, so thank you all for coming.

MS. WASSERMAN: Thank you.

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