

Session 5

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Patrick Nolan: And I'll invite Eric Bartelsman and Peter Crabtree to the stage. I'll just quickly see what's been happening on Twitter. Lots of good positive feedback on both Simon and Bronwyn's presentation. I have to say the tweeting activity's dropped off a bit now. People seem to have been happy about the lunch, there's no more complaints about the food, that's quite good, so thank you.

Eric, I'll just quickly introduce you. I'm very pleased now to be able to introduce Professor Eric Bartelsman and Dr Peter Crabtree for our final session. Professor Eric Bartelsman is Professor of Economics at Vrije Universiteit Amsterdam. He has a BSc in Economics from MIT and received his PhD from Columbia University. He served as an economist at the Federal Reserve Board in Washington DC, as an advisor to the CPB Netherlands [Bureau for Economic Policy Analysis], and as Head of the Economic Research Department at the Ministry of Economic Affairs in the Netherlands.

And Peter Crabtree is the General Manager at Science, Innovation and International at the Ministry of Business, Innovation & Employment and he currently has responsibility for enterprise policy, science and innovation policy, international science partnerships, trade and regulatory cooperation and international strategy. So Eric, thank you.



Keynote address:

Professor Eric Bartelsman, Vrije Universiteit Amsterdam

Eric Bartelsman: Well, thank you very much for inviting me, Paul Conway and the Productivity Hub, etc. It's a pleasure to be here. There's pros and cons of being the last session of the day. The benefit, of course, is that much about what this whole day is about, productivity, has already been said. We've had this morning stories on BERD, we've had stories on innovation, how to measure things, how to find the effects on why we're doing this – Adam Jaffe's talk. So that's the benefit to me, I don't need to explain all of that. The danger is that there's very little else, I'm afraid to say, so I hope there's some new things I can bring to the table. There may be; there may not be.

I'm not going to go into the technical details of my own research. After my policy period, the last 15 years I've been doing academic research and teaching, as a macroeconomist, oddly enough, but working with firm-level data, trying to understand how the dynamics of firms' entry and exit, doing innovation, how that adds up to productivity, with as a final goal to try to find out how can a society improve their wellbeing through productivity growth. And so given that that's what I'm doing, I'm not going to talk too much today about my actual research. I'm going to give a few highlights about the talk, but mostly I'm going to look

forward. I'm going to try to look 30 years ahead, see what's going to happen to us in society and maybe think about what can New Zealand do to be part of that.

The preliminaries that I took away from reading the materials for this conference are indeed that the GDP per capita here is similar to Spain, Italy, slightly behind South Korea, Japan and the UK. The framework conditions, the thing that our first speaker from the Treasury, Gabs, was talking about are really excellent in New Zealand. All the policies seem in place for doing the things that economists think should be good for productivity growth and for investing in R&D, innovation, adoption of ICTs and new technologies and going out and trying to collect the rents or the use value of all these new things that you can bring to the market.

However, that's not been happening here. R&D investment seems to be lagging. ICT spending, I don't think I have good data on. I haven't seen much yet, but the innovation certainly isn't as strong as you'd hope it would be, and productivity has not been catching up, possibly even diverging.

... how can you harness the potential of... ICT-led innovation; because I think right now and probably for the last 20 years, but for the next 20 to 30 to come, a lot of the innovation is coming through digitisation.

So the question is, how can you harness the potential of what I call ICT-led innovation; because I think right now and probably for the last 20 years, but for the next 20 to 30 to come, a lot of the innovation is coming through digitisation.

I'm pretty optimistic about that. I'm going to go over the technological prospects and try to understand what's happening. Then I'm going to talk a little bit about economic models. How to think about growth with knowledge-based capital, and I'm going to use



interchangeably the word “knowledge-based capital” or intangible capital. I think they’re two words for the same thing. I’m going to look at some evidence from the EU from research I’ve been working on in rather large teams of collaborators. And then I’m going to have two or three speculative slides, how to connect this with New Zealand policy.

On the prospects, two, three years ago Robert Gordon had a pretty provocative article saying that productivity growth was just going to slow down to a half percent a year. And that means doubling of welfare, of the wellbeing of people. It’s going to take another 100 years to double that, and he sets up a thought experiment and looks at three industrial revolutions, steam, railroad, internal combustion electricity and now the ICT and he says “well this latter revolution really wasn’t that impressive anyway and what impression there was from it, we’ve already seen it, so there’s not much more to come”.

...this technology says look, this really is out there and it’s very possible to have a doubling in wellbeing in 30 years.

Contrasting this is the work by Brynjolfsson and McAfee, the Race Against the Machine in the new industrial age, and related work of various academics looking at technologies. I’ve done some of this myself, some back-of-the-envelopes, where it’s pretty easy using technologies that already exist or are very close to being market-ready, and by very close, I mean somewhere in the next 5 to 10 years. It’s very easy to see a 2.5% per year productivity growth, or a doubling in wellbeing in 30 years. The next generation – we hear lots of negative stuff in the paper about our kids are having trouble and they’re not having the expectations of the future that we had when we were growing up; this technology says look, this really is out there and it’s very possible to have a doubling in wellbeing in 30 years.

...Osborne and Frey from Oxford did some back-of-the-envelopes based upon 800 occupations in standard classifications of occupations... and they tried to understand how many hours worked in each of these occupations can be substituted away by these four technologies in the next 30 years. And it seems that you can cut half of your workforce and then I can see the policymakers – “oh no, cut half of the workforce”.

And just taking four technologies: autonomous transport or the Google Car, universal programmable robots, data-driven expert systems and call it Internet of Things – just these four technologies can easily get to a doubling. So you could do a back-of-the-envelope, and Osborne and Frey from Oxford did some back-of-the-envelopes based upon 800 occupations in standard classifications of occupations that statisticians use, and they went through and they tried to understand how many hours worked in each of these occupations can be substituted away by these four technologies in the next 30 years. And it seems that you can cut half of your workforce and then I can see the policymakers – “oh no, cut half of the workforce”.

I actually discussed this with a journalist and the headlines in the big Dutch newspaper said “Economists predict half the jobs gone in 30 years”.

I actually discussed this with a journalist and the headlines in the big Dutch newspaper said “Economists predict half the jobs gone in 30 years”. My phone didn’t stop ringing for quite a while. And then you have to explain well, but new things will happen, and then they’re like well how do they happen, and I’m well, that’s economics. We do things, we do things for each other. I scratch my back, you scratch yours, and vice versa – it depends where you’re from. We do things for each other and we keep that circle flowing and it really doesn’t matter – what we do changes.

...given these technologies are on the way, how do you get your society ready for this?

In the meantime, what we spend on food and clothing and warmth is really a reduced fraction of our GDP right now, and likely it’s going to get even smaller. But this is still going to have major implications for the labour market and a lot of questions like, how do we get there? Sure, there’s technologies there but we need to use it. We need to experiment with it. We need to adopt it. We need to have it come in society. The returns for this, who’s going to get the benefits of these technologies? They may be widespread. There may be some places where they’re going to have a quadrupling of income, and other places are going to get nothing. So how do you make use, given these technologies are on the way, how do you get your society ready for this?

So here’s some pictures, the Google Car. I think they’re eating McDonald’s in the car. This was a fun one, a company called Kuka set up an internet thing that kind of went viral with Timo Boll from Germany, a world-ranked table tennis player, played against the machine. Oddly enough, the machine lost but the first three points went to the machine and then the caption at the end said, “we might not be the best table tennis player but we’re the best robots.”

Brain science. And here the Internet of Things. I actually got this from a New Zealand magazine and it’s an irrigation system connected to the web, can be driven from a distance. It has devices that can go into the ground and measure the moisture and measure the air temperature and download weather data, etc. These things, a new crop of applications, lots of potential things can happen with these technologies.

If you start thinking about just these four technologies and go through a list of stuff that we make and do for each other, you’re going to start thinking, how could we use this, how could we do this for sustainable land use, new materials, people doing stuff in healthcare. I liked Beth’s – her first slide had a chemist with a mask on and an Erlenmeyer beaker and a test tube. When you talk to chemists nowadays, most of the stuff is done on computers and are simulated. A lot of the new materials and the new things they’re discovering are done in simulation – and this is true in many, many areas of innovation. In our own work we model and we simulate. So you look at these lists and you’re like, well I can see potential ways that in 30 years, if we use these technologies well, we can do a lot for each other and make wellbeing high. So where’s the catch?

How do you free up the resources to start applying and using and playing around with these technologies to actually adopt them in a way that's going to deliver the goods? How are you going to mitigate some of the problems related to income distributions, labour markets, participation, etc.

Well, the catch is that it's not going to come automatically. We need to set up our economies, free up resources today, even though budgets are tight and everyone's worried about the next quarter's numbers. How do you free up the resources to start applying and using and playing around with these technologies to actually adopt them in a way that's going to deliver the goods? How are you going to mitigate some of the problems related to income distributions, labour markets, participation, etc.

So the key of these technologies are that they're intangible. You've heard many different ways of thinking about intangibles. The Productivity Commission has a really cogent piece on various characteristics and which types of intangibles have which characteristics, for example, are they saleable on the market, can you appropriate the benefits. I'm just going to take one key characteristic which is that it's non-rival in production. If I have a hammer that's rival in production. If I'm using it, he can't use the hammer. Intangible assets means we can both use it at the same time. How that's dealt with in terms of spill-overs and appropriability and is it in the head of the worker or is it in some object that both of us can use, that's all separate issues.

But the important part for thinking about the economics going forward – all these other things are important too – but for now, this intangibility says there's a benefit to scale. Because once I have this idea or once I have this new intangible hammer, the return to that hammer to the investments needed to make that hammer go up by the number of people that are actually using it. So scale is incredibly important. Firms invest in these intangibles and they get uncertain outcomes. We've heard that before, too. You just don't know what's going to happen when you start playing around with these new technologies. It may backfire. It may actually work, but the market won't like it. No-one's going to want to buy this stuff because it's just not exactly the way they were thinking that this should work.

So these uncertain outcomes mean that you're very uncertain about the return to your investment and because the things that you're making are non-rival and there are benefits to scale, you often get "winner takes all". One of the versions that got developed gets sold or bought by everybody and so some firms are going to make a lot of profits and other firms are going to find that they failed in capturing the market share, either because the technology draw they got wasn't good or because it might have been good, but the customers didn't like the stuff. It was just not exactly what they were looking for.

Traditional capital and labour are actually going to have a lower share of the total income and some of this income is going to come in the form of rents.

The next thing of this type of model, we were very used to in the last 50 or 100 years. For those of you who were economists, there were the counter facts about distributions of incomes going to capital and labour and Bob Solow who started using the production function that was

called the Cobb-Douglas where these shares depended on the technology and it wasn't because of fighting between labour unions and firms. It was just a matter of the technology. Well that technology is changing. Traditional capital and labour are actually going to have a lower share of the total income and some of this income is going to come in the form of rents.

...the optimal size of a firm is going to depend on its outcome from its investment in the intangible, which may be good and may be bad.

What this also means is the optimal size of a firm is going to depend on its outcome from its investment in the intangible, which may be good and may be bad. If you get a really good one, you can grow your firm much larger than if you get a bad one. If you look in the mobile phone market, market shares are skewed and profits are even more skewed. Someone who got the intangible just right can sell a lot more and make a lot more profit. The share for the traditional workers, well, those are commodities. If you don't have the knowledge associated with your labour or the knowledge associated with your capital goods, you're going to just get a market return. And in a global world that's a race to the bottom. You might be able to eat, but it's not going to be exactly what you want.

...if resources in the economy move to firms with the good productivity draws, aggregate productivity will be higher than if it happens the other way around.

The next thing that happens with an economy driven by this type of technology is that aggregate productivity, which is the thing that the Minister of Finance and the Minister of Business, Innovation & Employment will think about, aggregate productivity depends on the distribution of those productivity draws across firms, but also on the distribution of global market shares by those firms, by the scale of each firm. And that means that if the firms that get the good draws also get the high market share, your productivity is going to be higher than if market shares are even or if all the draws are even. So this is where the story of reallocation comes in. If you can move resources – I shouldn't say you can move – if resources in the economy move to firms with the good productivity draws, aggregate productivity will be higher than if it happens the other way around.

...even if innovation investments by firms on average have a zero mean outcome, the economy can still have a positive outcome

The next paradox here is that even if, on average, these productivity draws have an effect of zero, so even if innovation investments by firms on average have a zero mean outcome, the economy can still have a positive outcome, namely, if those that get a good draw get more resources and those that get a bad draw can shrink. So if your firm-level regression shows that your innovation isn't doing anything, on average, once you start weighting them up you may actually get a positive impact. And that comes through this, this reallocation process in the economy.

Investment in regular capital may appear sluggish. Your normal investment in housing, in buildings, in automobiles, in machines, in refineries may be sluggish for some time to come. Why? Because a lot of these intangibles we often think of them as labour saving, but a lot can be capital saving.

So what is this type of model that you have, this fixed investment, these decreasing returns to traditional capital and labour, these uncertain outcomes and this scale effect? Well, the income going to traditional factors is going to decrease. We're going to see labour share of income actually dropping. Investment in regular capital may appear sluggish. Your normal investment in housing, in buildings, in automobiles, in machines, in refineries may be sluggish for some time to come. Why? Because a lot of these intangibles we often think of them as labour saving, but a lot can be capital saving.

Once we get a self-driving car that you can control through your cellphone, we can probably get the utilisation rate of cars to 60%, which means that the installed base of capital in automobiles can drop a lot.

Our utilisation rate right now of automobiles is 5%, a back-of-the-envelope of how many miles are driven per year – you can get that from the statistical agency; how many cars there are and what the average speed is of a car. You can calculate that as somewhere between 4% and 8% utilisation of automobiles. Once we get a self-driving car that you can control through your cellphone, we can probably get the utilisation rate of cars to 60%, which means that the installed base of capital in automobiles can drop a lot. And that means for the next 30 years while this is happening that the investments in traditional capital is going to be sluggish. Office spaces, as you get mobile office workers who are paperless and can move because the computer follows them around the office, you need less square metres of office space per person. With Airbnb and sharing economy, resources get used at higher utilisation rates. This is going to look terrible to a policy maker, because it's going to look like GDP's not growing because the investment is sluggish. But it's part of the transition.

The next one is that the returns are just becoming increasingly skewed. You just hope that you have your fair share of the ones with this high return near you to all benefit from it. But if they're somewhere else in the world and you're not getting it, your return to traditional capital labour is going to be dropping and if you don't get any of those rents from having the successful innovators, it's going to be not as nice.

How about start-ups? How about this entry and exit process. Bronwyn mentioned before, I've, I've worked on and other people have worked on what does this entry and exit process contribute to productivity? And it turns out, a lot. You hope that not very productive firms fail. New firms, when they come in, you hope that within a short period they're going to be in there and better than, than the incumbents.

And we hope that this new technology's actually going to decrease the cost of start-ups. I can use my cellphone and travel to Middle Earth and make great scenery and videos of the mountains. I can actually do that at very low cost nowadays. On the other hand, the probability of me being successful in selling millions of tickets for people to view my film is pretty low. So this technology is going to go both ways. It's going to reduce the cost of trying something new like this, but it's going to also reduce the probability of it being exactly the right way to do it.

...we hope that this new technology's actually going to decrease the cost of start-ups. I can use my cellphone and travel to Middle Earth and make great scenery and videos of the mountains... at very low cost nowadays. On the other hand, the probability of me being successful in selling millions of tickets for people to view my film is pretty low.



Donal Curtin @donal_curtin:

Fascinating implications at #InnovateNZ from Bartelsman's model of economy where knowledge based capital becomes more important...

So what does this mean, this new model of the world with knowledge-based capital growth, mean in an island? Well let's say Case One, where knowledge growth is random and it's actually in proportion to the population and in proportion to existing knowledge. And let's say existing knowledge is only around locally, well, then what you're going to get is that large areas grow faster and Kramer has a piece predicting how large economies and what population is in economies in different parts of the world. However, remote islands will suffer because of this logic, and even more so if the new ideas that you get dropped as manna from Heaven don't just depend on population, but also on population density. And we've seen that by Shaun's work. It probably does. The more dense your area the more ideas per capita drop on top of you. So that's not very good.

But that's the good news. Bad news is Case Two, where this knowledge doesn't just drop at random as manna from Heaven, but you have to invest in getting it. And so now the knowledge you get, the new ideas that come per unit of time and per unit of person or depending on population density also depend on the investments you're making to make this happen and on the existing knowledge that's out there for you to build upon. In this case, the incentive for firms to do this investment depends on the chance of the technological outcome. What's the chance that I get a good draw and, two, the scalability, because to get the return you need both.

... since the ICT revolution, since the internet, the speed at which new knowledge gets used by new users has actually gone up. The visibility of the existing stock of knowledge has gotten larger for people because of ICT...

With transport costs of trade, output is just less scaleable. It's going to be more costly for a New Zealand firm to get the scale from their new idea globally than for an area that's more closely linked to large masses in high densities of consumers. So this is going to harm the incentive to invest in this stuff. And with distance and low population density, the visibility of existing ideas may be low, and that was my question before. To Shaun, my question was, did ICT actually make these interactions with people at distance easier, and he said no. Well my last point says I think it probably does, but it might not be traceable yet. So hopefully the cost of distances for the visibility of ideas has increased. There's a dissertation by Salomé Baslandze from the University of Pennsylvania that has some evidence that since the ICT revolution, since the internet, the speed at which new knowledge gets used by new users has actually gone up. The visibility of the existing stock of knowledge has gotten larger for people because of ICT, and I hope that's the case.

The other one is the cost of distance. At least for things that are digitisable or codifiable or can be sold at distance electronically, the costs of the distance has gone down. As phones get smaller, as the weight – Greenspan used to talk about the specific gravity of GDP – as the specific gravity of GDP declines, transport costs loom less large. So hopefully this is going to help make the story less negative. Yet the case against being remote and not densely populated is worrisome.

So let's get a few minutes of evidence. I've been working on various linked cross-country firm-level data projects. I've done this for the OECD 15 years ago. The last two years I've been doing this with the ECB [European Central Bank] where we have 20 countries looking at firm dynamics, productivity, credit constraints and trade. This is from a project that I did with Eurostat and we had 14 statistic agencies involved. In each country we linked the business registers like the LBD, production surveys, the Community Innovation Survey, which you've heard about, but also something called the ICT Usage Survey. So we know for

these firms what types of ICTs they're using: do they have broadband, do the workers have mobile. Do they use customer relation management software, enterprise resource planning software, etc. We use this data to do similar or identical analysis in multiple countries but we also did this – all these data sets are confidential, as the people here know. You have to be authorised to use it. You get a secure terminal to get access. The data are anonymised. Pretty much these rules are like this in all the EU countries. Some are looser. The Nordic countries are often a little bit looser. The Germanic countries, it's like you can't use it at all.

So what we've done is we've sent code, the same software, to 14 countries to run on these data sets and then we aggregate up. It's not aggregate tables, but it's intermediate results. It's means and variances and higher moments and joint moments of data in these data sets, which you then can analyse in a cross-country setting. And so the idea is when we know across countries what does firm entry and exit look like, what does the productivity distribution look like, what are the tables of people who do innovation and R&D and are productive by size class, we've got them all merged together in a data set that you can use if you want to travel to Luxembourg to use it. There's no cost other than going to Luxembourg involved, and that's just a short plane ride away.

...there's a very surprisingly large role for country effects... In some countries the adoption rates of these ICTs, they're just running four or five years behind other countries.

So what do we find? Penetration of the new technologies is continuing. Firms all over Europe are continuing to grow their adoption

of stuff. Some do it faster, some do it slower. Some do it at a higher level. R&D, ICT use, innovative output, human capital intensity – we also have data on schooling and grades and skills – and productivity are actually correlated across firms. So good firms do all these good things, also exporting, etc., and then there are firms that don't do any of these, but the correlation across these different measures in my database of firms is very strong. Even so, there's a very surprisingly large role for country effects. In some countries the proportion of firms doing these good things is just lower than in other countries. In some countries the adoption rates of these ICTs, they're just running four or five years behind other countries. You'd think that use of ICT or use of innovation, we've heard it today, could depend on your sectors. This is a low R&D sector and I've got more of this, so I'm not going to do as much R&D. Well it turns out there really is a strong role for a country effect and I've sliced and diced this in many ways. So that's a question – is that policy stance or is that distance or something else? There's some country fixed effect in all of this.

The other thing we find is that the aggregate industry impact of intangibles is positive, but often, and in many countries, the average firm-level impact is insignificant, and then the next thing we find is that the variance of outcomes across firms, either in sales growth, output growth or productivity, the variance of these outcomes increases with the use of intangibles. So the more intangible investment-intensive a firm is, the higher its variance in these outcomes.

However, the good news is that the ICT-using firms or the intangible-intensive firms, they grow more over time, both in output, employment and productivity and we see a rising wage premium for ICT. Here's the intangibles from the US and they're going up over time. Here's different countries' adoption of broadband, ICT by firms. Here you see that there's country fixed effects even though across we have three industries – they're weirdly labelled – and then the countries are from up to down. You see that the countries that are good in one industry are

also good in the other and then there's some countries at the bottom which are a lower use of these things.

...having high broadband intensity, having lots of ICT human capital, but also being in a market where the reallocation process, the shifting of resources from poor firms to good firms, where that's positive, all those things contribute to the adoption at the firm level for ICT.

We've run regressions similar to the firm-level innovation stuff we saw Bronwyn and Simon do, and here we did our own version of the CDM model. We have a two-stage version of it, where one is you look at the incentive for firms to do innovative activity and it turns out that having high broadband intensity, having lots of ICT human capital, but also being in a market where the reallocation process, the shifting of resources from poor firms to good firms, where that's positive, all those things contribute to the adoption at the firm level for ICT. And this makes sense, because your incentive as a firm to do this ICT means that if do get a good draw, I want to grow. If I'm in a market where there's product market regulation that doesn't allow me to win market share or where labour regulation is very tight so I can't get the workers I need because they're tied up in other firms with fixed jobs and they don't want to leave because there's a benefit to it... Or where financial markets don't allow the reallocation of capital across firms. In those countries adoption of this innovation is going to be lower.

So if someone tries to evaluate Callaghan and finds that on average their money didn't do anything, really all they need to do is find one good example of one firm that added 50,000 jobs and \$3 billion a year in revenue... Even if all the other 99% of the projects got zero, all you need is that one to make it worthwhile. And so that, that does change the way you have to think about evaluating.

...the point is, be careful with the evaluation and if someone says on average your result is zero, don't despair.

You take the predicted innovation from that equation and you feed it into a productivity equation and here we find that on average the predicted innovation is insignificant, but for aggregates of the industry. So we actually look at the average productivity of each firm and take that as a number by country, industry and year. The aggregate, we take the weighted average, or for capital employment we take the weighted average, and in this case the predicted innovation has a positive macro effect, even though at the firm level it's not very good. So if someone tries to evaluate Callaghan and finds that on average their money didn't do

anything, really all they need to do is find one good example of one firm that added 50,000 jobs and \$3 billion a year in revenue. All they need is one, to justify all the others. Even if all the other 99% of the projects got zero, all you need is that one to make it worthwhile. And so that, that does change the way you have to think about evaluating. Now evaluation actually is much harder, because the question is, would that one firm have made it without your help? If the, if the answer is yes, they would have made it without your help, then you're still not needed. [Laughter]. But the point is, be careful with the evaluation and if someone says on average your result is zero, don't despair. If you have good examples of why it was positive, I would almost say I'd be willing to just take good anecdotes of why those firms really benefitted. That would convince me more than an average firm-level regression.

...in industries where penetration of, for example, broadband is higher, the variance of productivity goes up.

Here's some data showing that in industries where penetration of, for example, broadband is higher, the variance of productivity goes up. And that's both in levels and first differences and I've hit up this in a thousand different ways.

...ICT-intensive firms have higher variances or higher dispersion in output growth and in productivity growth.

Another way to slice it with the data we have is I can track firms, I can take what's called a long panel. I can look at firms that are available between 1995 and 2010 in each industry in each

country and I can split them into two groups: those that are intensive in innovation or ICT and those that are not. And what we find is that the ICT-intensive firms have higher variances or higher dispersion in output growth and in productivity growth.

...the relative wages of ICT-intensive firms in the EU have been growing at 1.4% more per year.

...if I compare employment growth of firms that are intensive in ICT to firms that are not intensive in ICT, their employment growth across countries and industries is, in general, higher... their productivity growth is high, but they get it through an output growth that's even higher than the employment growth.

The next thing we can do with these firms, within each country industry in year, I can aggregate up all the firms that are ICT-intensive and all the firms that are not ICT-intensive and I can look at their relative wages over time. And as it turns out, the relative wages of ICT-intensive firms in the EU have been growing at 1.4% more per year. Over 10 years or 12 years I've got, what is it, 14 percentage points or 15 percentage points higher wages in the firms that are ICT-intensive. I can do the same and look over a long range at output growth, productivity growth and employment growth, and this goes to the policy makers worry that this new technology's going to cost jobs. Well, maybe so, but if you're not

going to use this technology, it might cost even more jobs. And indeed we find that if I compare employment growth of firms that are intensive in ICT to firms that are not intensive in ICT, their employment growth across countries and industries is, in general, higher.

Their productivity growth is higher and their output growth is higher and the trick is that their productivity growth is high, but they get it through an output growth that's even higher than the employment growth. It's not the case for all industries and countries, but predominantly I'm in the top quarter where both employment growth and output growth are higher for the ICT-intensive firms than not.

So how do you connect this – what does all this mean for policy? And, I must say, I haven't done research on this but I've been involved in the debates on R&D and on policy and national innovation systems for 20, 25 years. I think I've been changing my point of view on these issues, just by looking at the case of what's happening here.

...don't try to bet on everything, but in the small subset where your chances are good that if you make an improvement you're actually going to be able to be visible to the rest of the world and be able to ship your products to the rest of the world, go for those. Start from the current strengths, the primary sector, maybe instrumentation. Digital effects, yacht building, racing yachts.

There's this paradox that the framework conditions for high intangible investments seem okay. In my previous work, I said, look you need the scalability so you need your flexible markets and once you got that, firms are going to want to invest in these intangibles and you're off. Well that's okay, but there might be another bottleneck. Even if your internal markets, capital and labour markets and product markets work okay, maybe it's difficult to geographically ship your products, either within your own country or between countries. So this potential market size could remain small because of distance, and the visibility of this existing knowledge may be low as well. And one possibility is, as the world moves more and more to a production function of a knowledge-based capital growth model as opposed to a Solow growth model, it could be that New Zealand's going to fall further and further behind. Or you could try to connect yourself, but not broadly in the economy but actually narrowly focused: try to maintain connections in those areas where you're already linked-in in the global sales and global knowledge space. So for a smaller subset, don't try to bet on everything, but in the small subset where your chances are good that if you make an improvement you're actually going to be able to be visible to the rest of the world and be able to ship your products to the rest of the world, go for those. Start from the current strengths, the primary sector, maybe instrumentation. Digital effects, yacht building, racing yachts. I don't know what exactly you're good in, but I'd try to identify those and say, we need to focus our efforts exactly there if we're going to be trying to maintain this connection.



McGuinness Institute

@McGInstitute: Eric Bartelsman discusses importance of having a narrow focus on connecting with rest of world, be clever #innovatenz

...paradoxically, it calls for government involvement that goes beyond... the Anglo-Saxon innovation policy which says we need generic instruments, we're not going to pick winners...

So I would say, paradoxically, it calls for government involvement that goes beyond or is orthogonal to the Anglo-Saxon innovation policy which says we need generic instruments, we're not going to pick winners and those are all the things that actually up until a few weeks ago I would have called for. Looking here and contrasting this new area of innovation with knowledge-based growth, it seems to be heading in this direction in my idea.

If you can take away some of that future market uncertainty by giving a prize, you'd be amazed how much investment money appears out of nowhere to go for that prize.

I put down innovation prizes, even though today we heard well, it's a very limited area. But exactly when you're trying to pick areas where you have an idea of where it might be going, having thematic platforms and having directed technical change in areas that you want to have anyway; the worst thing that can happen is that you don't sell it internationally but it's going to really improve your life here. So invest in those things. And one way to do that is with innovation prizes. Entrepreneurs and innovators have hubris. They think they're going to win whatever happens. Their uncertainty

isn't the technological uncertainty. Their uncertainty is, can I actually get this to market later? If you can take away some of that future market uncertainty by giving a prize, you'd be amazed how much investment money appears out of nowhere to go for that prize. The prizes that we've seen so far in space vehicles or in these self-driving Land Rover automobiles, often a \$10 million prize will elicit \$80 million in R&D investment, just because the type of people that go for this think and know they're going to win. So choose these prizes carefully though. Choose thematic areas with a medium to longer-term horizon. Define the prize for achieving well-defined functional targets, so the board at the end, that decides, it's actually really easy to see ex post whether or not you've met the criteria. And this is going to provide the certainty on a future market that will help elicit the intangible investments today. And it doesn't cost the Treasury much today. I don't know whether you can actually make this promise without putting in on your books. I'll have to ask a national accountant that. Can the Treasury promise a future prize and not put it on the books today as an expense? They shouldn't be able to, but they'll probably find a way.

...the 20 to 25% of the economy where the Government's involved, these are really good areas to start thinking about innovation as well... Having these things being expensive and taking scarce resources is going to hurt your competitiveness, so try to do innovation in areas where the benefits could be exported.

So the next one, and again this morning we heard the 20 to 25% of the economy where the Government's involved, these are really good areas to start thinking about innovation as well. In a small, sparsely populated country, the relative costs of public service must be comparatively high. You've got to make it accessible in different areas. Having these things being expensive and taking scarce resources is going to hurt your competitiveness, so try to do innovation in areas where the benefits could be exported. Health care – not just the technological side of health care, but the organisational side. How do you organise it? I know lots of governments are interested in how the educational system here is being financed. That's an innovation. I don't know how you can sell that innovation – maybe through consulting services. But also, you could attract other students who might get a good deal coming here. You can think as we're getting richer through all this new technology, and so that's the positive message. In 30 years we're going to be twice as rich. We're going to be spending a lot more on health care and arts and leisure and back scratching than on automobiles and things that go whizz in the night. So these areas that right now are under budgetary pressure, we can open up for innovation by being clever about how to finance it and being clever about finding ways to innovate in these areas. And I think that's another good way forward.

That ends my talk. [Applause]



Discussant:

Dr Peter Crabtree, Ministry of Business, Innovation & Employment

Peter Crabtree: Thank you. I'm just going to change gear for a minute and I'm going to talk very much as a policy practitioner.

And where I start is probably where Eric has ended really, in terms of some of the conundrum that we face as policymakers in New Zealand around the evidence base on innovation and the fact that what we see is we have a lot of the framework conditions that you would expect to see underpinning really high performance in an innovative economy, but we don't necessarily see the performance from that, the outcomes from that, that we would hope for.

I'm going to talk a little bit about performance on innovation. Then I'll move to the Government's Strategy for Innovation, how that fits within a broader economic strategy and then drop down into just three main areas of priorities that we're focused on at the moment, and I'll pose some questions that we're facing as policy makers.

So just starting off: every time we look at a global index on innovation, New Zealand actually generally looks reasonably good, apart from a few areas, which we'll dig into in a moment. We've been spending a lot of time over the last few years, stopping comparing

ourselves so much from a policy context from the US and UK and large economies and focusing in on small, advanced economies where we think there are particular challenges for policy makers that we share. For example, how do you run a small science system, an open science system and how do you make choices around prioritisation, because you can't place thousands of bets in the same way a large country can.

...it's in the area of knowledge-based capital where we really fall down in terms of the levels of investment...

But anyway, when we compare ourselves, against some countries which you think are pretty high performers generally, we do pretty well. However, we think dropping down, it's in the area of knowledge-based capital where we really fall down in terms of the levels of investment and then that leads us to some of the areas of priority that we have, whether it's the public investment in R&D, for example, or private investment in R&D in particular.

The way that we work on it is we've got an integrated agenda across a set of themes which we see generally as enablers for business activity in the economy. We have a particular innovation theme, but I'd just like to point out that others of these themes obviously provide enablers for innovation. So if you're thinking about infrastructure, well we've had a huge focus on ultra-fast broadband roll out for New Zealand, which we see as a huge enabler of innovation in the investment context. Very significant reform of the financial markets; we think a lot at the moment around the shape of the early stage capital markets, venture investments, seed capital investment and so on. And there's quite a lot of innovation going on in those types of markets as well at the moment with things like crowdfunding and so on.

The key priorities at the moment are making the most of the digital economy, knowledge production, diffusion.

If I think about the building innovation theme. What we have is a cross-government process, an action plan on innovation and it has a set of priorities which, I was looking at the most recent OECD strategy the other day and they line up pretty closely, as you'd expect with those. So a lot of the difference really is when you start to drop down into New Zealand's country-specific characteristics. The key priorities at the moment are making the most of the digital economy, knowledge production, diffusion. I'll talk really about the science system in particular, because that's where we've been placing a lot of effort in recent times. And lifting business expenditure on R&D which has been a key topic for discussion today. But I'll just also point out that we are thinking

actively around the regulatory frameworks and how they adapt and examples would be areas like in telecommunications, what you're seeing around convergence of different technologies and making sure that you've got a regulatory framework that is really enabling and fit for purpose for the future and for innovation in those contexts.

...to what extent do you focus on STEM skills versus other skills. How important are they for innovation? I'd have to say that that one certainly isn't settled in the New Zealand context.



The whole question of skills for innovation, there's a hot debate between to what extent do you focus on STEM [science, technology, engineering and mathematics] skills versus other skills. How important are they for innovation? I'd have to say that that one certainly isn't settled in the New Zealand context. I think we were generally concluding that we could probably make a whole lot more investment in STEM, we probably lag quite a lot anyway.

...you're facing disruptive technologies and so on and New Zealand needs to be able to adapt and be resilient...

Just dropping into the ICT area. We think that the rationale for making sure that New Zealand could make much greater use of ICT certainly in the business context; well certainly as consumers, as government and as business – really strong arguments in terms of the gains for the economy and for consumer welfare and so on. But also in terms of things like, which Eric touched on, which is you're facing disruptive technologies and so on and New Zealand needs to be able to adapt and be resilient in that type of context.

If you were changing the way that your tax system operates in terms of the interface, your company's registrations and a whole bunch of other government services, taking those online and streamlining them, there are productivity gains for government.

Working on something like the digital economy means working on a lot of different things at the same time, and some of those things are more amenable to government activity than others. So if we were thinking around digital government, putting government services online, we think that could be quite a significant catalyst for, for example, business use of ICT. If you were changing the way that your tax system operates in terms of the interface, your company's registrations and a whole bunch of other government services, taking those online and streamlining them, there are productivity gains for government. There are certainly significant gains for business at the same time, and especially if you're seeing lags in terms of business uptake. We think that could be one of the ways in which you could catalyse that.

What we're seeing with the digital sector at the moment, the ICT sector in New Zealand is that it is growing extremely fast. It appears that we have an area of not only comparative advantage, but some emerging competitive advantage as well in that it certainly plays to the whole notion of a weightless economy – and I'll get to that later on. But that's where we are seeing a lot of the growth and investment in business R&D at the same time. There's a huge amount of that growth as well.

But again, underpinning all of that, you've got to work on skills, you've got to work on the infrastructural questions, particularly geographically, and that's expensive. We think we're quite far along in that process and there are really significant challenges around security and privacy at the moment and in the regulatory frameworks.

...New Zealand business use of ICT, we think it's been improving but it certainly hasn't been improving at the rate at which we would aspire to...

In terms of New Zealand business use of ICT, we think it's been improving but it certainly hasn't been improving at the rate at which we would aspire to, and here we've set ourselves a target of getting into the top 10 in the world in terms of business usage of ICT and we're currently at 19th.

So how do you work on this? Because when you start to really hone in on the business side of the equation – and this is an open question at this moment because we don't think it's settled at all – is that it's quite a black box. It appears that when you're dealing with how businesses are making choices around the use of ICT, they're obviously responding to a lot of external incentives to competition and so on, but there's a whole bunch of stuff going on inside the firms in terms of their capability to make these choices and adapt and so on. And they're the same types of issues around questions like management capability that we're seeing in other areas such as firms' ability to trade and so on and so forth.

While we see the Government has relatively few levers in these areas, we want to think quite creatively about how we can create the conditions for firms to adapt, and there's certainly going to be significant creative destruction in this area over time as well.

So just thinking about knowledge production diffusion, I'll talk about the science system really. We've just released a national statement of science investment which is a 10-year strategy, a government policy statement for the science system. It sets out a clear statement about where we want to go with New Zealand's science system. Generally, a science system we would observe as a very efficient science system. The quality of the outputs from the science system are good. There are a few areas of excellence, but there are far fewer areas of excellence than we would expect to have, compared to some of the countries that we compare ourselves to.

...thinking about the science system, there's actually some significant cross-overs in the economy with the business investment in R&D as well, because in the New Zealand context we've often seen the public science system doing a lot of work that you may well see in other economies being done by the private sector as well.

And the Government has made a very clear statement that it will invest over the next 10 years significantly in the public science system, but at the same time there are two major themes that we're thinking about in doing that. One is the focus on excellence across the whole system and the two on impacts. And thinking about impact in as a sophisticated way as possible – because impact obviously means something quite different from when you're doing it really far away from market research – and it may mean something quite different when you're thinking about health research or environmental research than it does in the economic context, and often these things are also joined up. So we've set out some goals for the science system but I just thought that, in thinking about the science system, there's actually some significant cross-overs in the economy with the business investment in R&D as well, because in the New Zealand context we've often seen the public science system doing a lot of work that you may well see in other economies being done by the private sector as well.

This diagram's quite revealing, because we're starting to, as we think our way through this, start to drop more and more into thinking in the sectoral sort of a basis. Because you're seeing quite different dynamics playing out in different sectors, whether they're economic or non-economic. And here you see a pattern and in many respects this chart tells a story around the New Zealand economy and path dependence in the New Zealand economy, so you're seeing a significant investment in primary industries' research. You're probably going to see a whole lot of associated investment in the environment part of the pie which are around essentially externalities from the primary sector and you'll see a bunch of manufacturing which is also in related processing as well.

But what you see in each of these different areas is a very different composition of who invests what in what kinds of research. And so generally in the primary industries you see the Government and the government labs. We have Crown Research Institutes that do a lot of the quite applied research that you may well expect others to do. But at the same time, what you're doing there is that you do some research that makes grass grow faster that applies across thousands of farms that has a more general effect, whereas if you were across in the manufacturing sector, you're dealing often with very particular technologies that relate to, in a small economy, something like, it could be one firm. So you have quite different questions about who should do what kinds of research over time.

...we, in our contestable funds, spend about 3% of our portfolio in ICT. That doesn't seem right given the scale of the ICT sector at the moment... how do you adapt your institutions and your funding mechanisms to keep up with these types of challenges?

One thing to point out: information and communication services is quite interesting at the moment. What we're thinking about at the moment is okay, this is a representation of where the economy's been and as investors in the science system, how do you make choices about where you're going? And in areas like ICT, you'll see that the Government has made very little investment further from the market research in ICT. Partly that just makes a lot of sense, because the market's moving so quickly and firms are best placed to move, but at the same time we can see that we, in our contestable funds, spend about 3% of our portfolio in ICT. That doesn't seem right given the scale of the ICT sector at the moment and where it's going and there are definitely areas such as cyber security or dealing with big data where there are really strong arguments for going further from the market research. And so we're thinking about okay, how do you adapt your institutions and your funding mechanisms to keep up with these types of challenges?

Another way of looking at it, and I'd just say here that we don't think of the system as a linear model of the science/designs and innovation but what this represents is the pattern of an investment portfolio. And how we're thinking at the moment is that we will make a whole bunch of complementary investments, because there's a lot of interdependencies across this.

There's a lot of acronyms up here, but generally they'll be further from the market. You've got funding mechanisms for more basic research, higher education research. You've got contestable funds in the middle which are largely around mission-oriented research, and you have the CRI core funding which is largely for our Crown Research Institutes which are very much facing the primary sector or environmental sectors as well.

...big questions around connectivity across this whole system and how you use these types of funding mechanisms to incentivise much higher levels of interconnection.

And on the right-hand side you have the Callaghan Innovation and really the demand side mechanisms that we've been using from a financial perspective to incentivise. So the big question at the moment is, how much do you work on the demand side, and big questions around connectivity across this whole system and how you use these types of funding mechanisms to incentivise much higher levels of interconnection.

...we need to have a basic capability to be able to adopt and diffuse knowledge in certain ways and we have to think very carefully about where we want to be fitting more closely to the frontier really.

And the other aspect here is, we do not see this as a closed system. We are very focused on the idea that New Zealand imports the vast majority of all of the knowledge that is used here; we need to have a basic capability to be able to adopt and diffuse knowledge in certain ways and we have to think very carefully about where we want to be fitting more closely to the frontier really. And as Eric said before, we have to make some quite hard choices about some of those areas, because we can't place lots and lots of bets. We simply cannot afford it.

 **Donal Curtin** @donal_curtin:
Listening to @MBIEgovtnz's Peter Crabtree at #InnovateNZ, struck by how many different buckets the national R&D \$ go into...

Just hitting on business expenditure on R&D. You've been talking all day about this, so I won't repeat it. It is a top priority. I understand there was some discussion earlier in the day about the target. It's an aspirational target, but we're pretty focused on it. New Zealand's level of business R&D is low. You can explain it away: firm size, sectoral composition of the economy and so on, but that's quite different from, I suppose, thinking about where we would like to be over time and where we would like to be over time is going to result in some sort of structural shift in the economy. The question is, how do you have that structural shift in the economy? To what extent does it evolve out of what you've already done? To what extent does it evolve out of things that you are going to be surprised about and so on, and to what extent are you deliberate about that, or do you essentially just create the enabling conditions for that to happen?

So things that we've been actually doing in recent times: Sarah talked earlier in the day about Callaghan Innovation. We created essentially a new institution that was going to drive a focus on business investment on R&D and the commercialisation of innovation.

Yes, a focus on using financial instruments to lift business investment but really packing around that a whole bunch of other things which is really stimulating businesses' connection to each other: networking, technology networks, connections to global technologies, thinking ahead in terms of foresighting and a whole bunch of other sort of services, and the idea was to bring those all together. And certainly we work really closely with Callaghan Innovation to push that along.

... we've moved much more to a grants mechanism which is non-discretionary, which is much more predictable for the firms, but the trade-off has been... a much lower rate of subsidy, but the firms can certainly plan around it much more...

We've also thought quite a lot about the redesign of the business R&D grant schemes. We did previously have quite a focus on what we call discretionary approaches, discretionary grants where we had investment managers making choices about projects that they thought were the best projects and so on. We've moved quite significantly. There was also quite a high level of subsidy rate at that – something like a 50/50 type subsidy on average. What we've done is we've moved much more to a grants mechanism which is non-discretionary, which is much more predictable for the firms, but the trade-off has been – and we've been thinking very much from a fiscal perspective – a much lower rate of subsidy, but the firms can certainly plan around it much more so. And that's very much, at this point in time, in the midst of implementation and we're really keen to see that succeed.

As I pointed out before, we're starting to think that we're probably getting into diminishing returns in terms of thinking about some of those financial instruments, so we need to think more cleverly about a whole bunch of other things that are going on. And that would range from regulation to government procurement and so on. But in different sectors as well. What are the dynamics that are going on and what types of institutional support is appropriate there, and so on.

We're very focused on a set of priority sectors, priority technologies where we think that New Zealand already has significant capability, where it has a presence of domestic firms that are really active, and essentially what we're looking to do is to create stronger little innovation systems and so on, including multinationals in the equation.

So we have moved quickly onto focusing on attracting multi-national investment in R&D and we see that as multinationals being involved in the New Zealand innovation system, whether that's in partnership with our science institutions or whether that's here as economic investors in R&D in and of themselves. We've got some countries here that obviously do a lot more than us at it, and we're certainly not proposing to get into a game of offering financial incentives to induce this to happen, other than the types of incentives we would offer to any firm. But where we're at, at the moment is we have a task force underway. We're very focused on a set of priority sectors, priority technologies

where we think that New Zealand already has significant capability, where it has a presence of domestic firms that are really active, and essentially what we're looking to do is to create stronger little innovation systems and so on, including multinationals in the equation. And you can take areas like agritech – where you would think that it was a no brainer that we should be having more global agritech firms in a New Zealand context because we have very strong agricultural science and it's essential to our economy. And the whole approach here is to join up a whole bunch of government actors and mechanisms to work on different barriers to that happening, whether that's making complementary investments in your science system, making sure that there's access to the right kinds of labour force, your regulatory environment, your infrastructure and so on. So that's a current work in progress.

So that was just a brief skitter across a bunch of priorities that we have at the moment. Obviously we come to these types of fora, we listen really hard, we try to synthesise the findings as much as possible. So this could look a little bit different next year, as I would expect, and have a rolling set of priorities over time. Thank you. [Applause]

 **Donal Curtin** @donal_curtin:
Quite liked idea from Peter Crabtree at #InnovateNZ that we may be looking at attracting MNCs to NZ cos the big ones are big R&D spenders...

Patrick Nolan: Thank you Peter and Eric.

What a fantastic final session to finish. I would just note that yesterday we had a conference in this room looking forward five years but I think you've sufficiently lifted our horizon to 30 years, so thank you very much for that.

It was a strong case for the technological optimists, which I think in the Productivity Commission that's where we like to position

ourselves and it raised a lot of really important considerations, as if the process of productivity growth and economic growth is going to be significantly different going forward. We really need to think quite differently about our policy settings and those sorts of things, and Peter followed on from that by discussing the Business Growth Agenda and some of the work that's being done to reconfigure that. There's some real challenges in there around the science system, not just pursuing excellence. Some of the work that Simon Wakeman has done has shown actually we do have relatively good outputs from the science system, but the challenge is commercialising it, so going that next level. And some of the stuff around ICT adoption as well – work that the Productivity Commission has done for our services inquiry has shown that one of the challenges is getting the organisational process to wrap around the ICT, not just the physical investment in the ICT, but going beyond that.

Discussion



Patrick Nolan: We've got 15 minutes for questions. Yes, Arthur Grimes.



Arthur Grimes: Eric, can I ask you a question? One of your important results was there were still country differences when you had your 14 country panel and you're trying to think why might that be the case. I'm wondering if you've got countries within them that have different cultures in there, and the reason I ask this is a) because I've been working on it myself. But Alesina and others are talking a lot now about the importance of culture on economic outcomes. In Switzerland I saw a very interesting study where dividing the French and the German, or French, Italian and the Germans versus the German systems where entirely different savings propensities, for instance – not surprisingly, the Germans save and the French don't. They didn't say anything about making love as the first one. And then you've got Belgium as well where you've got very different cultures and things like that, whether you've thought about whether there might be cultural differences within countries as well as country-specific effects.



I think I once even said thinking about cultural differences is like the last refuge of the scoundrel economist... But lately I'm changing my mind on this.

Eric Bartelsman: Again, I think my ideas on this are shifting. I think I once even said thinking about cultural differences is like the last refuge of the scoundrel economist or something like that. [Laughter] But lately I'm changing my mind on this.

I was at a conference that Ned Phelps at Columbia organised about four weeks ago and he's working whole hog on this issue of culture and productivity. There's this thing called the World Values Survey and we're actually incorporating, as we speak, there's an RA [research analyst] working on the World Values Survey merged with these data I have on innovation. I only have the country level. Ned Phelps and his collaborators are now also looking at these NUTS regions, these lower-level regions, where they can take the World Values Surveys, look at the values within each sub-region.



It might be that as your economy develops from an agricultural society with a high risk of droughts making you go hungry, towards an economy where the worst thing that can happen is that you'll have to cancel your third vacation when a recession hits, your values might change.

Eric Bartelsman: They've got something that they can split within a country to regions. Maybe I got that wrong. Anyway, they're starting to find some smoking guns, but it really is just preliminary and one of the problems with the culture, of course, is that like with a lot of our work, what's exogenous? If you've been in a certain circumstance for 20, 30 years with a certain way of thinking and a certain economic outcome, you might have very different cultures. It might be that as your economy develops from an agricultural society with a high risk of droughts making you go hungry, towards an economy where the worst thing that can happen is that you'll have to cancel your third vacation when a recession hits, your values might change.



Arthur Grimes: They do tend to be very long-lasting, according to the literature.



Eric Bartelsman: Right.



Arthur Grimes: But then there's a very multi-generational [indistinct].



Eric Bartelsman: Okay, but still actually the World Values Survey has on their website a thing where they're showing, they actually show transitions. As an economy moves, in 30-year periods, there can be quite significant changes.



Patrick Nolan: Peter, I think effectively the discussion today has just made your job harder, because if there were simple levers that we could pull, we would have identified them. Now we're talking about culture. You could also drill down into other things like regional disparities and differences between sectors. What sort of implications do you see that has, particularly for things like the Business Growth Agenda?



Peter Crabtree: Well, I think it is that you move down to more disaggregated levels of analysis in how you act at a particular point – regional development's hot at the moment. Obviously you see things playing out in quite different ways in different regional contexts.



Patrick Nolan: Okay. Bronwyn and then Beth and then at the back.



...labour market regulation... just has a huge impact on your willingness to start a firm, or your willingness to grow a firm or to try something risky – because if you can't lay workers off it's just too risky. And that varies, partly for cultural reasons, across countries substantially, just within Europe.

In the US you fail in starting a business, you don't even have to stay where you are. You can move to some other place and there's no memory of it, and it's just a lot more difficult in Europe.



Bronwyn Hall: On a previous discussion, even if you don't get as deep as culture, one of the interesting things about some of the work there is they try to instrument for this endogeneity with stuff which is 3,000 years ago and so forth. But more importantly, once you get into this business, there are some things that actually matter immediately. One of them is what I alluded to before, which is labour market regulation. That just has a huge impact on your willingness to start a firm, or your willingness to grow a firm or to try something risky – because if you can't lay workers off it's just too risky. And that varies, partly for cultural reasons, across countries substantially, just within Europe.

And the other one is attitudes towards failure. That's been pointed to over and over and over again as a big difference between the US and Europe. In the US you fail in starting a business, you don't even have to stay where you are. You can move to some other place and there's no memory of it, and it's just a lot more difficult in Europe.

And one of the things the World Values Survey revealed, I think, is that indeed this thing we thought was true is true, and that affects innovation rates. I would have thought that New Zealand would actually be on the US side of this. It's composed of people who took the risk – the descendants of people who took the risk of coming a very long way to improve their lot and that is actually part of the story in California also.



Patrick Nolan: Thank you, Beth. Although Peter, that does makes me think of bankruptcy provisions and those sorts of things. I should know the Business Growth Agenda better than I do, so is that an area of activity?



Peter Crabtree: Not that I know of at the moment.



Patrick Nolan: Right, okay.



Eric Bartelsman: But those are actually rules, so even if the bankruptcy is part cultural, in the US in many states, if you go bankrupt, you get to keep your house, your primary residence. So you take a mortgage on your house, you start up a business, you fail and you keep your house. So these rules that you can change. Whether you want to is another...



Patrick Nolan: Beth. We've got lots of hands in the air. There's one at the back and then I saw...



Beth Webster: One little point to follow on from that is that Australia last week has just announced they're going to change their bankruptcy rules to make it less punitive when you do fail business. They're going to do it in a way that doesn't allow those unconscionable developers [laughs] to get off the hook though.

...whenever I see those studies that show that the rate of return to innovation at the firm level... is positive or when innovation has a positive effect on productivity or profits, you immediately think, well why doesn't everyone innovate, if it was that easy.

My question was, whenever I see those studies that show that the rate of return to innovation at the firm level – and this is where culture's probably uniform across the whole sample – is positive or when innovation has a positive effect on productivity or profits, you immediately think, well why doesn't everyone innovate, if it was that easy. So there's obviously some additional factor in there that's explaining why some people are successful and some people aren't. Why some people, therefore, make the decision. Do you know what it is? [Laughter].



Bronwyn Hall: That's why we invited you. [Laughter]



Eric Bartelsman: Well, one is I don't think on average, there are excess returns. I think it's this makeshift that it turns out that someone's successful. On the other hand I think the type of people that become entrepreneurs are people with the hubris. So Giovanni Dosi, he has a 1998 piece where he does a lab experiment with students going into the electronic lab and the game is set up that you get money and you put up to enter in a firm. And it turns out that business students do much more so, even though it turns out that the average return is negative, even stronger, once people know that they can enter in a field that they're good in. If they select the people, for example, on football statistics and are like, "I know that", they even put in more money forgetting that everyone else selected is also self-selected on being good at soccer statistics. So there is something about the entrepreneur's hubris. At Ned Phelps' conference two weeks ago, Peter Thiel was there and he actually said he selects his ventures, where he invests in, on people who don't see the risk. He says once they see this as a lottery they become intellectually lazy and stop preventing failure. He wants people who don't even see it, but are continuously fighting to ward off the risks as they come along. So he's like, oh I asked them what percentage of your money fails. I think he was kind of cagey. I think he said 87%, but I think that means he put in 100 and got 87 back, so I'm not...

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Female Participant: [indistinct] in their own abilities.

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Eric Bartelsman: Right.

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Patrick Nolan: We've got a question there and then Andrew.

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Male Participant: Apologies if it's already been asked before. I missed some of today. Question about ways to improve connectivity and commercialisations of already existing innovations, innovative output. Unlike encouraging takeovers by foreign firms or bringing foreign firms here as a way to transfer knowledge and connecting to the rest of the world, were there any studies or discussions about basically buying in world top CEOs, managers, like I don't know, Google's ex-CEO, as a way to really push... someone who had been there and done that. Is it something that's been discussed, studied?

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Patrick Nolan: Peter, do you want to start and then Eric.

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Peter Crabtree: Well, not the Government doing it. Firms do it all the time. It's the labour market. [Laughter]

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Patrick Nolan: Peter, do you want to start and then Eric.

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Eric Bartelsman: Motu does it now. [Laughter].

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Patrick Nolan: Okay, and Andrew.

Other places throw a heck of a lot more money on infrastructure, say, than Anglo-Saxon countries do and certainly they throw a lot more money and attention on innovation.

Andrew Sweet: Thank you very much. I didn't introduce myself last time. Andrew Sweet, now working for the Secretariat of the Small Advanced Economies Initiative. I'm too tired to try and frame this as a question, so I'll just make it an observation, which is that I think policy systems have cultures as well, so I'm picking up the cultural point. In the Small Advanced Economies Initiative we spend a lot of time talking to the countries which are now increasingly turning up on our comparative graphs. And I was really glad to see mention of the Anglo-Saxon innovation policy paradigm. You didn't use the word paradigm, but what I found really interesting, when you go to those other countries, is that they do just think quite differently about these things and you notice how policy develops really incrementally in innovation, but also other places. Other places throw a heck of a lot more money on infrastructure, say, than Anglo-Saxon countries do and certainly they throw a lot more money and attention on innovation. So I think there's a huge opportunity but also a huge challenge for us to really take the time and effort to understand how they think and compare it to how we just naturally have been taught to think.

Patrick Nolan: Okay. So I'll get Peter and then Eric to respond to that statement rather than question. Eric, you were talking about, I guess, the attitude of the entrepreneur, always believing that they'd succeed. You often will find that with civil servants too [laughter] and so I'm just wondering how do we, in a sense, choose the right areas. If there's going to be a need for a new model, how do we choose the right areas to be thinking more creatively? How do we choose the right battles and targets?

Peter Crabtree: I think innovation policy, by its very definition, is going to be experimental at times because you are very much about creating the future, so you will rely as much as possible on the body of evidence that you have at your disposal. But we always have, I suppose, as part of our portfolio some things which are more risky. They're punts. You're thinking often quite creatively about what you think is going to work in your particular context and some of that particular context is going to involve questions of culture and political economy and so on and so forth. So, yeah, definitely the whole notion of the policy entrepreneur is, they exist, but it's all about teams and you've got balances of people who are highly analytical and are probably asking harder questions at times.



Patrick Nolan: Yeah, great, thanks. Eric.



Eric Bartelsman: Well I think looking at Peter's slide where they have the balls and the two axes of the different instruments and it just made me, in a way, humble as an academic saying well we don't have an answer to your problem. You've got a certain amount of money that you think should be spent on innovation and there's all these different instruments. There's the fundamental from Marsden in the top left to Callaghan in the bottom, and then a bunch of nameless acronyms in the middle. [laughter]. Well you've just got to get nice names for them as well – there must be some. [Laughter] It's hard to think about how to structure the decision process of what to put where. So in a way, I'd like to challenge the community here to think about ways in which to build criteria for what goes where. So one is the thematic – which are the areas, and I think that might be the easy one. The difficult one then is, at which stage in this process do you put how much? Do you first put it in education and wait 10 years till they're ready or do you go both directions at once? Within each of these balls too, there's a whole set of work on institutional setup. How do you do your R&D subsidies? Beth went through the list of all the pros and cons for various ones. Each of these balls will have similar issues of incentives and spill-overs and drawbacks.



Peter Crabtree: Oh very much so. We just redesigned our approach to contestable funding of science – where we've moved from ex-ante specification of research questions, very specific, to one which is very much about setting out some high level outcomes, turning it over to the research community to compete. So we're looking for a far greater level of competition. We'll test the level of excellence, but we'll test the potential impact much harder than we have in the past – but those types of things, where we're just trying to tip the balance to get more, in a sense, more disruption, more creativity.



Patrick Nolan: Well, we're a little bit over time but I think that the themes of disruption and creativity are a good note to finish the discussions on. So if you could please join me in thanking Eric and Peter. [Applause]



Shaun Hendy @hendysh: Great day at #innovatenz – pairing international experts with locals seemed to work well