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Participants

Convenor: Dr. Pierre-Marcel Desjardins, Université De Moncton
Chair: Dr. Pavlos Kanaroglou, McMaster University
Moderator: Dr. John R.Baldwin, Statistics Canada
Organizers: Drs. Bruce Newbold, McMaster University & Mark Brown, Statistics Canada

Discussants:
Dr. William Anderson, Boston University
Dr. Andrew Haughwout, Federal Reserve Bank of New York
Dr. Jack Mintz, Rotman School of Management, University of Toronto
Mr. Finn Poschmann, CD Howe Institute

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DR. DESJARDINS: My name is Pierre-Marcel Desjardins, I am the president of the Canadian Regional Science Association. I would like to welcome you to Toronto for these meetings. *J'espere que vous aurez l'occasion de despute au cours de prochaine jour avec les colleagues dans plupart tous et de veritablement prendre avantage des opportunities qu'on non l'... retrouve ensemble. (entire paragraph is phonetically represented)*. For this morning's session, I would like first to thank our partner, Infrastructure Canada, and with that I would like to pass it over to Pavlos Kanaroglou, the president of the North American Regional Science Council. Thank you.

DR. KANAROGLOU: Good morning, ladies and gentleman. Our topic today in this roundtable is infrastructure investment and economic growth. While I am sure in one way or another all of you have thought about these issues long and hard. There is a lot that has been written and yet the relationships are elusive. While there are a lot of questions that come to mind, what are our theories telling us about infrastructure investment and economic growth? What are the hard facts from the empirical literature? What do we tell policy and decision makers? What kind of infrastructure

investment will stimulate economic growth? This is at the heart of debates in cities and regions across the globe. Taking stock of what we know, what is then the way ahead? What is a suitable research agenda? How do we push this agenda forward?

I know from my own research, for example, that in urban and regional transportation that, while we know a lot about passenger transportation, our knowledge and data on goods movement is fragmented at best. But I guess I will leave these things to be discussed by our group here.

I will introduce the panel members. But first let me introduce our moderator, **John Baldwin**, sitting here to my left. John is director of Microeconomic Analysis Division at Statistics Canada, he received his doctorate from Harvard and he did his post-doctoral work at Chicago. He taught at Queen's University from 1970 to 1989. John was a research associate and then a research director at the Economic Council from 1990 to 1992. He then worked for the Canadian Centre for Economic Development between 1992 and 1993. His research has been broadly focused on issues of industrial economics. He is a director in charge of productivity measures at Statistics Canada and has written extensively on productivity.

Now for our participants, in alphabetical order, I will start with **William Anderson** – Bill Anderson. Bill is a professor in the Department of Geography and Environment at Boston University, where he is also a member of the Center for Transportation Studies. He received his doctorate from Boston University in 1984. He taught at McMaster University for 15 years. His areas of expertise include transportation studies, economic geography, urban and regional economic modelling, interregional and international migration and international trade and development. He has worked with government agencies in the U.S. and Canada and is a consultant to the World Bank. With colleagues in the Centre for Transportation Studies and with support from the Federal Highway Administration, he is currently conducting a study of the regional economic impacts of highway infrastructure investment in the US.

Andrew Haughwout: Andrew graduated from Strathmore College with a B.A. in Political Science and Economics and received his Ph.D. from the University of Pennsylvania in 1993. Andrew joined the research department of the Federal Reserve Bank of New York in January 2000, as an economist. He was appointed an officer of the bank in 2003. In July 2005, Andrew was appointed head of the bank's newly created Microeconomic and Regional Studies group. Prior to joining the New York Fed, Andrew served as assistant professor at Princeton University's Woodrow Wilson School of Public and International Affairs, from 1992 to 2000, where he directed the Urban and Regional Planning program from 1998 to 1999. He has taught numerous undergraduate and graduate courses on topics ranging from statistical methods to community development strategies.

Andrew serves as editor of the *Journal of Regional Science*, and associate editor for the *International Regional Science Review.* He is also a member of the Planning Committee of the American Society of Civil Engineers and has served as a member of the advisory board of the Greater Philadelphia Transportation Initiative. His research interests include public finance and urban and regional economics. Recent research projects include estimation of the sensitivity of the city tax bases to tax rates and economic conditions, economic and fiscal interactions between cities and suburbs and the economic infrastructure of infrastructure investment.

Finn Poschmann: Finn graduated in Economics from Carleton University, Ottawa, in 1986. He is director of research at the C.D. Howe Institute, where he has held a variety of positions since January 1998. Before that and for more than a decade, he was at the Parliamentary Research Branch in Ottawa, where he held a number of research positions principally involved with providing economic analysis and advice to parliamentarians and standing committees. He has worked in numerous areas within the field of economics, but his primary concern has been with public finance, taxation and federal-provincial relations. He is particularly interested in the distributional impact of taxation and in the use of microsimulation tools in the design of tax policy. He has also worked on monetary policy issues and disparate public policy questions. His research publications have dealt with public-private partnership, federal and provincial tax and fiscal issues, the tax treatment of retirement savings and Canada's exchange rate policies.

Last, we have **Jack Mintz**. Jack obtained his Ph.D. from the University of Essex and taught at Queen's University from 1978 to 1989. Jack is presently professor of business economics at the Rotman School of Management at the University of Toronto. Until recently, he has been the president and CEO of the C.D. Howe Institute, one of the leading independent public policy institutes in Canada. Dr. Mintz has consulted widely with the World Bank, the International Monetary Fund, the Organization for Economic Cooperation and Development, the governments of Canada, Alberta, New Brunswick, Ontario and Saskatchewan, and various business and non-profit organization. Dr. Mintz has published more than 180 books and articles in the fields of public economics and fiscal federalism, including work on infrastructure. His recent book, *Most Favoured Nation, a Framework for Smart Economic Policy*, was winner of the Purvis Prize for Best Book in Economic Policy and runner-up for the Donner Prize for Best Book in Public Policy in Canada.

While we do have an excellent set of speakers on our panel today, really I would like to thank Mark Brown and Bruce Newbold for their effort in putting together this roundtable discussion. I know turn the floor to John Baldwin, who will moderate the discussion. John?

DR. BALDWIN: Thank you, Pavlos. When Mark asked me to chair this session or moderate this

session, he pointed out that this was an appropriate issue for this group to address at this particular time because of the renewed interest, at least in this country, in the whole issue of the adequacy of the infrastructure, capital stock and the way in which it interacted with the economic system so as to facilitate economic growth and well being.

There has been a renewed interest in Canada in the past five or six years in this topic. It is one which our American colleagues are well aware of. The peak of interest in the States, as I see it, was much higher in the previous decade than in Canada, and Canada has indeed caught up. It has gone so far as to create a federal government department in Ottawa called Infrastructure Canada that was separate for awhile though is now integrated into the transport department. That department itself has stimulated a great deal of new interest across the country because of its support for research in a number of different dimensions, one of which of course is the topic we have on the agenda today. They have been kind enough to give us a little bit of support to bring together our distinguished panel.

In preparation for this, I did go back and read some of the literature in this particular area, including those of our distinguished panel members. But I found it most interesting to review Gramlich's article, the *Journal of Economic Literature* article, which ended with -- and this is of course the 1994 article, more than 10 year ago now – the following statement on our profession, our economics and economic specialities in general: "The contributions of economists," he said, "have not been all that they could. There seems to have been far too much attention to the details of macroproduction studies, which can never answer the relevant policy issues. More importantly, the relevant policy questions were never very carefully stipulated in this particular literature. Far too little attention to more disaggregated studies has been paid and is required in the future."

The task that was set for this particular group, probably not with that statement in mind, but it is certainly relevant to that statement, is to discuss four particular questions. I have divided them up into two groups of two. I am going to ask the panel to deal with the first two and then the last two. But we have a microphone in the middle of the floor and we were hoping, despite the fact that it is early in the morning, to elicit participation from the audience.

Therefore, after the panel passes through the first two questions, which will have to do with what we know about the literature and what do we know about the frameworks that we should be using, the theoretical frameworks, I would like those from the floor who have ideas in this area to come to the microphone and pose questions to the panel. We will go on to talk about some of the policy dimensions.

With that said, I will read off the first two questions that I am going to ask the panel to address. We will go through these questions in order, in alphabetical order, if we might, William Anderson first, Andrew Haughwout, second, Finn Poschmann and then Jack Mintz.

The first two questions relate essentially to our understanding of what we know about the framework that we should be using and what we know from that framework, applying it to empirical data about infrastructure and its effect on economic growth. With that, the first question is:

"What are the theoretical links between infrastructure investment and economic growth and, most importantly, are there gaps in our understanding? Where should that framework be taken?"

Most of our panellists, having worked in this area, have had to worry about the theoretical framework that they bring to their own work and therefore will be able to address those without much difficulty.

Secondly:

"***What does the empirical literature that uses these various frameworks tell us regarding the association between growth and infrastructure?"***

With that, I pass the floor first to William.

DR. ANDERSON: Thank you, John. From the theoretical perspective, the point of departure when we are talking about public infrastructure is most often to start off with the notion of some sort of a broad private production function in which some measure of public infrastructure is entered as an argument. The notion here is that the marginal products of the purchased inputs, capital, labour, energy, materials, are going to depend on the level of that public infrastructure and so having more public infrastructure is going to increase productivity overall.

That has been the basis of a lot of empirical studies, econometric studies which I will talk about in a minute. But I would argue that it is really probably not a sufficient point of departure from an empirical perspective – sorry, from a theoretical perspective, because I think theory is supposed to help us get an idea of what the underlying mechanisms are. And the question is, really, what is it that drives this relationship between public infrastructure and the performance of private firms in particular?

We all have an idea of what the job of capital, private capital and labour are in a production technology, and when we have a production function like that. But the way public capital functions in a production function like that is kind of ambiguous because it is a very disparate category because it is used jointly by firms. Some firms use parts of it, other firms use other parts of it. I think what we really need to be doing from a theoretical perspective is to be getting more at the underlining mechanisms -- what is actually driving it? Some work has been done along these lines and there are some areas where more work has to be done.

Let me briefly give you some idea of what I think are important underlying mechanisms and I'll talk from the perspective of transportation infrastructure in particular just to keep it simple and because I know a bit more about that. There are mechanisms that I would call microeconomic in the sense that they are ways in which individual firms respond to, or their behaviour is changed by, the presence or the level of public infrastructure. One that has got a good deal of attention both theoretically and empirically is the whole question of logistical costs. And the idea is that if you have a better transportation network, you have cheaper transportation as a result; you are able to maintain lower inventories, lower inventory carrying cost and so it lowers logistical costs and improves the performance of the firms.

Another mechanism like that which I think is as important or perhaps more important and I think is a very useful way to think about transportation infrastructure and the role it plays in the economy is essentially that it expands the locational choice set of firms. Basically, if you have an expanded transportation network then firms have got more options in terms of where they might locate. And if you accept that a firm's location might affect their productivity, then expanding their choice set should only increase their productivity or at least their productivity should be non-decreasing in the range of choices they have in terms of location.

And this is true from the perspective of individual firms but it may not be true if there are externalities involved, as in the case of agglomeration economies. This is something that Andrew has written about and so I won't get on that topic too much. But the basic idea is that it may be that a location shift by one firm has a negative impact on another firm and so the effect on aggregate productivity may be ambiguous.

I generally think that when we are talking about the impact of transportation infrastructure, at least on the economy, one of the best ways to think of it is not from a sort of a microeconomic or a partially equilibrium perspective but from more of a general equilibrium perspective and from the perspective of gains from trade. And if you think about big, diverse -- it doesn't even have to be big, but diverse -- multiregional economies like the United States or Canada, how have those economies

benefited from the transportation network?

Well, essentially it really comes down to or an important factor there is increasing regional specialization in trade which gives increasing productivity either from the perspective of comparative advantage or, as we see in this new economic geography, from the perspective of scale economies. But, from a comparative-advantage perspective, you know you really, even without increasing the productivity of individual firms you can increase aggregate productivity by increasing specialization of trade in a multiregional context. So, really, all you need is that, to give you a productivity effect from transportation infrastructure.

Now I mentioned briefly the new economic geography and it is something that there is a lot on the program about it. These are a whole suite of multiregional and spatial models that are based in the market assumption of monopolistic competition as opposed to perfect competition or monopoly. I think what is important from a theoretical perspective is that they have been shown to provide a framework within which you can look at things like transportation infrastructure from a general equilibrium perspective rather than a sort of partial equilibrium perspective that we generally take.

However, some of the results that come out of it I think from a policy perspective may be a bit disconcerting or inconsistent with what people have assumed in the past. We will talk about policy later, so I will leave that until then.

With respect to the empirical side of it, as I said, there has been a lot of econometric work that has been based on this notion, starting off, of some sort of an aggregate production function or a restricted cost function or something like that where public infrastructure is an argument. And anybody that has followed that literature knows there is a famous paper by Ashauer; there was work that was done actually by early by Koichi Mera. And then there is a sort of an avalanche of empirical econometric studies addressing this issue and coming to all sorts of different results. Most of them basically say, yes, there is some sort of positive relationship between a level of public infrastructure or public capital and the productivity of private firms. But there is a tremendous divergence in terms of, is that a modest impact in some cases? The argument is that the rate of return on public infrastructure is much higher than on private infrastructure.

These different results all over the place, some of them I think are the results of differences in methodological differences, and that is what a lot of the literature has addressed. But I think a lot of them also have to do with contextual differences. And contextual difference meaning that it depends on the time and place where the public infrastructure is observed. In general, we tend to have the lowest impact coming in very poor countries and very rich countries and the biggest impact coming

in maybe middle-income countries or countries in a period of rapid growth.

There is significant evidence in some of these studies of diminishing returns in the sense that through time the rate of return on public infrastructure seems to be going down. That again I think is very important from a policy perspective because what that means depends on how you interpret it. One interpretation of that is that if you think of it as some sort of a network, if you add more links to the network then the marginal benefits are going to be declining.

Consequently, you might take the conclusion that well, yes, it was good for us to spend a lot of money on highways in the past but now we have pretty much exhausted the benefits that can come from that. But another perspective might be to say that through time because public infrastructure is not eternal, it wears out, a higher and higher proportion of the expenditure on public infrastructure goes into basically reconstructing or rebuilding old infrastructure. And we wouldn't expect to see any sort of a productivity effect from that, a productivity benefit from that but, if we didn't do that, we would expect to see some sort of productivity decline. I will maybe come back to that in the policy section.

DR. BALDWIN: Thank you very much, Andrew?

DR. HAUGHWOUT: Thanks, very much, for inviting me and I am pleased to be here and thanks to Infrastructure Canada for sponsoring this. I do think that infrastructure remains an important issue. It is one that gets a lot of attention both in the U.S. and elsewhere. It is interesting to me how the perspective, my perspective on infrastructure, has been influenced by the places I have worked. When I started out I thought about infrastructure mostly as long-run decision making and its effects on long-run economic activity.

Now, at the New York Fed, there is a very different perspective, where the cyclical effects of changes in government spending are very much emphasized, so the idea that new public capital spending by state or local governments, or the federal government in the U.S., is a conversion in a sense of savings into activity right now. Current demand is an important factor. Then the question of how big an effect that has on the short run, on the economy, boils down essentially to various discussions about how big multipliers are for private activity versus public activity.

So that is an interesting set of discussions and it is very much a topic of concern among the macroeconomists that I work with. But I, like Bill, am going to focus on the long-run effects of infrastructure, which I think are the more interesting questions. That boils down to the fact that new investments by the public sector create a potentially productive asset that could be used in

individual firms' production functions.

Now Bill describes the fact that it is very difficult to think about exactly how infrastructure goods and these public goods that are created might enter into individual firm production functions. But I would emphasize that it is important to think about individual firms here, and how they use the public capital stocks that are being created in the process of infrastructure investment. Another thing that I think is very important to keep in mind is that infrastructure stocks, in addition to their direct effects on firm productivity, offer the potential for benefits to households. Households actually use infrastructure stocks very heavily. If you go out on the road today you will see some trucks, sure. But you will also see lots of cars, people taking leisure trips, people taking trips to shopping centres, people taking trips to work, similarly, with all other kinds of public capital stocks.

Now, at the regional level, I think it is important to pay attention to those benefits to households because one of the ways that regions grow is by attracting particular kinds of households. So it is important for regions to pay attention to the effect that their infrastructure investments are having on households because that becomes an argument ultimately in regional economic growth.

So the fact that infrastructure is a productive asset or a potentially productive asset means that it leads to the potential of external increasing returns in production functions of firms. That is in a sense in which infrastructure is really an agglomeration economy. Because firms cooperate and through the public sector make an investment in a particular kind of public capital stock, that ultimately means that the more firms are in one place the more potential there is for sizable public good. That leads to the potential for increasing growth at the regional level.

In my view, an important way in which that growth is realized is in increases in returns on other assets, on private assets, in particular, land, which I have emphasized in some of my work, but also labour. Wages go up in a place with a higher infrastructure stock, at least potentially, and private capital structures, machinery, are more efficient and are more valuable in places where there is more infrastructure, a better infrastructure stock, than in places where there isn't.

Now I am going to keep saying more infrastructure but I want to take a slight tangent here and point out that infrastructure, we can think of it in a couple of ways: One is the sort of the size of the stock, and then the other is the size of the service flows that come from that stock. We will return to this at the end of the discussion, when we talk about data needs, I hope. But it is important to make a distinction between those two things, and the big difference that I want to point out here is in the management of infrastructure stocks. So it is one thing to have a very large highway system; it is

another to have a large highway system that is very well managed in the sense that demand is managed on that system so that it is efficiently allocated.

So returning to the notion that infrastructure affects the returns on private assets, a key question that theory isn't very helpful on, I am afraid, is which of the returns are going to be most affected by changes in the size of infrastructure stock or the efficiency with which an infrastructure stock is managed. That is going to depend in large measure on the spatial extent of particular kinds of investments, the benefits of those investments. So when we invest in a public school, we know in the U.S. at least that the school building is going to serve a particular, well-defined geographic area defined by the school district boundaries. So we can sensibly look for the effects of that new school building within the boundaries of the school district.

Other infrastructure stocks, other kinds of public capital investments do not have such a clear definition of their service area. In particular, highways, which link users in one part of the system to users in another part of the system, potentially very far away, are a particularly complicated kind of infrastructure to evaluate on these grounds.

Theory doesn't help us much here but what is important to focus in on is theory can help us determine what are the key things to look at. So in particular, it is important to look at the spatial extent of the benefits. It is also important to look at the mobility of other factors of production and the elasticities of supply, essentially, of those other factors of production at the regional level.

Bill mentioned something that I want to underline as well, and that is that infrastructure has the potential to have a significant interaction with other kinds of increasing returns. So in the new economic geography, for example, new transportation investments can have a very surprising effect. In an underdeveloped area, new transportation investments can actually reduce growth because they link the underdeveloped area to a more developed area which has an advantage in essentially in increasing returns. It is on a more productive and growing part of the production function.

And that is an interesting kind of way of thinking about infrastructure. The ways that infrastructure interacts with increasing returns at either the firm level or at the regional level are very important to think about. Again, theory can tell us we should be thinking about these things, but it can't tell us very much about how important they are or which direction the effects go.

A final thing I would like to mention in theory is something that hasn't received as much attention as I wished it would in the literature, and that is that financing of infrastructure should really matter. Infrastructure is part of a portfolio of assets and liabilities held by governments. Physical capital is

one element of that portfolio, but there is also financial capital, there is debt, there is debt in the form of pensions owed to future retirees. All of those assets and liabilities come together to form in a sense a portfolio that individual citizens and firms evaluate when deciding where to locate.

So these debts are promises of future tax liabilities. These assets, like infrastructure, are promises of future services. They are commitments, in a sense, to a particular place by a government. And that kind of way of thinking about infrastructure, which is very much influenced by a public finance perspective, I think is important to keep in mind. It makes key the distinction between current tax finance versus debt finance. Those things actually matter quite a lot in a way that infrastructure might affect activity. And of course the choice of taxes matters as well.

Turning to the evidence, I agree with Bill, I may be slightly more pessimistic. The effects of infrastructure on economic growth seem to depend quite a lot on the measurement of the infrastructure stock, the measurement of the relevant kind of growth that people are looking at and the method that people are using to examine it. There is quite a lot of attention paid to aggregate production functions and infrastructure's role in those. It seems that there is a large range of estimates that come out of those.

One thing we have learned I think is that the geographic scope of most infrastructure investments is fairly limited. Even new highway investments, which have the potential of providing benefits far away, seem to have most of their benefits at a fairly limited geographic scope. Which means that they have positive effects at the regional level, maybe even at the local level, very small geographic areas, but essentially smaller effects or negligible effects at the national level.

The other thing I would point out that comes out of the empirical literature is that it does seem to be true that infrastructure investments do have a lot of their effects reflected in asset values. So land prices clearly are responding to changes in infrastructure investment. The value of private capital clearly seems to be responding, and wages to a lesser extent as well. I will leave it there.

DR. BALDWIN: Thank you, very much, Andrew. Finn?

MR. POSCHMANN: I will stand up.

DR. BALDWIN: Absolutely.

MR. POSCHMANN: I am grumpy. I got home very late last night. There were switching troubles on the local light rail and not very good communications between the public provider of the

light rail services and clientele. So there was a lot of lost time and wasted time last night, among people like me who use the light rail system. It certainly cut into my output yesterday. Some of it was shifted to the morning but there was a net loss.

I would probably be tempted to jump to an assumption about the extent of public infrastructure provision and the quality of infrastructure provision and its links to … its rather obvious and clear links to output? And it is a reasonable assumption to make. But to skip to the end, I point out you might be missing the point because what me and the other passengers who were grumpy last night were looking for was quality-of-service provision. We didn't have anywhere to go back to get our lost time. And we couldn't sue anybody, we couldn't get compensation.

What this should point out is that performance standards probably are really, really important, and it is less important in this context that was a public infrastructure or a publicly provided service but, whether or not there is a suitable contracting environment to generate the desired output.

So I am skipping way ahead, but just to observe that the contracting environment and private provision is an important point about infrastructure. Usually, we are mostly concerned with public infrastructure and issues that surround that. And that of course is where I am going to start because in public infrastructure, where there are public good characteristics, difficulty in pricing, difficulties limiting access of different kinds, it is where we tend to worry about underprovision and the quality and maintenance of infrastructure provision.

But having said that, there is one big area of infrastructure or trouble area in infrastructure provision, and that is in the regulated industries, where price regulation has an important impact on incentives to build out infrastructure. We will come back to that, I am sure, in policy. I know we will, because I am going to raise it again.

But turning to the theoretical backdrop, I want to point out that, beyond some truisms and recent innovations thereon, we probably haven't done very well. And there are of course these questions about the role of the public sector in building infrastructure and especially some of the assumptions looking behind debate on the point. And here, my injunction is to be aware of claims about market failure because it turns out that probably markets don't fail that often and claims about private underprovision should be eyed very warily.

And because this often turns on the question of positive externalities and capturing those positive externalities from some networks, well, just be careful right there because yes, there are externalities. But Wallace Oates made a very good point in an essay recently, which is the question is well, how

big are those externalities? Are they important? Is it something that we really have to spend a lot of time worrying about, because in some cases, the presumed fixes might be worse than, or have bigger costs, than the externality is trying to address or capture.

With that injunction noted, my starting place is the observation or claim that some particular kind of infrastructure has public good characteristics, or network economies are natural monopoly characteristics, (extended inaudible segment) any of which would suggest that private markets might fail, underprovided infrastructure or generate unexploited or unexploitable externalities, or, of course, create pricing issues that would otherwise lead to underprovision or inefficient resource allocation.

So, of course, these assumptions and the theories surrounding them might be perfectly unexceptionable in many circumstances, as when establishing a theoretical prior, such as government ought to help in financing the provision of infrastructure that is likely to be underprovided in private markets or particularly when public infrastructure is a compliment to private production. And we have already heard a few comments on that.

So the goal here would be to improve productivity or enhance the production-possibility frontier and this sort of thinking certainly governed Canada's policy or approach in the post-war era, where it was bluntly assumed that public projects facilitated private sector economic growth.

In this line of work, as we have already heard, it is not hard to find empirical results that suggest strong growth effects from public investment in complimentary infrastructure. But, of course, there is extreme risk of conflating cause and effect, as in, does infrastructure cause growth or does growth cause infrastructure? And it is on this sort of argument that David Aschauer and Alicia Munnel's work came under severe challenge. In other words, the large returns to public investment I think are generally held among us to be too-high estimates.

Now a fundamental variation on this production function approach is the cost function approach, where public infrastructure investment might be supposed to lower the cost of intermediate inputs to private production. And this is a plausible claim, and the empirical estimates of a growth relationship based on this sort of model are also more modest and in my mind therefore more plausible. And it does lead to some important implications, and I think true insights, such as that public infrastructure might facilitate specialization. And that is one potential growth path. And perhaps most importantly, public investment in infrastructure might facilitate agglomeration or pockets of complimentary specialization.

But let's be clear on this point: My view is that specialization and agglomeration, especially the

latter, are superb growth drivers or at least have the potential to be so. There are networked economics in business. There are networked economies in personal business relationships, there are network economies driven by spatial communications, interconnections among local professionals, and you know, someone else who has done terrific work on this is Ed Glaeser, and probably everyone has read him. If you haven't, I strongly recommend it.

What this suggests is that density infrastructure facilities that make density productive are goals to work for. What I don't know and I don't think anyone knows is how good governments might be at generating the sort of infrastructure that would produce these agglomeration economies. Now if you have doubts about government's ability to choose projects, let's think of a couple of recent ones and older ones, like northern and rural access to broadband, municipal provision of broadband services or the Tennessee Valley Authority or the U.S.'s Rural Electrification Act of 1936, all of which I plainly think involve disastrous diversions of investment. And so, maybe we haven't learned much in 70 plus years.

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DR. MINTZ: ……. Typically, many studies that look at public infrastructure will go to OECD data, and use something like net capital stock and divide it by GDP and look at a country's record over time. Alternatively, they might look at gross capital formation by governments as a portion of GDP. And that is a very perhaps useful way of trying to get an idea of how much governments are spending on capital stock.

If you do look at what country records are like, you will find that, for example, net capital stock as a portion of GDP has declined in the past 40 years from the period 1960 to 2001, in countries like Australia, Austria, Belgium, Canada, Denmark, Ireland, Netherlands, New Zealand, U.K. and the United States. In fact, to give you an example, Ireland, back in 1985, had net capital public stock of 80 per cent of GDP and, by 2000, that number has gone down to 30 per cent of GDP.

Now given that Ireland is the fastest-growing OECD country in the past 20 years, actually one might come to the conclusion that government net public capital stock has a negative impact on economic growth rather than a positive one, if one wanted to use simple univariate analysis for one particular case, which I would not want to suggest.

But it does raise a very important theoretical question and that is, what do we mean by public infrastructure? First, on the point of infrastructure, I think we need to differentiate amongst different types of things that we think are critical in terms of understanding its role in an economy.

So I think everybody around this room I am sure would agree that roads, highways, ports, telecommunications, can be important infrastructure, because it contributes to what the private sector can do. It adds to growth in the economy because it facilitates transactions that are undertaken.

But what about government-department spending, on buildings? Is that infrastructure or not? Certainly it is needed to develop programs that governments provide, but that gets into an issue of the role of government. And really what has happened in Ireland is not so much that public infrastructure has been running down, necessarily. There has also been a significant move from public to private sector in terms of what governments actually do.

So net capital formation and government formation and capital formation could decline as a portion of GDP, but that simply might reflect political decisions to undertake privatization or basically changing the role of government in terms of what it does.

Another very important question is that of ownership: Is public ownership necessary to understand public infrastructure? I can think of lots of infrastructure that is provided in the private sector, whether we are talking about pipelines, electrical transmission lines, telecommunications and even transportation, like port facilities, et cetera. There are a lot of things that are owned in the private sector and handled by the private sector, and may be subject to regulation in various jurisdictions, but it is still run by the private sector.

Yet, to me, there is certainly a very important role that this network-type infrastructure spending has and yet we don't really think of it as public infrastructure per se. So what is so special about public infrastructure that it differs from overall infrastructure in the economy? This gets to the question of what is the role of government in providing that infrastructure?

That leaves me really with a few points I want to make. In terms of the various studies that have been done, macro studies are most problematical. While it is useful to know to what extent public infrastructure might add to productivity in the economy, frankly, I don't find that a very interesting issue in terms of understanding how to spend money on infrastructure. I think we need to get to the micro-type issues.

In fact, years ago, I used to teach cost-benefit analysis. One of the useful things about cost-benefit analysis, even though it was sometimes as much an art as it was a science, is that the analysis does get you down to the micro level in thinking about how a particular project can add to value to the economy.

Of course, one can ask the question whether it should be government owned or privately owned, and that gets into a separate set of issues. But certainly, if you do accept that it has to be public owned, at least you have a methodology to understand whether a project should be undertaken or not, and whether the net benefits that it contributes to society are positive or not.

That I think is the sort of question that I think we need to understand more. And perhaps some of the productivity impacts in the macro economy are useful in understanding some of those benefits that come from a particular project. But the macro approach does not allow you to get more into some of the management issues and other matters compared to cost-benefit analysis.

The other point I want to make is with respect to the so-called notion of infrastructure deficit that has become a central part of Canadian discussions. I am not sure if it is really that relevant around the world; I haven't really seen it too much discussion appearing elsewhere But in Canada, we got stuck on this concept of the infrastructure deficit.

Now I can understand government deficits: that is the difference between revenues and expenditures; those are two very observable things. But what is an infrastructure deficit? The only way you can define it is the difference between what governments actually spend and what government ought to spend, on infrastructure. But what is "ought to spend"? Well, maybe in the sense of allocative efficiency, we might be able to get an idea of how much money should be spent on infrastructure in order to have the optimal amount. Now, of course, that assumes that we have benevolent dictators in society and that we can somehow assess that very easily. In fact, I would say that is probably what cost-benefit analysis does at least try to do.

However, on the other hand, we also know that governments do make political decisions. So really what is optimal may be simply what governments decide what to spend because they are trading off all sorts of issues that they face, whether it is efficiency and equity issues or even political economy questions in terms of keeping the country together, et cetera. So it is not entirely clear what a deficit even means.

In fact, if one thinks that the right decisions that governments are doing today are the ones that ought to be done, then there is no infrastructure deficit because what is actually being spent is reflecting what is optimally being spent, depending on how you want to view government decision making.

So I simply want to raise these matters as we get into the policy section next. I am going to suggest

some concerns I have vis-à-vis the incentives for government to spend money on infrastructure which I think we need to look at a lot harder in the future as opposed to trying to run some more macroeconomic and cost-function studies to measure productivity. Frankly, I don't think we are getting a lot of value out of them unless one gets to the micro-level, and one starts also asking the question, what should be public when we talk about infrastructure?

DR. BALDWIN: Thank you, Jack. I think before we open it to the floor, can I ask the panel if there is any discussion, any comments that they would like to make further on these particular issues in light of what others have said? William? Andrew? Finn? Jack? No?

From the floor, are there some issues, some comments, that you would like to make? The two questions, just to reiterate, that were posed, put to the panel at this stage, were: What is the sort of theoretical structure we should utilize when addressing these questions and, the second, what does the empirical literature tell us regarding the association between growth and infrastructure?

And as you are making your way to the microphone, thinking about that, I would like to add one comment on what does the empirical literature tell us and what is the importance here. Jack and others here have indicated that the infrastructure "deficit" has been of interest to the Canadian public policy community for the last five or six years, somewhat more intensely than previously.

But the literature that evolves out of various social science groups such as this one has other impacts on society. You may not be aware of it but the national accounts of most countries produces data at the aggregate level on the total amount of economic activity and its monetary value. At the present time, the national accounts is undergoing a substantial amount of thought. There are international groups that are having a look at how it measures activity in the economy. One of the more important issues that they have been facing and addressing is the way in which they measure the output of the government sector, including government-owned capital.

They have been making great use of the macroeconomic literature that is now a good 10 years old on the rates of return to government capital because, at the moment, all national accounts completely ignore the rate of return to government capital. They don't ignore the rate of return to public capital and in effect they understate any wealth that is created in most of our systems from government-owned capital.

I rather expect to see in the next five years the implementation of considerable changes in the way in which government output is measured. It certainly seems to be moving in that direction, and I expect that they will indeed include a rate of return to government capital. And I expect to see them

making use of this particular empirical literature, not to argue that there should be more or less infrastructure but, in trying to come up with a more accurate measure of the actual value of output of economic activity across the OECD and most of the United Nations countries.

So with, could I ask you identify yourself and pose the question? Thank you, very much.

DR. EDGINGTON: Thanks, very much, chair and the panel. It was a very enlightening discussion this morning. My name is David Edgington. I am from the University of British Columbia. I am over on the West Coast of North America. We need a lot of help with our infrastructure there. Vancouver is touted as a gateway port to and fro North America and Asia Pacific. The federal government of Canada has very kindly agreed to spend billions of dollars strengthening the gateway role, which means increasing port infrastructure, some of which is public and private and also the highways leading to and fro the port, which is public infrastructure.

My question this morning is what does the theoretical base tell us about risk management? Much of what I understand is that economic and econometric analysis still looks at marginal analysis by and large when dealing with infrastructure projects. But the scale of what is happening in British Columbia and Vancouver and some of our other ports, like Prince Rupert now, is an order of magnitude much higher than what I think marginal analysis can cope with. So, on the basis of very large projects, what does the theory say about risk management? The whole infrastructure development associated with the gateway project in Vancouver is predicated on long-term growth of the Asian market. But things may change in the years to come and these highway improvements and port improvements take an awful lot of years to actually implement and to make the benefits flow.

Just one factor: You may realize that, with global warming, the Northwest Passage, which will allow ships to come into the Pacific Ocean from the Atlantic, may be a reality in 10 to 15 years. It is ice at the moment; no ship can get through. But in 2020, there may be a serious contender and competition to the natural development of ports on the west side of North America.

DR. BALDWIN: Thank you for the question. So if I can put that to the panel. Do we have a response? Jack?

D**R. MINTZ:** Okay, two things on that: Recently, I have been involved with some private sector businesses looking to buy ports and related infrastructure. And I can tell you that these are large investments. And I can also tell you that the concept of trying to deal with risk is a bit of a hunch, instead of really trying to measure it. What one does is look at potentially the internal rate of return

and think of it in terms of being sufficiently high that one can absorb any particular shocks that might affect profitability.

Theoretically though, there is some work, particularly the work that was done by Dixit back in the 1990s on irreversibility of investment and risk. That has been applied in some contexts and I think that has been a very useful way of maybe handling some of these large project-type issues. In fact, some of those concepts have also been adopted in the effective tax rate literature in evaluating the interaction between risk and taxes when irreversible large projects are undertaken. So from a theoretical point of view I think that is actually not a bad thing to look at, maybe as a way of thinking about these issues.

DR. BALDWIN: Does somebody else on the panel what to address that? Andrew?

DR. HAUGHWOUT: I will add very quickly: One of the things that is interesting in my mind about infrastructure investment by the public sector is that it represents a commitment to a particular place, and it sends a signal about a particular place, that there is an expectation of economic activity in this particular place, going forward. That tends to, I think, bring with it the potential for private sector actors to move to that particular place to conduct activity and then that can sort of in a sense take on a cumulative causality kind of process which will lead ultimately to a bigger city.

I think about New York and its large investments in ports over the last 150 or 200 years. Those ports really don't play the major role by any means in the New York City economy. Similarly, the Erie Canal, which was outdated very shortly after its opening, but in fact cemented New York as a gateway.

So to the extent that these things ultimately lead to specializations in other kinds of activities, they may have benefits that are very difficult to see today, even if it turns out that Seattle's relationship with the Asian Pacific Rim changes dramatically over the next 20 years.

DR. BALDWIN: Before we go to the next questioner, I would like to read the third and fourth questions we are going to put to the panel, in case we are getting into areas that I am about to ask the panel to address. So the third and fourth questions have to do with essentially what are the policy implications of our present state of knowledge. And fourthly, where should the research agenda be going? So if either any of the questions that are coming here deal with the policy implications or new research agendas, if you could leave that in a minute. Then I will give you a warning that I have only got time for about two or three minutes here, so that we can go on to the

next and then still have time to ask questions at the end of the session -- because we do have to end by 10 o'clock, is that right, for the next set of sessions?

So, for the next question, please?

DR. FRIEND: My name is Anthony Friend. I must confess that I have migrated to your conference from ecological economics and therefore I am sure you can anticipate my question: The question has to do with the use of the national accounts as your data. And I would like to ask the panel how they would reconsider the question of using the national accounts insofar that they are incomplete as a database?

My question has to do with the fact that in ecological economics, as you know, we consider the economy as a subsystem of the larger ecosystem. Therefore, our analysis changes enormously from the basis that we use that as our database, the larger system. We consider the SNA (phonetic) as incomplete insofar as it does not take into account the ecological impacts and effects.

DR. BALDWIN: Thank you, very much. Do heavy users of the national accounts need to justify themselves? Is there anybody who wishes to address that?

MR. POSCHMANN: Sure. I don't want to leave that untouched. My answer, though, and it is going to be a bit of a punt to the extent that if we are focused on the micro-underpinnings of projects, I don't need to rely on the macro relationships to which you would turn in investigating the productivity and growth output. Now as to accounting for ecological impacts of investment growth, that has got to function or, rather, be part of the cost-benefit analysis that governments undertake in choosing projects. But if I am doing the analysis from a micro-basis, I don't need to pursue the broader national accounts question.

DR. BALDWIN: Thank you, very much.

DR. HAUGHWOUT: I will add very briefly that what we are after here is improving welfare. That has got to be what the objective of these public investments is. And so to the extent that there are ecological impacts that have effects on human welfare, those are very important to account.

DR. BALDWIN: Thank you. Last question.

DR. FUJITA: I am Masahisa Fujita from Japan, Kyoto University. And thank you very much, very comprehensive discussion on the impact of infrastructure investment on economic growth.

But I feel that (inaudible) very comprehensive discussion by four members, but I think we are missing some; maybe we might need some new point of view. I think we must make much sharper the question, I think the question the very general, answer the very general discussions, very general.

I think, let me take example: Okay, instead of …I think when we talk about the economic growth, let me take …you are all talking about productivity increase. It sounds like …let me take a … back the impression in a different way: How the infrastructure affects the rate of economic growth? I think, repeat: How does the economic infrastructure investment affect the rate of economic growth in a particular region or a particular country? I think that will encourage the rate of economic growth different from the increase in the productivity, once and for all.

Let me take example, or suppose I know the (inaudible) Africa, country Uganda. Okay, World Bank investment on the irrigation. The increase agriculture productivity, for example, twice, in the (inaudible) but the twice increase, that will happen this year, but it is twice, forever. Now, but suppose let's take action on another example, in the Uganda: They built a small airport, which is connected to Europe.

Now instead of a traditional commodity, they are starting to produce the high-quality (inaudible), a new type of (inaudible), and the village people started to produce (inaudible) which is transported by the Europe, the European market. Now that will develop the environmental in Uganda, in the mountain area, all the village people becoming, trying to be more innovative, and not only making the (inaudible) road is more high quality every year, every bridge, people trying … but they are starting to develop a new spices, all the kind of new agriculture product sending to the airplane to the Europe, and in that way, the growth rate of that village increases tremendously.

I think increasing the irrigation and increasing the productivity twice and the rate of increase and the changing I think will … the rate of increase will increase. We need to ask (inaudible) particular important innovation, broadly defined, how the infrastructure activity impacts on the, affects to the kind of innovation activity. I think that is the … in that way, I think we can make the discussion a little bit more sharper.

DR. BALDWIN: Thank you, very much. Let me have the panel try to address that question.

DR. ANDERSON: I couldn't hear very well, but I think one of the things you are saying is asking the question of how does infrastructure affect innovative activity as opposed to just affecting productivity. I think that it is a very important comment. If you look historically … I mean, if you look at what economic economists have written about the history of railroads and things like that, I

mean, they really emphasize more not so much to what extent did this railroad improve the productivity of activities that are already taking place, but to what extent did the railroad cause some sort of transformation in the economy, some sort of innovative activity, the creation of new industries, making it possible for new things to happen?

There is a difference between doing things you are already doing better and doing new things. And I think that is something that econometric analysis is almost not designed to do because it is looking into the future through the information about the past. But I think it is a very important observation.

DR. BALDWIN: Thank you, Bill. I would like to go on now to the final two questions: The third question was: ***"What are some of the policy implications of our current understanding of the links between infrastructure and growth?"*** I notice both Finn and Jack were restraining themselves from answering that question before we got there. But this gives them their opportunity to worry about the main policy implications. So let me start in reverse, this time, with Jack and Finn, to talk about what they see as the major policy implications that are surrounding or should surround this debate and, I suppose, to what extent has our profession generally provided us with any guidance in these particular areas? Jack of course has written a book, but he is not going to refer to that. (laughter)

DR. MINTZ: Thank you, very much, John. Actually, I will try to be brief because I really want to hear Bill and Andrew, particularly, on what they have to say on this issue. But I am going to focus on one very narrow point, but I think it is an important one. And that is the interaction actually between fiscal rules and the incentive for governments to spend money on infrastructure. This work is based on some paper I did with Michael Smart at the University of Toronto for the World Bank last year. Basically, the puzzle that the bank was concerned about is that in many countries there has been a reduction in public infrastructure spending. And the concern may be that fiscal rules were actually contributing to undermining the incentive for spending on infrastructure by governments.

The more that I see things happening in Canada, the more convinced that there may be something to this issue. The problem is the following: Many governments throughout the world have now adopted either balanced budgets or, let's say, a rule that let's say deficits can be no more than three per cent of GDP, as under the Maastricht Treaty in the EU. It doesn't matter really what the constraint is; the point is that there is fiscal constraint.

Because we do not use capital budgeting for governments, when politicians look at spending money on infrastructure they have this very huge outlay that they make in the current year for benefits that

are not going to be immediate to the voters, but perhaps important for the long run to the economy. And politicians who are interested in maintaining either their power or getting re-elected certainly will put more emphasis on short-term benefit programs than they will on long-term ones. So, under the current approach with the fiscal rules that are in place, plus the political-economy incentive to spend money on short-term fixes, therefore, infrastructure tends to take a second place, or third or fifth place, to other program spending by governments.

The question is how can one fix this? There are some papers done by Olivia Blanchard, for example, and William Buiter in the U.K., of looking at perhaps a different fiscal rule that would create more incentive for governments to spend money on infrastructure.
And what has been often proposed is to perhaps use debt to finance infrastructure spending with the debt itself not being part of the operational budget of the government so that more infrastructure spending would take place.

The question though is that governments will end up putting a lot of things into the capital column to be called infrastructure and be debt finance. So this really gets to what I think is very important, and that is the notion of capital budgeting that governments should be undertaking in order to perhaps create more incentives for the use of public infrastructure.

And John, to just add to your comment earlier, I can't understand how the national accounts will ever measure the rate of return on public capital because we are having enough trouble even trying to understand what depreciation of public capital is in a lot of contexts. But if we can understand the social returns, certainly one of the things that we could do at least is to look at capital budgeting as a way of trying to get around that.

The fiscal rule on the deficits or balanced budgets would apply to the operational budget. You can think of the capital budget as really kind of a budget in which capital is being leased to the government, which financing and depreciation charges would cover the costs over time of that capital. And it could be fully debt financed or one could take a view that you don't want capital to be fully debt-finance it, but instead partly tax-finance it, as well.

Now capital budgeting in my view is that you would have an operational budget in which the operational budget would be charged depreciation and financing costs. And that is not just for new capital spending, but also old capital. Some governments, when they went to capital budgets, just started it with new capital, which was the wrong thing to do.

One needs to make sure that the proper incentives are in place for political economy reasons,

perhaps have a fixed debt-GDP or a fixed capital-debt capital ratio that would put some constraints about how far you can debt-finance these infrastructure expenditures.

The main point though is to try to get around the political-economy problem where, right now, the current incentive is for many governments facing these fiscal rules to delay capital expenditures on infrastructure which could mean a lot to their budgets, instead preferring to spend money on short-term-benefit programs.

DR. BALDWIN: Thank you, Jack. Finn?

MR. POSCHMANN: One overarching observation is that some of the policy stuff that I think is interesting and I think we ought to pay attention to are policy issues irrespective of whether we perfectly understand the growth-infrastructure relationship. The first general area, and one which I referred to earlier, is the role of regulation or, rather, infrastructure in regulated industries.

And here, the issue is about assumptions again. And the obvious examples are electricity, generation and distribution, and in telecoms. These are businesses with network characteristics or arguably are natural monopolies … in most, or many and perhaps most jurisdictions, characterized by price regulation.

These are also cases where technological change has clearly obviated some of our assumptions about what is a natural monopoly or what is the market, and therefore assumptions about externalities that need managing through regulation.

So this has got to give us serious pause, because it was through technological change that we discovered, serendipitously discovered, that local cable service is a competitor in the market for telephone voice services, and both cable and wire line are competitors in the market for data delivery and content. So when dynamic competition, where there is competition for the market, utterly blows away an existing network, technological change has overwhelmed the assumptions that were underpinning the price regulation.

And what this implies is that price regulation in the interim is distorting the provision of network infrastructure. On this point, Canada's federal industry minister announced yesterday a policy of strict forbearance with respect to price regulation of voice-over Internet, clearly an acceptance of the role of technological change. And, in doing so, the minister has overruled the regulator and of course regulators, being unlikely to restrain themselves in regulation. So fascinating stuff going on, literally as we speak. Anyway, clearly, there are policy challenges remaining.

The second one, and I will try to be brief on this, is infrastructure finance. And I really did have to sit on my hands earlier on because this is absolutely key. There are gains to be had from efficient capital allocation and efficient incentives for maintenance spending. Profit motives help a lot in managing these, but there are gaps in understanding. And on this, and I think we all agree that public infrastructure, if it is privately financed should be contracted in a manner that properly allocates risk and financial reward. Doing so, is an art. Choosing a suitable social discount rate is an art. In different jurisdictions we have governments that choose different social discount rates in their models, for quite similar projects. So, if that is true, then somebody's assumptions are wrong.

One aspect is managerial incentives, when there is a risk-reward trade-off in an uncertain contracting environment. So here we have things to learn from the behavioural economics literature and more of the business economists' work on managerial incentives. Another message is that infrastructure and the provision of financing end up being intertwined or influenced by our capacity to write, good incomplete contracts, which you might think of contracts that account for what happens when the unexpected happens. So on the theory of incomplete contracting, the writing referred to here is Bentley MacLeod, now at Columbia.

Finally, on the pricing of infrastructure finance and the appropriate risk allocation, which involves laying off on to a private partner a share of risk commensurate with potential reward, that is a thing of risk to the public sector, that laying-off of the risk. So the question of price needs careful assessment because we assume that private sector debt is more expensive than government financing. But this is wrong, if you haven't properly accounted for the default risk that is laid off on the private partner. So the theory of options is important here. And …

-- END TAPE 1, SIDE B

… into different sources of risk and obtaining the present value of those cash flows on a risk-adjusted basis and summing up those present values. So there is a real challenge. We know how this should be done but can you properly specify the risk and aggregate it, given our state of knowledge (inaudible) data is a different question.

DR. BALDWIN: Thank you, Finn. Still going in reverse -- Andrew?

DR. HAUGHWOUT: Well, I was going to start out by emphasizing the public finance issues, but I think they have gotten a lot of attention. I will boil it down to a simple rule of thumb which is that the benefits should match those who pay. That is the benefit principle in public finance, so that the finance should be set up in such a way as to ensure that the benefit principle is met. That means that long-lived assets should generally be financed by long-lived debt and the future residents of a jurisdiction that just invested in a new school today, down the line, will be helping to pay for the benefits of that new school.

That is easy to say and that is not always so easy to do, I recognize. But that is the sort of principle for that kind of an investment, I would say. The other thing that I would like to emphasize is that what has come mostly out of the literature I would say in terms of policy implications is that we need to do really individual project analysis, that there is no such thing as a good infrastructure policy or a bad infrastructure policy. There are projects that should be undertaken by the public sector because they have a benefit-cost ratio greater than one. There are lots of projects that shouldn't be undertaken, that have a lower-than-one benefit-cost ratio. And there is no substitute for careful analysis of individual projects in making the determination as to which kind of project is which.

Now that kind of analysis should incorporate a lot of things, I think, that it doesn't necessarily incorporate now, when conducted. One is this important dimension of land use and agglomeration. And this speaks a little bit to Masa Fujita's earlier point. That is to say, the kinds of infrastructure investments we make have the potential really quite dramatically affect the economic geography of regions and nations. And those kinds of effects on economic geography are very important in determining long-run economic growth of the kind that Masa was referring to. So that agglomeration benefits, for example, resulting from increasing returns at some level of geography may be enhanced by particular strategic infrastructure investments. Those kinds of benefits which are ongoing into the future -- growth benefits as opposed to level shifts -- those kinds of benefits should be accounted for and thought about in terms of infrastructure investment.

I think about highway systems in the U.S., where the marginal investments are really taking place for the most part on the fringes of metropolitan areas. Those kinds of investments may well be serving to undermine agglomeration economies which have been shown to have their highest benefits in very concentrated geographic areas. So that is a kind of effect that should be accounted for in our benefit-cost analysis, which I think isn't always done right now.

The final thing that I will draw attention to, one last time probably, is that we must include

consumption benefits in our benefit-cost analyses. So the focus here is on economic growth, and that is an appropriate dimension, but there are many other benefits as well. I recall Finn's story about sitting on the train and being stuck there. He said it did lower his productivity. It also made him grumpy, though, and that has made him worse off. That has made all of us worse off. (laughter). That is not going to ever be reflected in the national accounts or in anyone's income, but that is an important effect. We should try to always keep in mind that those kinds of effects are very relevant to social decision making. I will stop there.

DR. BALDWIN: Thank you. William?

DR. ANDERSON: Let me start actually by sort of reinforcing that last point about consumption benefits. One thing that strikes me as interesting, if you look at cost-benefit analysis and the ways those numbers sort of stack up, I mean, most of the benefits are actually coming from benefits to consumers, to households, rather than benefits to firms, in this ex-ante analysis. But in the ex-post analysis, where we are doing the econometric work, we seem to be much more focused on the benefits to firms. I mean, we have to think more about the benefits to households.

But I want to finish with a kind of a general comment about the relationship between theory and where we are in terms of theory, and policy. I think Andrew sort of mentioned this before, but you know, for years, certainly here in Canada, there has been regional policy that has been dominated by infrastructure. That is, in the United States, regional policy is basically been infrastructure investment. The notion being that infrastructure has a positive effect on productivity, and so we have low-productivity regions, we want to give them infrastructure and therefore that is going to lead to a convergence in incomes and things like that.

What some of the new models and the new economic geography are showing is that if we are talking about highway infrastructure it may actually have the perverse effect. It may actually have a negative impact if you improve the connectivity of some of those. There is a sort of a hollowing-out effect, especially if a region is very focused on producing some commodity or something like that, they may actually lose certain types of activities, services, differentiated goods, et cetera.

The whole question I think that is difficult right now is how are we going to convey this rather more complex but probably more realistic world that we are looking at, now, to policy makers? I am sort of a dilettante with respect to this new economic geography, but I have been reading this stuff for years, and I tend to get sort of frustrated because I will say, "Yes, but they can change this assumption and everything comes out different. If you start from a different initial condition, everything comes out different. So this isn't a very good theory because it doesn't give clear

indications of what should happen."

But then of course you go back to your old theory and you keep saying, "Yes, but this stuff is all wrong." And the message is that the world is complicated, the world is messy. And, in this case, I think with those types of theoretical models, really what they are doing is telling us things that can happen rather than just things that will happen.

Now the difficult step is that how do we then convey this to policy makers? Anybody that has had to deal with policy makers in this room, and many of you have, you know you always get, you know, "We want the answer. Don't tell us what might happen and that sort of thing."

Yet there is this sort of a level of complexity with respect to the impacts an infrastructure could have, especially when you are talking about the spatial impacts. I certainly think that if you don't look at the spatial impacts, you are missing an awful lot. I think we have got to get away from this idea of measuring infrastructure as some sort of an aggregate, one single aggregate number, and start to look at the network characteristics and the spatial characteristics and whatnot.

It seems we have a huge challenge ahead of us with respect to making policy prescriptions. We have to rethink the way we give policy advice, because of that.

DR. BALDWIN: Thank you, very much. We have about three minutes left. Mark, do you want to continue with questions? Do you want to end the session? What is your constraint? When does the next session start, 10:30?

DR. BROWN: (inaudible) starts at 10:15.

DR. BALDWIN: At 10:15. I will take one question. The gentleman who has stood up has the floor.

DR. OOSTERHAVEN: My name is Jan Oosterhaven, from the University of Groningen, in the Netherlands. I think we agree that macroeconomic research doesn't tell us where we should invest in infrastructure and what type of infrastructure we need. We also agree I think that there is nothing better than a good cost-benefit analysis, where you want to judge individual projects, which is really the policy issue. But there, we are in problems. We already discussed the new economic geography model. I have been working with those models in the Netherlands. Other European countries are working with those models also.

They are operational now, but the outcomes vary widely. And they specifically are interesting because they add to standard direct, transport, benefit analysis, wider, indirect economic effects by adding market imperfections. But I have heard nothing, and I would like some comments of the panel on urban infrastructure. Like, I think it was Andrew who said most of the impacts are very local and, if he wants to add to a transport model that estimates the direct transport benefits, we want to add market imperfections somehow. Otherwise we do not get additional benefits because the direct benefits just will be passed on, but they will be equally large. There is a well-known problem. So, if you have no market imperfections, you can stick to transport, direct transport cost-benefit analysis.

Within the urban area, there is one big market that is rather imperfect, and that is the labour market. And I think that for the future what we need to do is to build much more realistic labour market modules, both in the new economic geography models, but also in the urban economics models. And I would like some comments of the panel on where they think what to do, what type of modelling we need there, because there may be additional benefits which could be quite sizeable on top of the direct benefit, transport benefits … if you take labour market imperfections into account.

DR. BALDWIN: The question's effect, to come back to it: Do you have a quick comment here on where the research agenda should go?

DR. ANDERSON: I should say, thank God we are almost out of time. (laughter). Yes, I mean, I think the research agenda is to explore all of these interrelationships in some sort of a general equilibrium framework. And I think from a theoretical perspective there has been a lot of progress made in that area. But I think there is a huge step to translating that into the type of research that is going to generate policy prescriptions. So what you are posing is a very, very difficult question and I think it is the main question that, at least those of us that are interesting in sort of multiregional theory, are faced with now.

DR. BALDWIN: Andrew, you of course would agree that the microeffects on labour markets are important to investigate?

DR. HAUGHWOUT: Yes. I think that is a key thing to focus on, general equilibrium models with households in there, making decisions about where to locate, how much labour to supply. We have some models that do that. They are not very rich in public finance, typically, and that is I think a margin where we could really make a lot of progress.

DR. BALDWIN: And I am going to cut off Finn and Jack, who have already told us where they

think the emphasis should go, because it now 10:02. And I am going to thank the panel very much for giving so much thought to this topic over the last several days as they prepared their notes, and for all of you for attending this morning, getting the session off to a great start. And let's give a round of applause to our group here. (applause) As Mark has reminded me, everything continues now at 10:15, in the rest of the rooms. Thank you, very much.

--- END TAPE (90 minutes)

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