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P R O C E E D I N G S

MR. WALLSTEN: Welcome today to this workshop on "Economic Growth, Job Creation and Private Investment." We're actually going to be speaking a bit more broadly, the workshop is going to be broader than that, looking at lots of the effects on broadband on the economy in general, on IT and productivity, wages and other issues. We have a really nice panel here today.

I am Scott Wallsten. I am Economics Director for the Broadband Task Force or as Google Voice transcribed in the voicemail offering me the job, I'm the Condiments Director. They're still working on that technology a little bit. We also have moderating with me Don Stockdale who is the Deputy Chief and Bureau Chief Economist for the Wire Line Competition Bureau, and Jonathan Levy who is the Deputy Chief Economist for the Office of Strategic Planning and Policy Analysis, both of whom who are great economics and I've learned a lot and look forward to working with them.

I'll introduce each person quickly just

before they speak, and I encourage you to read their bios because it is a very impressive panel. First we have Jim Prieger who is an Associate Professor of Public Policy at Pepperdine and just finished spending a year here at the FCC as a senior economist. He specializes in regulatory economics, industrial organization, applied econometrics, and has written many, many articles on lots of issues of broadband and also writes more broadly including issues such as cell phones and driving and the effects of the Americans With Disabilities Act on retail firms. So if you have any question about economics, come see him afterwards. Jim?

MR. PRIEGER: Thank you very much, Scott. I want to thank Scott, Don and others at the Commission for this opportunity to come back. In some ways it feels like just coming back from my August vacation being back at the FCC.

I asked to speak first because what I'm going to do is try to provide a bit of an overview on the topic of today from the standpoint of

academia and academic studies that have been done that hopefully will be useful to set the context for what we'll be looking at.

I wanted to start by looking at macro approach that have been taken to measuring to a lesser extent employment, most of what I'll talk about today with have to do with productivity studies. The smallest literature is that that deals with broadband in particular. Stepping back, many more studies have looked at ICT, information and communications technology. And then there's a middle set of studies that have looked at communications more broadly than just broadband. Most of the results that I'll mention have to do with ICT because to be honest there are very few that look at broadband specifically, but many of the same issues pertain so this will still be useful.

These studies disaggregate to different levels this way, but regardless of the type of study that they are, there are two main approaches. The first is to do a traditional

growth accounting study and this is just the economist's version of an accounting exercise where you try to disaggregate the sources of growth, productivity growth in this case, into growth of capital, growth of labor, growth of other inputs, and in this case broadband is treated as just a specific type of capital, or ITC more generally is treated like one type of capital that you look at. Or you can do an econometric study and take as a dependent variable productivity growth, regress on a bunch of different things, look across countries or across sectors and do a macro type study. Regardless of which type of study is one, at this point the effects of ICT and broadband do show up quite strongly. It took a while for it to happen. There was a productivity paradox that listed until the mid-1990s. But since that time there is an unmistakable relatively large impact.

To give one example from one study, I won't talk about a lot of specific studies this morning, finds the boom in the late-1990s years,

three-quarters of the labor productivity growth, in other words, 1.8 percent of the 2.5 percent growth rate was due to ICT, which is a very large amount, maybe too large. It makes you wonder. In the early-2000s that number drops down a bit but it's still very large. But the key here is that ICT is an enabling technology. It makes people do what they do better, faster and cheaper, so that these impacts should be there and they do show up.

Just as a warning, growth is always of course a win-win situation. Part of the growth at the macro level might come from less productive firms being forced out of a market which makes room for more productive firms to come in, so you always need to keep that in mind when you're looking at aggregate numbers. The other thing that I want to emphasize this morning is that there is a lot of heterogeneity in the impacts, whether you're looking at one sector versus another, one country versus another, and later on as we'll see one firm versus another, results may vary, that past performance is no guarantee of

future results. It's not just dollars spent on ICT that matters, so as we think about measuring impacts of the National Broadband Plan, of course we're going to have to do more than just measure the amount of inputs that we've put out there, and I will turn to this in a moment, because there are certain intangible factors that matter a lot.

Those are macro studies. You can also do microeconomic studies, and in some ways you can get more out of the data if you have firm level data. With firm level data it's always a bit tricky in the United States, and in general I'm not in favor of looking to Europe to take our lead on these matters, but it is interesting to compare the data collection efforts and the differences there. The European federal data effort, Eurostat data of well over 100,000 firms, they have plans to grow the survey, to grow the sorts of questions that are asked, and they ask many different questions on many different things to do with ICT use and broadband in particular. It's a very good dataset and we should expect to see some very good

studies coming out of there. The U.S. Census does a bit less at least with what I could find. They survey to find out what firms are spending because they want to get this into the National Income and Product Accounts, but they don't have anything on uses, what they're using it for, how they're using it or what the results might be. More could be done here of course.

As with the macro studies, there are generally positive results when you look at the impact of ICT on firm performance, but there are similar issues with these firm level studies that you need to be careful with. Again, heterogeneity and the impact is the norm. Things can be very different across firms. It matters very much in which countries you might be looking for example. There is a problem potentially endogeneity which is just a fancy way of in this context saying what type of firms adopted broadband? It's going to be the ones who are going to get the most bang for their buck that adopted it first. So if we only look at studies that have those sorts of firms in

the sample, you'll get large numbers of the impact of broadband, but you might be able to extrapolate that reasonably to the next round of firms or the subsidized round firms that take up broadband. So that becomes important.

Then intangibles become important. Let me talk about what these are instead of just bandying that term about. For example, human capital, education and training. We all know that if a new computer program or a new technology is plopped down onto your desk without any instruction or notion of what it could be used for or how it might help, it will just sit there. The same is true of course with technologies such as broadband. But it's more than just that. There is whole new substrand of the literature on the complementary investments that have to take place. In other words, broadband needs to be used and coupled with changes in perhaps how the firm is organized for it to be made use of. Just one quick example. Broadband enables collaboration across firms and inside and outside of the firm.

Will the firm's organizational structure allow that sort of collaboration or are you siloed into different units that don't get to talk to each other or aren't encouraged to talk to each other? And competitive pressure has been found in these studies to be important to get the maximum gains out of the new technology. How flexible is your labor market? Is it liberalized? In the European context that becomes a question because productivity gains might come from doing more with your workers. Are you able to do that? That's a question. That's one of the reasons why Europe has probably lagged the United States in productivity growth.

Implications? Why do these factors matter? What it points out is that broadband is not just a Band-Aid that you can slap onto an ailing sector, an alien market or an alien economy. It has to be used intelligently and in conjunction with other things. A good example of this, this is not a panel about education but just to use an example of U.S. schools, schools provide

an example where most of the intangibles work against having broadband make an impact, for example, lack of ICT competency. It's not what most of the teachers may have been trained in or trained for. Training for the teachers might not be funded. They might have rigid organizational structures or might be if there is a lack of competition or a lack of flexibility in adjusting labor. As recently as a decade ago a government panel reported to then President Clinton that, "The history of ICT in schools was a 20-year story of unambiguous failure." I think things have gotten better since then, probably a lot better since then particularly with funding for broadband for schools, but the point is that you can't just measure an impact of broadband, slap it onto a new firm and expect all these things to change.

Two minutes left so this is good. Very quickly on employment. I'll say much less here, but I just mention there are lots of employment numbers being floated around in policy circles that I noticed in the past year about the impact

of broadband and some of the other workshops here have even talked about that. I'm a little unconvinced for the following reasons, unconvinced about the exact numbers, not that it can have an effect on employment. For example, it is really hard to say what caused what. You see broadband growing in an area, you see employment growing in an area, to assign causality one of those to to the other is always tricky. It's a hard thing to do. I haven't seen that really nailed down in a convincing way yet in studies, not to say that it can't be done. There is also the question of mobility of workers. If town X deploys a lot of broadband or ICT and attracts workers away from neighboring town Y, from the state's point of view is that necessarily a good thing? You would need to think about that.

The other issue is when you have more productive workers because they have more ICT and broadband to work with, in general, after that transition is done if you still have a job, that theory suggest that's a good thing because your

marginal product has risen and your wage probably is higher now, but the firm might be able to do more with fewer workers so it's not clear. There are a lot of things going on there. Just very briefly, there is the whole globalization question. Senators from rural states often like to wax eloquent about how broadband can help their rural workers into urban workforces through telecommuting and so forth, and that's fine, but why rural India and not rural India? Once you break down that distance barrier, that barrier is down. So again not to say that there aren't good impacts on employment, but that it may be a little bit more complicated than sometimes we think.

Let me close with one suggestion per second for the National Broadband Plan. More data is always better, and I realize that firm level surveys are probably not what the FCC should be doing, but this is the National Broadband Plan and not the FCC's Broadband Plan, so we can get Congress involved here to fund a census. We have a great chance to evaluate firms who are getting

funding for example under the BTOP program. It's not a lab experiment by any means, but it has some element of an experiment since these are firms that otherwise presumably wouldn't have gotten the funding to do what they were going to do so we can evaluate that. My suggestion for the analyses is here at the FCC hopefully you can be freed up to do good, empirical analysis where the conclusion is going to come from the data and not from other quarters. And external analysis is always good. Partner with academia. There are professors across the nation with graduate students who would love to get the data to work on this sort of stuff and can help you out a lot. Thank you very much.

MR. WALLSTEN: Thanks, Jim. I also forgot to mention that if you have questions you should write them down on a card and give them to Carrie-Lee Early who will collect them.

Our next speaker is Brent Goldfarb who is an Associate Professor of Management and Entrepreneurship at the Robert H. School of Business at the University of Maryland. He

studies issues such as production and exchange of technology differs from more traditional economic goods, national innovation systems and the relationship to firms and policies.

MR. GOLDFARB: Thank you, Scott. I'm going to use my time to talk about broadband as what we call a general purpose technology and this is going to echo some of the thoughts and maybe unravel some of the things that James was talking about.

The original thought about a general purpose technology is that you have some underlying infrastructure technology that is both pervasive and enabling. One thing about broadband is it's very close to saturation or it's going to reach saturation soon, so it is certainly pervasive, and it is also, most importantly, enabling. And the one thing about enabling technologies is it is a priori quite unclear how they will be used throughout the economy, so I'm going to quote Nathan Rosenberg in his article about experimentation and this will get at the

core of my little talk, "The freedom to conduct experiments is essential to any society that has a serious commitment to technological innovation or to improve productive efficiency. But the interesting part, the starting point, is that there are many things that cannot be known in advance or deduced from some first set of principles. Only the opportunity to explore alternatives with respect to both technology and to form and size of organizations can produce socially useful answers to the bewildering array of questions that are continually occurring in industrial and industrializing societies." By way of example, this is an early advertisement from CompuServe circa I believe the late 1980s. What you see is a couple and the couple is excited about how they sent a bunch of emails to their friends and they called it a party, and they only had one glass of wine to clean up. This is early experimentation not in broadband but certainly in Internet connectivity. Here are some examples of broadband experimentation from today. Most of

these are the big successful ones that you may all recognize, Google and Facebook are number 1 and number 3 in terms of time spent on Websites, Orange is banking, Netflix is there as well as Major League Baseball -- as Internet video providers, Major League Baseball is the largest in terms of revenue today -- and of course I put in WebVan which was an Internet grocer that blew through about a billion dollars, to point out that many of these experiments, in fact most of them, failed.

The experimentation is in a broader range of things, in technologies of course, how do we exploit this broadband capability, but importantly, in products and services what are the offerings of the companies; importantly, business models and how do we monetize the offerings; organizational forms, given that we know what we want to sell, how should these firms be organized; and of course, implementation strategies.

How would we know if we are succeeding in managing the ecosystem in the sense of

encouraging experimentation? Another way to rephrase that is how do we know if barriers to entry are low enough so that new firms and new experiments can be conducted to try to exploit this broadband capability? One way is, this I pulled off of TechCrunch which for its own motives keeps track of the ecosystem of Internet firms. In the upper left you see new firms that have been founded in the last few weeks, in the upper right what you're looking at is venture capital funding of new firms to the tune of about a billion and a half dollars a month, and in the bottom right you see acquisitions which represent successful exits which generally reflect successful experiments in the broadband space. So these are new services which have reached a point where they have attained enough value that somebody would like to buy them as a business.

Measures of the number and outcome of experiments, one thing that we might do is we might keep track of this broadband ecosystem so that we could know is broadband policy

successfully allowing entry and experimentation in this space. This is an example. So far we're doing pretty well. What you're seeing here is each one of those numbers is the number of broadband based companies in that one area. This is of course the San Francisco Bay area which is the center of this, but this is a national phenomenon. There is experimentation happening all over the country and indeed all over the world.

One interesting thing is that most broadband traffic is not related to this experimentation in the sense that our infrastructure currently is sufficient for the vast majority of these experiments. Just to point out, this graph shows us the share of Internet traffic based on different protocols. The green line which is increasing from about 2000 to 2006 in this graph is peer to peer. The green line is essentially movies and music peer to peer, and probably generally most of it is illegal. So these traffic measures are imperfectly related to

the experimental ecosystem and we should not be confused by them. The second point that I wanted to point out is that experimentation generates big winners and big losers and when you have big losers especially when they're incumbents they have very strong incentives to try to maintain the rules best to their advantage. As an example, peer to peer appears to be killing the pay for music model, and of course you need only to be alive to see the activities of the RIAA in trying to prevent the end of their business model. Google and Craigslist plus zero cost publishing are killing the newspapers' advertising models and ending newspapers as we know them today. Wikipedia killed Britannica, helped out a lot by Encarta and Microsoft. Online video is on its way though it's earlier in the stages of killing television, and voice over IP and cell phones of course had led to the demise of landlines.

This leads to two things. The first is that you might note that broadband providers generally bundle video content, cable and voice.

If that is true, then the providers have incentives to leverage control of broadband provision to restrict competition particularly in the video space and the telephony space. I have no evidence of this. This is just kind of a thing that we should be aware of and keep track of carefully.

I'm not going to use all of my time. To conclude, to enable economic growth, broadband needs to enable experimentation. Another way of saying that is we must make sure that there are no barriers to entry in the provision of broadband and its use most importantly. So far we're doing a pretty good job at this as best as we can tell. Most Internet traffic is file sharing and associated with only a small share of these experiments. So the vast majority of the use on the Internet and the traffic is associated with file sharing. Yearly measures of the broadband ecosystem would be informative. So if we had a sense of how well our broadband policy is sustaining entry into this space over time, that

would be very useful. And broadband providers face incentives to restrict certain types of traffic and in turn certain types of entry. That's it. Thank you.

MR. WALLSTEN: Thanks, Brent. Our next speaker is Ryan McDevitt who is a lecturer in the Department of Management and Strategy at Northwest University where he is also a Ph.D. candidate. In addition to his work on broadband and GDP, he has also worked on the relationship between market structure and firms' ability to send quality signal measures and pricing strategies. And he has also worked on market structure and how market structure affects venture capital decisions to specialize.

MR. MCDEVITT: Thank you very much. I'm delighted to be here to present some of my research that's joint with Shane Greenstein also at Northwestern University. The motivation for our paper is fairly straightforward. We've interested in measuring the economic value that has been created by a new good, and the new good

in this case is obviously broadband Internet. I think straight away you can see why we might be interested in selling such a product practically speaking that has become the primary means by which households are accessing the Internet, and I think intuitively a lot of people latch onto the fact that has become a very popular technology, it's affecting our lives in many unforeseen and unspeakable ways, there must be some great economic value associated with this. So our primary objective is going to be to somehow measure and place bounds on the value that's been created that is coming directly from broadband Internet. In this sense it's going to be complicated by the factor that experiment is replacing an existing technology, in this case dialup Internet which many people who have switched to broadband had experience with before they crossed over. So to properly account for the gains that should be accrued just to broadband, we also have to be very careful in measuring what would have happened in lieu of broadband. In this

case, many of the gains were already brought forth because of dialup, so it's going to complicate our analysis. There have been many previous estimates of the value of experiment Internet, but we just weren't fully satisfied with the methodologies put forth in those papers because we felt they weren't being extremely careful with applying economic principles in actually measuring the gains.

So in our paper we're going to be very precise about how we measure economic value that is created by broadband and we're going to focus on two primary measures. The first is revenue growth. It's going to be very specific in that it's GDP growth in excess of what would have occurred in the absence of experiment technology, and in this sense we're going to focus on essentially opportunity costs and say the gains that should be attributed to broadband are in excess of the next best alternative and in this case we're going to focus on dialup.

In addition, we're also going to attempt to measure consumer surplus which is simply

compare what a consumer would be willing to pay for a technology such as broadband to what he actually does have to pay, and this difference is going to be accrued to him in the form of a surplus.

To jump to the main results, we find that in 2006, we studied the period 1999 through 2006 in our paper, about $22 billion is generated from broadband, but this is very much different than what we contribute to created value, and here we assign then umber of only $15 billion, where $8-1/2 to $10 billion of this is new revenue generated by broadband suppliers, and the remainder, $4-1/2 to $6-1/2 billion, goes to consumers in the form of surplus. Also an implication of this is that the price indices for broadband have actually declined about 2 to 2- 1/2 percent which is different than the actual official numbers which have been very flat through this period which was somewhat of a mystery because when you see this mass adoption, usually that's concurrent with a dramatic reduction in

price to spur this adoption, we didn't see this in the official numbers and part of the reason was we just weren't measuring the consumer surplus properly. What's going to jump out from this page I think to most people in this room is that these numbers are drastically lower than numbers you commonly see in projections of the economic value created. Usually they're in the range of hundreds of billions of dollars, conservatively we're at about one-tenth of that at best. There are two to three main reasons for this. First, we're very careful about measuring what broadband is actually generating. We're going to be very careful to assign to the different buckets which ones should go to broadband and which one would have occurred with dialup anyway. So if you can think of two sides to the same scale, as broadband becomes comparatively more popular, dialup is becoming less popular, we can't attribute that whole left side just to broadband because we're losing dialup in addition to that so that the aggregate is not changing nearly as much as we would suspect just

from looking at the numbers from broadband.

Secondly, we're not going to worry about externalities such as people have a better user experience on Amazon so they buy more books and this would be attributed to Amazon, instead we're going to focus just on what we can specifically measure. But in our defense, I think one of the nice features of this methodology is that we are not exactly missing this externality because as Brent just showed in his slide with all these disruptive technologies were coming directly at the expense of offline bricks and mortar retailers, so book sale at Amazon probably came at the expense of an offline Barnes & Noble, so we can't properly attribute all those gains just to broadband and what's going to Amazon.

Finally, our numbers are going to be grounded solely and exclusively on historical facts and numbers. We're not going to take a base year of 2006 and extrapolate forward from that which would also serve the magnify the gains from broadband because we're taking the highest year

and extrapolating an exponential growth rate. So we're just going to focus on historical numbers, and this is again going to diminish the economic gains occurring to broadband.

To drill deeper and to show you how we calculated these numbers, we have the two sides. One is suppliers. From revenue, they're losing about 50 to 60 percent of this in cannibalized sales of dialup and second phone lines. As users switched over from their dialup service to broadband, they were dropping a service they probably paid $20 for in terms of dialup, many people had a second phone line so there's another $20 dropped, so a lot of times this is going to be completely offsetting in terms of measuring GDP, and because of this it's going to serve to pull down the actual number that we should put for broadband. This number is going to vary with the assumed price for broadband. We have somewhere between $36 and $40 in our paper, and obviously it's going to shift the line a little bit depending on the assumptions. We should be clear

up front that this is not a measure of profitability for firms, but this is just simply a revenue number. We don't have any estimates of the cost to deploy broadband to households, and because of this all we say is this is revenue. But put differently, also our estimates don't imply that the firms that are supplying broadband would be losing quite a bit of money, that they're within a reasonable ballpark, so we're very confident with the numbers that we shouldn't see all these firms existing based on our numbers.

On the consumer side, we're going to measure surplus, and again you can think of it as just the revenue underneath the demand curve, the area there. To estimate this we had to look to a summary measure of consumers willing to pay, consumers are notorious for not telling companies exactly what they're willing to pay for their product, so instead we have to go out and get a survey measure. We're used the number from Savage and Waldman's 2004 paper. They estimated from their survey that users who had experienced dialup

were willing to pay about $26 more pre month to buy broadband and that number was higher because they value broadband more for its speed, its reliability and it's always on. So to back into these numbers, an average person is spending $20 on dialup, he is willing to spend $26 more on broadband, so about $46, he only pays $40 for the broadband subscription, so he gets to keep the $46 minus $40 with a $6 consumer surplus to himself. This is an economic gain for an economist that should be measured as a utility, it doesn't show up anywhere in the GDP numbers, so this is going to serve to increase the contribution of broadband because we're accounting for the consumer surplus. In doing so we are not able to look at different elasticity of demand among consumers. You can think of a teenage girl who is always on Facebook and Twitter. She probably has a much higher willingness to pay more than $46 a month, we're not factoring that in anywhere, so again we're probably at a more conservative estimate. Also this survey is from 2002, and as our experience

has shifted and we now value broadband comparatively more, we will probably a little bit higher willingness to pay of we redid the survey today which isn't quite so bad for our paper because we stopped at 2006, but I think if we wanted to extrapolate the out years of 2007, 2008 and 2009 and we would want to get an updated to be comfortable with our results.

Now to jump to the implications of what the numbers in our paper would mean for some policy discussions, if the whole value across the country is $15 billion, this doesn't bode well for a cost-benefit analysis of deploying the last mile of broadband out to rural areas. If you think of a kind of Cash for Clunkers stimulus and we have a Broadband for Boondocks equivalent, we're not very optimistic that if we're only giving $15 billion as a nation that $1 or $2 billion to roll out new technology to rural areas is going to be very effective in terms of contributing to the gross domestic product especially in the sense that we have these alternatives such as dialup which many

users already have experience with and so that we feel that the firms that provide broadband have already revealed that these aren't probably the most cost-effective areas, they have very detailed and sophisticated cost analyses and likely unwillingness to pay, so any subsidies that are going directly to rural households are going to come at the expense of not being offset by drastically increased benefits for households. And I want to again point out that this is just an analysis of households and we're not looking at businesses, and this is just the U.S. And especially as we think of new technologies and innovations coming online in the next five or so years, we think that probably a better situation would be to wait and to let the more cost-effective technologies come into place here.

Finally, I want to plug some future research. If you are interested for the U.S., Shane and I are currently working on doing similar analysis for other nations, and you can look for that later this year if you're particularly

interested. Thank you.

MR. WALLSTEN: Will that paper be done by the end of this panel? Thanks. Our next speaker is Chris Forman who is Associate Professor in the Robert Associate Professor and the Robert and Stevie Schmidt Term Professor of IT Management at the College of Management at the Georgia Institute of Technology. His research interests include adoption and returns to IT investment among business with particular interest in the role of geography, and standards on the value of IT infrastructure investment, and he also studies innovation in the IT and software industries and electronic commerce.

MR. FORMAN: Thanks, Scott. What I'm going to talk about today is a specific study about the use of broadband, and specifically what I'm going to talk about is did the diffusion of the Internet among businesses contribute to convergence or divergence in wages across locations in the United States. What we mean by convergence is that locations with high income

have lower rates of growth, and by divergence we mean those with high wage levels already have higher rates of growth, and there is a lot of anecdotal evidence to support either view, but not a lot of statistics. What we're going to do is we're going to combine a dataset on IT investment in advanced Internet like e-commerce among businesses, combine that with BLS data on wage growth and compare how changes in Internet between 1995 and 2000 is associated with changes in wage growth across counties in the U.S. so that this is a local level study. We proceed in two steps. We measure the average relationship between Internet and wage growth across all counties and we're going to establish some kind of link. We're going to show that there is an effect although it's economically quite small. We worry a lot about some of the causality things that James talked about earlier. Then we also examine whether Internet investment led to faster wage growth in high- or low-income areas. I'm not going to spend a lot of time talking about the specific

regression model other than to say that this is what we do. We look at how changes in advanced Internet among business is associated with changes in wage growth, controlling for local demographic characteristics, and then do the same thing again looking to see whether that wage growth is fastest in high income, high education, high population and high-IT-intensive industries to examine whether the benefits of advanced Internet among businesses is greatest among regions that are already doing well along a number of different measures.

The IT investment data we use is from a private survey, one of the best available. It has data on 87,000 establishments on advanced Internet use along with a number of other dimensions of IT use. We aggregate this to a little over 27,000 countries and drop about 300 where we don't have any data on Internet investment mainly because these are locations that are very, very low-density and there is not a lot of investment data. We combine that with local wage data from

BLS from the Quarterly Census of Employment and Wages, and then also to control for changes in demographic characteristics, collect some data from census and a variety of other places within the government.

The basic story can really be seen in two pictures. This is a graph of changes in Internet use at the county level on wage growth and this is the average relationship between Internet use and wage growth. You can see that it's upward sloping but the slope is really quite small, so that there is a statistically significant effect but economically it's really quite small in our data when you look across all counties. However, if you take the subset that have high-income, high-education, high- population and have a high fraction of IT-intensive firms, you can see the relationship is quite different. Among that subset of firms, there is actually quite a strong statistically and economically significant relationship between Internet use and wage growth. Again, these are among the locations

that are already doing well along a number of different dimensions. That is some descriptive evidence. We then do some more careful statistics first to establish that average link between investment and advanced Internet and wages, and then to see how that relationship differs among counties that are already well-off. If you look at the average relationship, again the effect is statistically strong, but economically relatively small so that average levels of Internet use are associated with.24 percent in wage growth among regions with no Internet use, a one standard deviation increase in the use of Internet, and associated with about a.33 percent increase in wage growth. So these effects are statistically significant but economically not large. Over the time period which is again 1995 to 2000, average wage growth is about 20 percent, so Internet use is explaining relatively little of that.

We go through a number of statistical exercises to worry about some of the causality issues that Jim mentioned. I don't want to spend

a lot of time on those now. Perhaps we can take those in questions. One thing we do at least is to examine whether Internet use is associated with wage gains prior to 1995, prior to the diffusion of the Internet, as sort of a falsification or sanity test, and there is no evidence that that is the case.

The next thing that we do is we examine in what location Internet use is associated with wage growth and we find that advanced Internet is associated with wage growth in high-income counties and high-education counties, and also those with both high income and high education. Of course, there is a pretty strong correlation between those two groups. Probably one of the main takeaways from the paper, however, is the association between advanced Internet use among businesses and local wage growth is strongest and primarily concentrated in what we call these high-all-factor counties. So these are counties again with high income, high education, high population and a large concentration of

IT-producing and IT-using firms.

How much can we explain along those metrics? If you take those 180 counties that are all-factor counties. Their wage growth over our sample period is 29.2 percent versus 20.5 percent for the rest of the counties in our sample. For this all-factors group, advanced Internet is associated with 2.5 percentage points of total wage growth. To put it another way, advanced Internet use among business explains one-quarter of the 8.7 percentage point difference between the 180 all-factor counties and the rest of the counties in our sample.

Just to conclude, I probably also won't use all of my time, the use of advanced Internet technology is associated with local wage growth again looking at the county level. However, it looks like the relationship is isolated to particular locations, those that have high population and in which high-IT production and use are concentrated, and those where income and skills were also high. Specifically, advanced

Internet use explains about a quarter of the difference in wage growth between those counties and the average county in the U.S. and we see little evidence of growth from Internet use outside of urban areas. One thing I didn't spend too much time talking about is there is relatively little evidenced that advanced Internet is associated with growth in either employment or establishments, so our results are isolated or concentrated in the wage growth results. With that, thanks very much.

MR. WALLSTEN: Thanks, Chris. As a fellow economist, I make this next comment with all due affectionate respect. We move from now the academics to people who have real jobs. Our next speaker is Ralph Everett who is the President and CEO of the Joint Center for Political and Economic Studies which is a think tank that focuses on the concerns of African Americans and other people of color. Prior to starting that job in January 2007, he worked for 18 years specializing in telecommunications and transport

policy as the first African American partner in the law firms of Paul Hastings Janofsky & Walker.

MR. EVERETT: Thank you very much, Scott. It's a pleasure to be here and I would like to first thank the panel for convening this important workshop. As you said, I'm Ralph Everett and I'm President and CEO of the Joint Center for Political and Economic Studies which is a public policy research institute that for the last 40 years has spent time focusing on issues of concern to African Americans and people of color. Our historic mission has been to develop research and policy initiatives aimed at helping our communities obtain the knowledge, the political strength and the economic might they need to improve their lot in life and to give their children opportunities that they did not have themselves. That's why I'm here today because broadband goes right to the heart of this. In fact, broadband's deployment, access and use is so important to us at the Joint Center that we recently created a Media and Technology Institute

to focus on this and other related issues.

As you know, broadband has become a vital part of American life. It impacts how we live, how we learn and how we earn. So it's increasingly an important factor in determining whether or not someone will be successful in life at all. But yet, only a third of American households have no broadband and they have dialup or they have no Internet connection at all.

My first gives one example of why that matters. A well-known 2007 Brookings Institution report projected that for every 1 percent increase in broadband penetration in a state, employment would rise by.2 to.3 percent a year in an increase of 300,000 jobs. Another study says that a mere 70 percent increase in broadband access has tremendous economic impact, 2.4 million jobs per year, and as you can see on this slide, billions or dollars in direct economic benefit. Simply put, broadband means jobs and communities need jobs.

On the next slide, here are some results

from a study performed in California 2 years ago by Sacramento State University. It makes a direct link between broadband growth and the growth of economic indicators, new business ventures, new jobs and payroll growth. Most notable is the finding that increased broadband use contributed to about 52,000 of the 281,000 net new jobs created in California in 2005 and that's about one-fifth of those jobs. I look at these results and I can't help but think what broadband deployment could do for what are now broadband-deprived communities, and these communities tend to be communities of color whose residents face tremendous barriers to employment. In some cases they do not have the basic skills to be competitive, in some cases their children go to substandard schools, and these communities also tend to be socially isolated from the mainstream. You see the numbers before you. There is higher joblessness amongst African Americans, massive joblessness amongst black teens, but let me focus on the fourth bullet on this slide: African

Americans remain at an all-time low in broadband adoption. I really see a connection here. When you have a communities in which access and a culture of broadband use is not supported, then you can see why there are some economic problems that persist.

But I also see a way out of this, and it can begin with the National Broadband Plan, on economic growth, on job creation, on private investment, all sorely lacking in our communities of color, and broadband I believe can actually provide a breakthrough in our communities. As you craft the FCC's plan, I want you to think what can we do to give these communities a fighting chance to survive and recover. We are the Joint Center stand ready to help you, and we are actually working now to gather and analyze needed data and other information that can be of help in determining exactly how broadband deployment can bring economic and social progress to areas of our country where progress of any kind is just a dream, and we want to be able to help you develop

the evidentiary record which our policymakers can craft that can help these communities move forward to a brighter day.

Let me conclude with some specific recommendations that you see on the slide in front of you. First, we feel that the plan should call for integrating broadband infrastructure and revitalization plans of urban and rural communities. For example, empowerment and enterprise zone initiatives to require broadband infrastructure to be integrated into municipal and community plans and providing incentives for broadband deployment through other community development programs such as tax increment financing and industrial revenue bond financing for nonprofits. Secondly, you should call for tax incentives to spur broadband deployment by the private sector and to migrate new business ventures to some of these low-income communities. When you have broadband in distressed communities, vacant lots can become homes to call centers and other service industry businesses that require a

broad connection of phone lines and workers. On the final slide, you ought to focus as well on raising awareness and access to broadband for deskilled and underemployed workers. In other words, let's bring broadband to these communities and then help local residents get online and begin to benefit from their access to the digital world. It begins with teaching how to use email, how to get information from the Web and how to use important applications that can change their lives, with online job matching services, for instance.

Finally and importantly, as we seek to expand broadband deployment in unserved and underserved communities, it's very important that we support minority- owned businesses. Minority business owners represent a tremendous opportunity for us to bring economic progress to communities particularly through their participation in broadband deployment and operations. These businesses tend to hire minority workers, thus creating a positive effect for the local economy.

And today more than ever we need to understand how to leverage broadband as an economic development tool. Broadband can be a key to whether communities live or die, and it can deliver hope to communities where opportunity is really fleeting. To make this happen we need data, we need ideas, we need a spirit of collaboration and a policy framework to achieve these goals. We at the Joint Center look forward to working with the FCC and others to bring all this together. Thank you very much.

MR. WALLSTEN: Our final speaker is Tom Wheeler who is currently Managing Director of Core Capital Partners. He's been working in telecommunications issues and telecommunications policy for nearly 30 years. Most recently he led the Obama-Biden Transition on Science, Technology, Space and the Arts, and has been an entrepreneur in pretty much every aspect of the communications industry that I can know of. Tom, please go ahead.

MR. WHEELER: Thank you, Scott. It's a

privilege to be here and to be with this august panel. In case Scott had skipped in his introduction that I'm a venture capitalist, I'm the guy without the tie. I've been asked today to address the question of whether or not broadband has an impact on the investment decision making of venture capital, and the answer is most assuredly yes.

It is particularly true for a firm like ours, Core Capital Partners, because what we invest in are IP- based companies, Internet protocol-based companies. It is just simple that the better the distribution, the greater the opportunity in IP for the development of new companies with new ideas. I think it is intuitive that this affects other areas of venture capital such as biotech and other such things as well, but because the ability to move data is integral to innovation, broadband IP means growth in opportunity because it is forever creating new ideas, new opportunities because of its nature as an iterative and compounding technology.

What do I mean by that? IP is iterative in that it spawns additional ideas, additional vision, additional companies that improve on and refine what the status quo is. IP is compounding because every time something is built, it creates the opportunity for something else to be built on top of it. So we invest in IP because we believe that IP is the growth engine for the technology economy.

We also believe that nothing that IP has ever touched has avoided being transformed by that event. IP is more than delivering O's and 1's. It is about delivering data in a format that can be used for other purposes, and new companies leveraging the iterative and compounding nature of IP need to have the ability to move those apps around, period. Sure, a lot of the innovations take place and can be contained in a datacenter, but they will have a broader economic from the broader application of the ideas as distributed by a broadband network.

But I think there's a bigger answer to

the question that has been posed here today, and that is that connections have consequences, and that throughout history, network links have defined economics and because they define economics, they have defined the way people lived. In a broader scope, we are as we connect, and broadband IP is reshaping the patterns and traditions of the last network revolution, therefore changing that economics that we exist in today, and therefore changing the way we live.

The first high-speed network was the railroad. It was the original death of distance. Since the beginning of time up until the railroad, animal strength and stamina determined the ability to communicate. The historian Jacques Barzun has a quote that love where he calls the railroad "the completest change in human existence since the nomadic tribes became rooted in one spot to grow grain and raise cattle." This network created the scope and scale economies that defined the 19th and the 20th centuries, and that are the basis of the things that broadband IP is taking us out of

now. It destroyed the distributed self-sufficiency economy and created a centralized economy of masses and materials being delivered for mass production and then shipped out to a mass market, and it defined our urban geography as a result. It also shaped telecom because the telegraph followed the railroads' topology, the telephone followed that, and it even stole their terms, switches and trunks. Those are railroad terms.

But why am I talking about history at a forum that is supposed to be talking about what the future is? Let me tell you a story. Chicago is called the Second City as you all know. Why is it the Second City? In the beginning of the 19th century, the Second City in America and access to the west was St. Louis. St. Louis was located on the western side of the Mississippi River. The rail lines to the East Coast markets were located on the eastern side of the Mississippi River. The city fathers of St. Louis refused to build a railroad bridge across the Mississippi so that the

network of the day could connect the source with the market. The city fathers of Chicago at exactly the same time illegally built a railroad to connect with the new line coming out from the east, and by 1861 there were 100 trains a day in and out of Chicago and St. Louis was still arguing about whether they should build the bridge. Distributed broadband IP is the greatest change to how we connect since steam on steel. Is there economic growth? I say look at history. Look at the history of the last network revolution, and we are talking about the network revolution that will build tomorrow.

But I think one of the other lessons of history is that build it and they will come exists only in Iowa cornfields on the silver screen, that in the Chicago story, for instance, the reason why they could build that connection was there was demand to wed the western range production with East Coast consumption. There was demand for the network. Let me give you a more recent and personal story. Years ago when Steve Case was the

CEO of AOL I was sitting in his office and he turned to me and he said, "Didn't you used to be president of NABU?" I said, "Yeah." NABU was delivering data at T-1 speeds in 1985. We were called the Home Computer Network, and Steve at the same time had a business down the street called Quantum Computing where he was delivering at very slow speeds. He said, "We used to really worry about you." And I said, "We used to look down our noses at you, because here we were doing it at T-1 and you were piddling out there at a few thousand baud." Now look where we are. The point of the matter is that Steve Case was able to build to a demand. I was running a company that was trying to create a technology to derive the demand, and I've got the bloody scars to prove that demand is more important than supply.

Last suggestion. The poster child of the economic stimulus was the cash for clunkers program. It created demand. Why not a bucks for broadband program that creates demand? This follows on something that Ralph was talking about

here. I don't think it's necessary to appropriate funds, but we can use public policy to create demand for broadband. Electronic medical records, there are billions in the stimulus for that. Let's stipulate that they have to be tied in to broadband. Education and e-rate applications of federal funds need to stipulate that they need to be tied in to broadband. Ralph had the idea that enterprise zones need to stipulate that they are tied in to broadband. Intelligent transportation systems need to be tied in to broadband in a mandatory way. Public safety needs to be told that they must utilize private broadband networks. Green and smart grid initiatives need to have broadband tie-ins before they get funding. The point of the matter is we can create through public and existing funding mechanisms the demand that will produce greater returns on a broadband future than just simply subsidizing the building out of that new capacity.

Let me close with one last point. Broadband IP is taking America back to the

dispersed economic activity that was destroyed by the centralizing force of the last network revolution, the railroad. Broadband IP is remorselessly flinging activity to the edge of the network, and at that edge are individuals and entrepreneurs, the kind of people who we invest in. In the centralized economy, innovation happened at places like Bell Labs, massive places where you did research and innovative activities. In the decentralized broadband IP interconnected economy, innovation takes place with two guys and a dog in a garage. Those are the kinds of people who venture capitalists like us invest in. Those are the kinds of people who take that money, who turn around and hire others who spend that money at the grocery store, to pay their mortgage and to send their kids to college. So if we go back to the topic that I was asked to address, does broadband availability influence VC investment decisions, the answer is you bet.

But the story is even bigger than that, that history's greatest changes have been driven

by network changes and that we are now at another hinge moment in new network development, and that opportunity that venture capitalists will invest in beckons.

MR. WALLSTEN: Remember, if you have questions, write them down, and if you're watching online, if there is a way to submit questions, please do.

Let me work backwards a little bit and start with Tom. I really like your bringing history into this issue. I've also written on history though not as much as you have. You can find lots of similar debates that we have today historically with the telegraph and even the optical telegraph before that and with telephones and their interconnection and intercarrier comp debates back in the 1900s. With your studies of development of networks over history, do you see particular policy lessons, things that governments did back then, that either helped or hindered development of new networks and what we can learn from that?

MR. WHEELER: That's a really interesting question, Scott. The story I didn't tell about Chicago and St. Louis is the reason that St. Louis didn't build the bridge is the local politics was controlled by the watermen who were ferrying things back across the river and they didn't want the competition of the bridge. I don't think anything has changed in the politics of networks since that time.

What's interesting though is that this agency, the FCC, which has had a very important history, but a history that has been one of refereeing among various economic interests for the public benefit, has with this initiative the opportunity to become an economic growth agency and to say that there are policies that we can initiative that will stimulate innovation and investment. The only point I'm making is that as we saw on one of the charts, there are billing of dollars from venture capitalists out there that are ready to follow that kind of encouragement of innovation and investment from policy decisions.

MR. WALLSTEN: If anybody else on the panel wants to jump in, especially Don and Jonathan if you have questions before I move on, please jump in. Ralph, also building on what both you and Tom said about demand, one thing that you didn't mention in your discussion was direct subsidies to users of broadband. When you look at the Pew surveys for example one of the main reasons for people who don't have broadband who want it, they say they either can't afford it don't have a computer which are relevant to the digital divide issues. Do you think that that kind of direct subsidy is less effective than enterprise zones that you talked about or do they address different issues?

MR. EVERETT: I think that that's a good point that you raise. I do think that a direct subsidy would be helpful in the process because a lot of times you hear people say they don't have this because of the financial conditions associated. So I think we have to use an approach where we do all of the above if we can, including

direct subsidies. So I'm glad you raised that issue, and I should have raised that earlier.

MR. WALLSTEN: To the economists, it seems that putting it all together you find that broadband has an important but indirect maybe economic effect because it's related to so many other things in this innovative ecosystem. Given that, how do you then connect your comments to particular policies that the FCC or any other part of the government for that matter might consider as ways to not just affect broadband, but what they can do that can help ensure that broadband has some positive economic effect?

MR. GOLDFARB: Thanks, Scott. The bottom line is because of the indirect nature of the benefits to broadband deployment which were described which Tom and I described earlier, if broadband is easy to get, if it is cheap and widely deployed, that is of course good. However, we also know that the lion's share of the benefits are going to be concentrated in particular areas. That's the first thing. The second point I would

like to make is that if we can make sure that as for broadband, that the types of traffic are not regulated in some sort of systematic way so that we can have unfettered experimentation in how broadband is used, that would be good, with the exception perhaps to peer-to-peer file sharing which takes such a large chunk of the broadband traffic, it might actually inhibit other sorts of experimentation.

MR. WALLSTEN: So you think that most broadband use is actually not particularly related to productivity or economic effects?

MR. GOLDFARB: No, I would not say that, in the sense that if there are a huge number of start-ups and other organizations, incumbents, billing out services for broadband, clearly it's creating something of value.

MR. WALLSTEN: So that's the demand side?

MR. GOLDFARB: Yes.

MR. PRIEGER: If I could just mention one thing. I think one of the direct policy

implications that I've learned of looking through the literature and seeing what we know and what we don't yet know is that the policy has to be very careful as to what it takes as its measure of success. For example, I don't want to pick on education in any way today, but if you look at wiring schools, a laudable goal and excellent progress has been made in that area, but the measure of success cannot be number of schools wired, it has to be what are they doing with it, how is it impacting what gets done in the classroom, is it being used? So it takes an extra step I think beyond what many policies may go in terms of measuring their success because it's easy to measure something like number of schools wired, it's much harder, it takes much more postgrant monitoring or whatever to figure out actually what the real effects are. That's one practical implication that I learned, that when you have something complicated like broadband where you can't just give it to someone and then it does its thing, with the subsidies, it might be more than

subsidies, it might be giving the computer to the household, giving the broadband connection, giving the training, something that goes far beyond what an agency like the FCC has done in the past.

MR. FORMAN: I'll confine my remarks to business investment, the area that I spoke about earlier. I think a lot of our findings are consistent with some of the things that James had talked about earlier in terms of one potential explanation for the result that the impact of advanced Internet use is greater in these high-education, high-income, high-population regions are some of the reasons that we heard about earlier, the importance of local skills, third-party markets for outsourcing and technical and programming services, education, organizational change, all of these things which are easier to do in some sense in some areas, in urban areas, than others. So in some sense at least on the business side it makes it that much more difficult to draw at least a straight connection between broadband investment

potentially and wages or economic growth.

MR. STOCKDALE: I have a general question to pose to the panel. As Professor Prieger pointed out, there have been a number of different ways that the effects of broadband have been attempted to be measured and he identified some of the potential limitations. Could I ask an open-ended question about what you view as some of the benefits may not have been captured by the studies to date? What might be done? And how important these overlooked benefits are? Because part of the purpose of these workshops is to try to get as much information as possible about the potential benefits of deploying broadband, and if we concluded as Ryan's study seems to that the benefits are relatively limited, that might affect our conclusions as to what policies we should adopt. So are there any suggestions on how to go forward and develop studies that capture more fully the social benefits of broadband?

MR. PRIEGER: I'll take a first stab at this very difficult question. We can't measure

what we can't measure, and that's one of the reasons why it took so long for the impact of ICT to show up in the productivity statistics at all, that first researchers in the area had to learn what it means to measure something that can be amorphous as some of IT and ICT actually is. Strides have been made in that area. Let me give some example. You asked in the first part of your question what may we be missing. For example, in productivity where the impact of ICT first showed up is in the knowledge producing ICT producing sector, but that's where it's hardest to measure the output of a knowledge producing firm that might be less tangible. Where the output of the firm is intellectual property, it's much harder to measure than when they produce a widget that you can see, feel or touch and put a price on.

Yes, I think we're probably still missing a lot in how we measure it. I don't have any great suggestions there, but I think the good point of view that you can take from that is whatever the impacts these technologies are that

we can measure, we can certainly scale that up by some unknown factor because the impact has to be greater than just what we can measure.

MR. EVERETT: As I said in my remarks, broadband impacted the way that we learn, live and earn, and I believe it also determines whether or not somebody is going to be successful in life. I could not sit here and imagine a neighborhood or a state without broadband. I would not want to be in that state when I compare myself to others who have the benefit of broadband. So if you just sit back and imagine what your life would be like if you were in an area that did not have broadband, I think that the answer to your question would become fairly obvious, that broadband is extremely important to whether or not one is going to be successful in life.

MR. WHEELER: As the qualitative as opposed to quantitative guy sitting here, first of all I think we've got some issues with data lags. We talked about latency of data, 0's and 1's, there's latency of data that we can measure as

well. Second, I hope that this process doesn't lose sight of being a proactive encouragement of growth, not just a retrospective measurement of growth. When you stop and think what is it? It's 60 percent of all new American jobs or some number like this come from small business, the kind of folks who we invest in. None of the companies we invest in could make it on dialup, period, full stop. And we need to be providing the platform, but we also need to be encouraging the demand that calls for that platform.

MR. GOLDFARB: In preparing for this talk I looked around and tried to find what people are actually doing on the Web, just some sort of standardized data of how people are using this technology, if it's delivered via broadband or dialup, and it was very difficult to find anything. The best you can find is you can see which Websites are most trafficked, but we do not know. You could think of a lot of scenarios. I now back online so therefore I don't have to go to the bank and that frees up time for other

activities such as watching YouTube videos which is of course highly productive. But there is certainly a tradeoff between maybe the Internet provides us more leisure time, but we have no idea as far as I can tell what those things are and I think that really follows-up on James's comment that we want to know, that if broadband gets to the house or broadband gets to the school how is it being used because without that we're really not going to be able to answer these questions.

MR. FORMAN: Just two points, and this is going to follow-up on what some of the other speakers have said as well. Certainly one challenge has been that of data. If you look at where we'll often see the measurable economic broadband impact, it's going to come through business and the data that we have on IT investment in business right now is pretty scarce. We end up using a private survey which we believe is some of the best data on IT investment available simply because firm level or regional investment in IT and particularly Internet

investment simply isn't out there, so it make it very difficult to quantify the impact of broadband because there just aren't the data out there and I think that's hindering a lot of issues in trying to understand the policy implications here.

The second thing is, and this is going to follow- up on some of what James said as well, this big question about what other areas could we look at to understand, I'm just going to pick on one. The majority of what's been looked at in terms of business investment of IT or any kind of IT capital is predominantly these labor productivity studies that look at output deflated by labor inputs or some similar measure, and we know very, very little about the impact on innovation or other measures of economic activity rather than just the one that everyone looks at which tends to be productivity which is what we have data on. So that would be the other thing that I would mention.

MR. WALLSTEN: Jonathan, do you have a question?

MR. LEVY: I'll ask one question if I may. The range of studies reported on here or referred to here span some that look at residential broadband penetration and some that look at business broadband penetration. My question is a plea for some help about how we should go about combining those indicators as we conduct our policy analysis and try and figure out the overall impact. The one specific subquestion of that is, is there any intuition to suggest, or what is the intuition that might suggest that an increase in residential broadband penetration might have some effect on labor productivity or on GDP beyond just the end user experience?

MR. FORMAN: I'll make a couple of remarks on that. In our work, one of the controls that we had in our regressions on the impact of advanced Internet use on wage growth is we took the CPS data, current population survey data, on residential Internet use and in particular some of the data on use at work. Although that seemed to have some effect, the effects weren't as strong as

that on direct advanced Internet investment. If you look at correlations between the CPS individual measures of investment and the measures that we use at the firm level, there is a correlation, but it's imperfect in some sense. Unfortunately I think that survey is not being refreshed now every year so our data even at the residential level or at the individual on Internet use is somewhat imperfect, so again we have an another issue associated with not having data unfortunately.

MR. STOCKDALE: Could I ask a follow-up question based on your comments and Jim's earlier, which is that several of you have pointed to this lack of data that would be necessary to do a more precise quantification of the impact and benefits of broadband. The question I pose to you is can you identify and give specific suggestions about the kind of data that would be useful because it could be something that we could include as part of our Broadband Plan. I will give you an opportunity here to make some suggestions. I also

will give you an opportunity to think about it and then provide those suggestions to us at a later time, but if anybody has an answer now.

MR. MCDEVITT: I can jump in. I think as economists what we're interested in is a clean identification strategy to help uncover where the gains are coming from, and we usually don't get that because we have to rely on natural experiments to help tease out correlation and causation. So I think what I would suggest is that part as of these policies try to randomize the trials and systematically and randomly pick winners and losers that we talked about earlier today and say let's roll out gradually and that way you can identify who is gaining and what are the causes of these gains.

MR. PRIEGER: There are two things that I would mention. One is just to reiterate one of the points that I tried to make during my talk is that certainly more could be done with the federal agency census data collection effort. For example, again the comparison to Europe. They're

doing much to study firm productivity. It's a bit of a shame that anyone needs to go and probably pay thousands of dollars for some proprietary dataset where the quality is unknown. Why can't we provide funding to census so that they can do firm level surveys to find out what firms are doing with their ICT and their broadband, how they're using it and so forth? It's either an easy place to start or a hard place to start depending on whether you can get interest in funding it.

The other thing that I would mention, as these studies are done, we've already lost the battle with getting BTOP to have randomized trials and giving money to places in ways that approximate a lab experiment, but there are still state-of-the-art econometric methods that we can use. For example, you can look at firms that just barely missed the cutoff, whatever the NTIA cutoff is going to be, to getting the grant. Those firms just missed getting the money should be similar a priori to firms that just were over the line. So

in a sense they're similar in other ways, but that one got the funding and the other one didn't. So there's your control and there is your experiment group. You can do analyses of these sorts and we have techniques for dealing with these sorts of data problems in econometrics. What it's going to take realistically is probably a lot of partnering with people outside the federal agencies and just to tap on that expertise from academia.

MR. FORMAN: Two points. You can even build on the surveys that are out there. Census did a 2000 survey on business IT use at the micro level, so at the firm level, but that hasn't in general been refreshed over time. So information on that kind of data would be very useful. The current population surveys, computer and Internet surveys, have not been refreshed every year and that has been a very useful source of data for folks who were studying early on the uses of the Internet and the impact of the Internet at the individual level and that survey unfortunately hasn't been refreshed over time. So those are two

things that have already been out there that would be very useful to continue.

It's interesting that researchers who are looking at firm level or regional investment and IT almost always have to turn to private surveys at this point because the only official government statistics that are publicly or even privately available at the industry level for the most part. These are things that have already been done in the past that if they could be done in the future would shed a lot more light on some of these issues.

MR. WALLSTEN: We'll start with questions from the audience. This first one actually builds on some of these data issues because it's about enterprise customers. The question is, "The increased availability of broadband has had a huge impact on the so-called enterprise customers in non-ICT industries such as banking, ATM services, airline reservations and ticketing, business processing outsourcing, et cetera. But competition has failed to develop for

most last-mile business broadband services result in supercompetitive prices which prevent customers from capturing the potential of these services. How should the National Broadband Plan or the FCC address this pricing issue and ensure that business customers can achieve the full promise of broadband -- lower prices can expand demand?" In addition to answering the question, what do we know about broadband services available to businesses and those prices?

MR. FORMAN: In terms of broadband services, James, I guess you would know to push the ball back to at least a concentration of broadband providers are differing across regions. That's not something I know as much about. I know in terms of broadband services available beyond prices, I haven't seen the most recent data other than the sort of traditional statistics that people have shown that obviously it's more concentrated in urban areas. I haven't seen the most recent data.

MR. PRIEGER: I'm not even sure to what

extent there are systematic data on enterprise prices for broadband. We all know that the FCC hasn't collected such data in the past so it's not there at the federal data collection level. Again there probably are private sources out there. To be honest, I don't think I've ever seen them used in a study. Most pricing studies have focused on mass-market services and DSL and cable modem basic rates, and quite often prices are collected by researchers having their graduate students hit Websites in different locations and pull out prices so that it hasn't been rocket science in the past. I would say that there is more that we don't know than we do know about prices there.

MR. WALLSTEN: Do you think that business enterprise prices are something that should be looked at along with all the other data issues that you mentioned?

MR. PRIEGER: It's hard for me to imagine that that's the margin where federal intervention is most needed. If I can think of a competitive market or a market where the private

provision is probably working pretty well, you would expect it would be those high-value enterprise customers.

MR. WHEELER: The other thing here is that in so many of those situations, you're actually talking about VPNs that are then turning around and being sold as a broadband service to track your credit cards or when you swipe a credit card at the store or something like that and how in the world do you get to that pricing data?

MR. FORMAN: Just to make one point to follow-up on some of the other comments, in our study a lot of the action has been in urban areas and urban areas competition has been quite robust. I don't know what the pricing data exact are, but in general if you look at metropolitan areas, competition amongst broadband providers, we don't know the pricing data, but we at least know the number of providers across regions and that seems to be quite robust. I would agree with some of the things that James had mentioned, that that's probably not the margin that matters within urban

areas. I think some of these other things in terms of skills, third-party resources available, outsourcing providers, these things are probably going to matter more on the margin than pricing at least within urban areas.

MR. WALLSTEN: Let me put two questions together here that I think are related. The first is whether anybody has studied the effects of telework. The question asks, "Jobs will not initially be created in unserved and underserved areas, they will be brought in from other areas. We call this telework, jobs to people instead of people to jobs." The second question is, "What mechanisms exist or could be developed to track and address the relationship between economic growth, employment and technical skills, education and training to the social and economic stability of historically neglected communities?" What do we know about the effects of telework, and how would we go about measuring those effects? What would people need as a prerequisite to make that work especially in historically neglected

communities?

MR. PRIEGER: I did run across a few studies when I was doing some earlier research on e-business and how it's used. Actually there are very few formal studies done on telework itself mainly because, again, if you don't have data you can't study it and the data are hard to come by, but even with survey data it's hard to tease out the impact on a particular worker of allowing that worker to work at home because, again, companies don't randomly assign the option to do telework, so there are lots of confounding factors. I think I only ran across about two studies that I'd say made a serious attempt at this and one found that it had no effect and one found that it has a positive effect. I'd say we know very little about that, but you can certainly imagine that it could have impacts in many ways, probably many of them nonquantifiable and probably many of them not necessarily of benefit to the firm but to the worker as well.

MR. WALLSTEN: Let's also break that

second question out a little bit more and ask how we should in general aside from telework track and address the relationship between economic growth, employment and technical skills, education and training to the social and economic stability of historically neglected communities as the questioner asked. Ralph, do you want to address that?

MR. EVERETT: Repeat the question again.

MR. WALLSTEN: What mechanisms exist or could be developed to track and address the relationship between economic growth, employment and technical skills, education and training to the social and economic stability of historically neglected communities?

MR. EVERETT: Can one of my economists help me out on that?

MR. FORMAN: I agree that I don't think there have been a large number of studies on telework. My understanding is that the information that's out there suggests that most of the telework that's going on is not people

telecommuting in from some distance away from a city and doing all of their work. It's not a complete substitute for work in a place of business at least right now. Most of the telework in at least the studies that I've seen that have been going on seem to suggest that it's a complement to working at a place of business, so that people are spending 3 days a week at work and 2 days a week or 1 day a week at home. It's important to be clear how telework is being used right now.

In terms of the second question, there's a lot of meat there. I think I agree that the questions on causality are pretty daunting, but even beyond that I don't think there have been a lot of surveys about who is doing telework, how much are they spending time at work versus at home. I think most of the information that we have is out there. So again coming back to the data issues, there is a lot more that we could know before we even progress forward.

MR. WHEELER: May I try an off-the-wall

thing there? I'm sitting here and I'm saying to myself if somebody came to me with an idea that married telework with crowdsourcing as a variation on outsourcing of work, I would think that would be a really interesting business idea, but I would stipulate that it requires broadband connectivity. Again, I think what we're playing with here is we're playing with how do we establish demand that drives into the market this kind of connectivity so that there will be residual activities like telework meets crowd sourcing that nobody even dreams of today. I know of examples in the developing world where there is telework. There's an outfit called TXText, I believe, where they use crowdsourcing concepts on mobile phones in the bush in Africa to do work for back in a central city but it requires this kind of connectivity and I think you can take connectivity to the kinds of enterprise areas that Ralph was talking about, the kinds of challenges we have, and those kinds of things result.

MR. GOLDFARB: Related to that, I guess

I would be surprised given the information we had that simply providing broadband to underserved communities would do much of anything of high value if it were not coupled with a whole bunch of other programs that have made broadband high value in other communities such as improved education, improved training for social skills, a wide variety of things. So if all we did was provide broadband to underserved communities, it would probably not provide many benefits at all.

MR. EVERETT: But I think broadband would open up additional opportunities, whether that is education and other things that you get through broadband. By not having broadband you wouldn't even have access to those types of things.

MR. GOLDFARB: But the evidence doesn't support that.

MR. EVERETT: We'll have to do a study.

MR. GOLDFARB: We have, the studies that we've heard from today, not mine I will put out, that the benefits in terms of wages have come to

communities that are already highly educated.

MR. WHEELER: So that there is a variation on this theme which is, back to the point that I was trying to make, that you can't force demand with supply. First you got to have demand, and a national broadband policy needs to worry about how am I going to create demand, and when I put demand into that impacted area for this purpose, lo and behind, guess what happens? People start hanging things on there and other things that you never anticipate happen, but it has to start with that demand.

MR. GOLDFARB: But the point is where there is broadband in rural communities, there seems to be little effect. That is the basis of the statistical comparison in these studies. So it is insufficient to simply provide broadband. We must also provide education and other activities which may be beyond what the FCC does, but without that, we will provide broadband which will not really be used.

MR. MCDEVITT: And if I could jump in

here as well, I think the reason for this is that most of the low- hanging fruit comes with something like dialup, the access to email and the very basic services from the Internet, the huge come from are already available, but broadband provides incremental benefits. So if there is going to be this huge effect, we probably would have seen it already with dialup which I think goes for especially consumer surveys, their time online at least in the middle of this last decade, they didn't increase their use of the Internet drastically once they got broadband which goes to evidence that it's not a transformative technology over and above what dialup was already providing. It's a better experience of course and at the same price everyone would rather have broadband, but at the same time there are going to be diminishing gains we continue to roll out broadband service.

MR. FORMAN: More broadly, at least in our study, one of the takeaways is there's a lot of complementary other stuff that you need to see wage gains. Certainly some of those are

associated with lower costs associated with cities, either labor markets, education, things of that nature. Also that collection of things and predominantly the things we have been talking about lower the costs of not just broadband investment, but the things that businesses need to do to use broadband effectively. Obviously it's not just building a broadband connection, it's creating e-commerce and doing all the logistics and all those other things that are needed to create a business model out of broadband and all of those things are easier to do in some of the areas that are already doing well.

On the other side, one neglected thought is that often times we usually think of broadband of networks as being complements to face-to-face communication, but there's a lot of evidence to suggest, and things like entrepreneurship in particular, a lot of times people at least need to meet once or a number of times in addition to the telecom or the ICT's enabled communication and those things again are easier to do in locations

that are highly agglomerated and have all these other things. So at least from our work we see that one of the challenges of getting benefits out of in our case advanced Internet investment is you need some of these complementary things that are available in particular locations.

MR. WALLSTEN: How do we think about the incremental returns? Ryan, you pointed that to measure the economic effect you want to measure the improvement over what it replaced. But broadband isn't either/or. There are lots of flavors of broadband, and some people care about faster speed, some people care about lower latency, less jitter. How do we think about what are the various increments that matter and how people value different types of broadband?

MR. MCDEVITT: I think that's a good point. We've been talking about broadband generically here, and the reality is there are very different types of broadband with varying speeds and quality and prices. But to think of the average consumer, we can look back to the

survey conducted in Savage and Waldman's 2004 paper, and they did put a price on that. They said that the consumers that they surveyed were willing to pay $26 more per month to have broadband over dialup and it's because of these things that it's always on, it's more reliable, with faster speeds. So I think the willingness to pay, as economists we really measure the gains that are going to accrue from something and they're revealing by their choices of what they're having as their service and this is how they prefer broadband over dialup. There has been a mass migration, but dialup is still pervasive for many communities, so I think if it were vastly greater, the numbers would have dropped off the charts and everyone would have dropped dialup straight away, and we just didn't see that in the data. So I think there is some evidence that they're willing to pay more for broadband but not so much more for this transformative, completely new technology.

MR. STOCKDALE: Could I push back a

little bit on what you just said? Since 2004 there have been a number of new applications that have been made available over broadband that would not have been made over dialup. There is file sharing, there is streaming video, there is online banking and online government. One might think that this may have increased, A, the value of broadband so that people would not take dialup would find it useful to take broadband, and, B, that a 2004 survey that considered what applications were available with broadband then but weren't available for dialup probably might underestimate the value in 2009 where there is so much more available. I welcome your response and any other panelist's.

MR. MCDEVITT: No, I think you're absolutely right. It's very hard to imagine something like YouTube being a compelling technology over dialup. It's just not going to be very useful for consumers. At the same time, the beauty of the methodology that we laid out which builds on Fogel's Nobel Prize winning work is that

we're not properly attributing these gains to what they're replacing. So you're on YouTube more, you're going to Blockbuster less, you're watching TV less. As a net effect for the economy that is probably almost certainly offsetting, maybe even decreasing overall GDP because now something like a television studio is not going to invest as much money in the quality of their programming because they can't capture the advertising so the overall quality in general has declined. We actually don't take a stab in trying to measure those, but I think it's important to consider what we're giving up as technology progresses. It's not just simply saying we like YouTube a lot so this is a huge economic value, it's what's the value above and beyond what would have occurred without broadband.

MR. STOCKDALE: What I was suggesting was that the data you used from 2004, how consumers value broadband over dialup may be no longer relevant.

MR. MCDEVITT: You're absolutely right

that we certainly need to get an updated survey to continue this methodology, but my point is for overall economic gains, it's not going to really matter. They're going to be offsetting I think for the most part just because consumers value it more while they're revealing that they're not going to buy a movie from Blockbuster at this point, so the overall impact on the economy is actually offsetting.

MR. GOLDFARB: I think the big benefit at least to consumers right now is video. That's what you're getting with broadband and I would argue you could do over dialup without much trouble. I can research my medical concerns over dialup, I can do my email over dialup, so the inferior technology works for most of the things people are going to do on the Web with the exception of video. So if we leave it at that, what is the value of having Internet video is we don't know.

MR. WHEELER: I think we fall into a trap if we assume that economic growth and

consumer use are synonymous. I really don't think that we're talking about universal YouTube. We need to enable the productivity in the engines that will hire people and allow them to go to the grocery store. We have multiple companies that are virtual companies. The CTO is out on the West Coast, the CEO is here on the East Coast, the marketing guy is down South. They've got to have broadband connectivity.

MR. GOLDFARB: But they do don't they?

MR. WHEELER: They do, but they are limited. They make their life decisions around that and have to make corporate decisions around that, and there is a limitation. I'm not disputing and I stipulated at the outside that first you create demand and that will cause the investment to go out there for new broadband, but we need to look at it as a lot more than consumer applications.

MR. GOLDFARB: Right. I am in complete agreement with that statement. My question would be then what evidence do we have that businesses

are not being served sufficiently well by broadband?

MR. WHEELER: I'm telling you that the kind of iterative and compounding IP that I invest in has to have broadband and that we are de facto making decisions as to where economic investment is going to be made because you can only place them in certain areas.

MR. EVERETT: And in that way you're leaving out certain people in certain neighborhoods and certain talent because they don't have broadband connectivity.

MR. WHEELER: We're looking at the wrong thing. We're looking at the pipe. We ought to be looking at the reason for the pipe, and we need to be saying what are we doing as federal policy to incentivize people like us and others to want to invest in building that pipe to the demand, and we don't look at it that way.

MR. WALLSTEN: Jonathan?

MR. LEVY: I wanted to partially reask the question I asked before maybe to Tom. If we

wanted to measure what you're talking about, is this business or residential or both or neither?

MR. WHEELER: What I'm talking about is business. I think that we've seen the spurt in economic growth from consumer applications of broadband. I don't mean they're going to disappear, but I think that the great compounding activities are in the enterprise space and that we have to enable those compounding activities. We don't have any data on what's happening in the enterprise space other than the anecdotal kind of stuff that I pointed to.

MR. FORMAN: To follow-up on that, I agree completely that if you're going to see an impact on measurable economic returns from Internet investment, that's going to come predominantly from the business sector. And to follow-up on the original question about measuring different dimensions of broadband, to come at that a different way, I would say that we need to know more about measuring the different applications of broadband. We're not just talking about plugging

in a pipe to a business. There is a lot of heterogeneity and a lot adaptations that businesses need to do to make these broadband investments effective and that's likely to be quite different depending upon whether this is a collaborative technology for new innovation or enabling supply chain and logistics, all those things and the sorts of questions that we're asking about the impacts on local economies and how that varies across locations are likely to vary quite significantly across these heterogeneous applications.

MR. WALLSTEN: Let me ask more questions from the audience which will further this discussion. People are itching for a fight so that we can continue this. I'll combine these three questions. "Could Chris and Ralph comment on their conflicting analyses and predictions about the impact of broadband deployment on employment." Also "McDevitt's and Forman's studies suggest that broadband availability has not had a substantial effect on wages and

productivity for low-income or low-education populations. Everett, conversely, suggests that broadband availability would benefit all populations. Are these views in conflict? If so, can they be reconciled? Does the answer depend on the short- versus the long-term?" And a third question which is related asks how Ryan's study takes into account innovation. Why do you all disagree?

MR. EVERETT: I was citing some existing studies that we looked at from Sacramento State University where it showed that there was a direct link between economic growth in indicators of new jobs and payroll growth, so those were the studies I was citing. I'm sure there are studies all over. One thing that's been clear from this discussion is that in order to go forward here, there is a lot more data that we need to collect and understand in this area so that there will be studies that differ, but that's what I was citing when I said that.

MR. FORMAN: I don't want to start any

fights here.

MR. EVERETT: Particularly when you're sitting right next to me.

MR. FORMAN: That's right.

MR. EVERETT: So be kind.

MR. FORMAN: It's an extraordinarily difficult question. I think James alluded to this in the very first talk of disentangling supply versus demand in some sense. There have been a number of studies that have examined how differences in local supply are associated with or broadband providers are associated with local employment or wage gains, and I think we need to be a bit careful because there are very tricky issues about what's different about locations that have lots of broadband providers. In our study too we tried to address this in a careful way and I think that's something that we need to think about and we need to look at very carefully.

In terms of short- versus long-run effects, I'll say one thing. In our work we were looking at a period to be clear now a different

sample period between 1995 and 2000. I think more work needs to be done on more recent data. At least in our own study we tried to see whether Internet investment in 2000 was correlated with future wage gains so that this gets a little bit at the short- versus long-run issues. I didn't talk about that in my remarks, but what we seem to find is that the short-run increase in wages associated with Internet and the difference between what we called the high all factors versus other areas, but there were not additional benefits at least associated with 2000 investment as you to between 2000 and 2005. I want to be very careful in saying this that this is looking at the long-run effects of this 2000 investment on future data, I think there is a lot of work to be done here that everyone on the panel has mentioned about looking at either different margins of investment or future data than what we have and what other folks have done to try to flesh this picture out a little bit more. So I think there's a lot of additional work that needs to be done

here.

MR. EVERETT: For the person who was looking for the fight, I think listening to Chris that we probably can get together on this and get some new data because he's talking about data between 1995 and 2000, just think of how fast things have changed over the last 9 years. So people are using it differently and everything else, so we can get together on this.

MR. LEVY: I guess this is the third time I'm saying the same thing. It appears from the slide that the studies that Ralph was referring to were to actually looked at residential Internet penetration, and the data that Chris was using is based on business, so that it's at least possible that they are reflecting different mechanisms or different phenomena, but we don't know.

MR. WALLSTEN: We do have to wrap-up, but I do have a very quick clarifying question for Ryan. You talked about these offsets, that people when they're spending money on one thing that

they're not spending money on another. Is there any data on what sorts of things are being crowded out by broadband or by Internet activity?

MR. MCDEVITT: Straight away we have the numbers on dialup, so that's immediately in there. Again we'd have to do a more systematic consumer survey and see how they're spending their time on line and what they're doing. Is a trip to Amazon different than a trip to an offline retailer? I don't think we have systematic numbers on that. We certainly don't in our paper. There are certainly going to be studies like that out there. We just haven't incorporated them into our analyses. But certainly it's something to consider.

MR. WALLSTEN: Unless somebody has a burning comment that they have to make before we finish, I want to thank all the panelists for joining us today, some of whom came from out of town at their own expense. We're very, very grateful that you all did. I think it was a very interesting discussion and I learned a lot. Thank

you.

(Whereupon, the PROCEEDINGS were adjourned.)

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