Productivity in the 21st Century

United States Department of Labor
Secretary Elaine L. Chao

This Productivity Conference was hosted on October 23, 2002 by the Department of Labor's Office of the 21st Century Workforce and the American Enterprise Institute. In addition to this complete text, a Webcast can be viewed at www.dol.gov.

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200 Constitution Ave., N.W.
Washington, D.C. 20210

Library of Congress Control Number:
2003100214

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INTRODUCTION

"We have the opportunity to spend the next several hours discussing thoughtfully one of the most important aspects about our economy, and that is productivity growth. We are going to look at its driving forces, its impact and its future. There is a good reason why we are devoting an entire conference to this subject. Productivity growth is absolutely critical to maintaining and increasing the standard of living for American workers."

- U.S. Secretary of Labor Elaine L. Chao

It is a pleasure for the U.S. Department of Labor to co-host this conference with the American Enterprise Institute. I appreciate the hard work that the AEI staff has put into this conference to ensure a stimulating dialogue on the subject of productivity in the 21st century.

We are especially delighted to have with us the Chairman of the Federal Reserve Board of Governors, Dr. Alan Greenspan, who will be speaking to us at lunch. We are also delighted to have Dr. Glenn Hubbard, Chairman of the President's Council of Economic Advisers. I am pleased to have Kathleen Utgoff, Commissioner of the highly regarded Bureau of Labor Statistics at the Department of Labor. Kathleen, many thanks to you and your staff, in particular Marilyn Mansur and Mike Harper, for helping us plan this conference as well.

I also want to extend my thanks to the other participants on our panels today. We appreciate your time, your participation and your expertise as we tackle this very important topic. And, of course, I want to thank Steven Law, the Chief of Staff at the Department of Labor, for his guidance and Shelley Hymes, Director of the Office of 21st Century Workforce. Steven and Shelley, thanks so much.

This is a time of year when discussions about the economy are reduced to 10-second sound bites on the evening news and the slash and burn rhetoric of political ads. That is why this conference is so important. We have the opportunity to spend the next several hours discussing thoughtfully one of the most important aspects about our economy, and that is productivity growth. We are going to look at its driving forces, its impact and its future.

There is a good reason why we are devoting an entire conference to this subject. Productivity growth is absolutely critical to maintaining and increasing the standard of living for American workers. That is particularly important to me as the Secretary of Labor. The Department's data shows that real wage gains closely track productivity growth. Since 1947, both real hourly compensation and productivity have tripled. Higher wages are not the only benefit that workers reap from productivity growth.

Higher productivity also means lower production costs, which translates into lower consumer prices for many goods and services. The productivity growth that we have experienced over the last seven years is one reason why our economy has confounded the experts, expanding rapidly without the usual accompanying increase in inflation.

We know that productivity is critical to our economic vitality and plays a key role in raising living standards for all Americans, but there are a lot of things about productivity that are still the subject of study and debate. That is why we have convened this conference. For example, we do not fully understand all the factors that drive productivity. Our first panel will examine whether recent productivity gains can accurately be characterized as miracles. If so, what caused these gains and what impact have they had on our economy?

Second, we need to explore the relationship between productivity and jobs. For years, some people have argued that productivity growth comes at the expense of workers, but the last decade has turned that line of thinking on its head. Throughout the 1990s, we saw productivity grow at the same time that

national unemployment rates fell to their lowest levels in a generation. Even today, as productivity continues to increase, unemployment levels remain far lower than in previous economic downturns. We need to have a better understanding of the complex relationship between productivity and jobs.

Finally, we want to get a feel for the road ahead. Our third panel will discuss the prospects for productivity growth in the future. They will also look at another important issue that holds particular interest for me, and that is the impact of productivity on worker safety. Productivity does not have to come at the expense of a safer workplace. In fact, many companies have shown that a safe workplace improves productivity. I look forward to hearing our panelists' views on this subject as well.

If productivity growth is a key ingredient to economic recovery, then there are encouraging signs. Despite the recent slowdown, productivity growth has held up well since the latter part of 2000. In the five quarters since the business cycle peaked in 2000, productivity has risen at an annual rate of 3.8 percent. That is stronger than in any other economic downturn since 1969. In fact, between 1995 and 2000, productivity grew by 2.5 percent a year. Compare that to the annual productivity growth rate of just 1.4 percent between 1973 and 1995. These are not statistical anomalies. They demonstrate solid productivity growth for the past seven years.

Many people point to technology as a driver of productivity growth. Just as important is the effective use of technology to increase efficiency in everything from manufacturing processes to inventory management. In fact, a report released by the Bureau of Labor Statistics today shows just how widespread technology has

become in the workplace. More than half of all Americans now own a computer at the worksite.

Sound monetary policy has almost certainly played a role in productivity growth as well. Still another factor can be summed up in the theme that we invoke a lot at the Department of Labor, and that is a 21st century workforce. By that phrase, I mean a workforce that is flexible, skilled, and diverse enough to respond to the needs of a rapidly changing economy. It is not surprising that today's highly productive workforce is led by the Baby Boom generation, the most highly educated generation of workers in our history. In just the last 20 years, the number of workers with college degrees has more than doubled.

Today, nearly one-third of American workers have a bachelor's degree or higher. More women and minorities than ever before have entered the workforce, opening up opportunities for segments of our population whose talents and skills have been underutilized. It is important for us to look at the connection between productivity growth and the dramatic changes that we are seeing in our workforce. We need to ask the question, can we stimulate productivity further by investing in human capital through training and education? These are major issues to consider and our answers could help determine our nation's future prosperity.

America's immensely productive economy has given us so many things - the highest standard of living in the world; a flexible and resilient economy and as we have seen in the aftermath of the attacks of our country of September 11th --; a broad, competitive advantage that no other nation can match. Clearly, productivity is an important issue and it is time to place it

squarely in the forefront of public policy debates. We have assembled a first-rate group of experts from academia, business, government, and public policy organizations to discuss all aspects of this issue. I look forward to hearing the views of the experts on our panels. I hope and I trust that you do as well.

I appreciate your attention to this important issue in our economy. Thank you so much for being here.

* * *

Is There a Productivity Miracle?

R. Glenn Hubbard
Chairman, Council of Economic Advisers,
The White House

Frank L. Lichtenberg
Professor,
Columbia University School of Business

Steve Oliner
Associate Director of Research and Statistics,
Federal Reserve Board

Kathleen Utgoff
Commissioner, Bureau of Labor Statistics

Moderator:
Kevin Hassett
Resident Scholar,
American Enterprise Institute

Kevin Hassett, Resident Scholar,
American Enterprise Institute

We have a marvelous panel today. The first panelist, who is on his way, is Dr. Glenn Hubbard, Chairman of the President's Council of Economic Advisers. Glenn is also a professor on leave from Columbia University. Before joining the President's Cabinet, he was here at AEI as Director of Tax Policy Studies. It is great to have Glenn back. Next to Glenn is Frank Lichtenberg, who is a colleague of Glenn's at Columbia and one of the world's leading experts on productivity, in particular on the linkages between new technologies and new drugs and worker productivity.

Next to Frank is Steven Oliner. Steven is Associate Director of Research and Statistics at the Board of Governors of the Federal Reserve. He and his colleague, Daniel Sichel, have been following the productivity debate for many, many years. When I want to know something about productivity, then Steven is the one I call,

as he knows, because I am constantly bugging him. Next to Steven, we are very delighted to have, as Madam Secretary mentioned, Kathleen Utgoff, who is Commissioner of the Department of Labor's Bureau of Labor Statistics.

Thank you for coming. We are going to give each person about 10 minutes and we thought we would start with Commissioner Utgoff's presentation, which will give us some of the facts that we are going to be talking about.

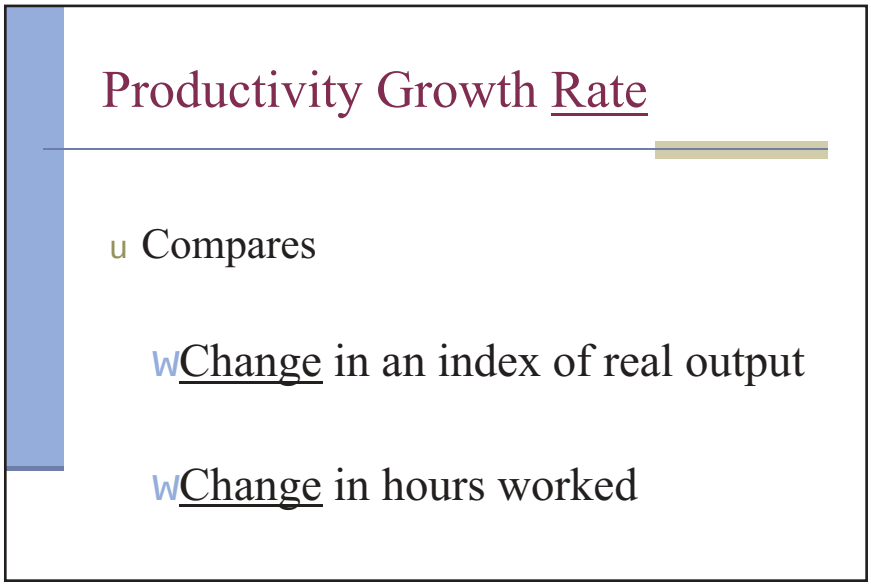
* * *

"How the BLS computes productivity is that it compares a change in an index of real output to a change in hours worked. If the percentage change in real output is greater than the change in hours worked, then there is an increase in productivity."

- Kathleen Utgoff, Commissioner, Bureau of Labor Statistics, U.S. Department of Labor

The reason I have been asked to talk today is because the Bureau of Labor Statistics measures productivity, and we have been doing that for 60 years. What I would like to do in this 10 minutes is give a very short summary of how productivity is actually measured so you can put it in the context of what is talked about later. Then I am going to talk about some trends in productivity that really demonstrate the question of where that productivity miracle is coming from. What do we mean when we

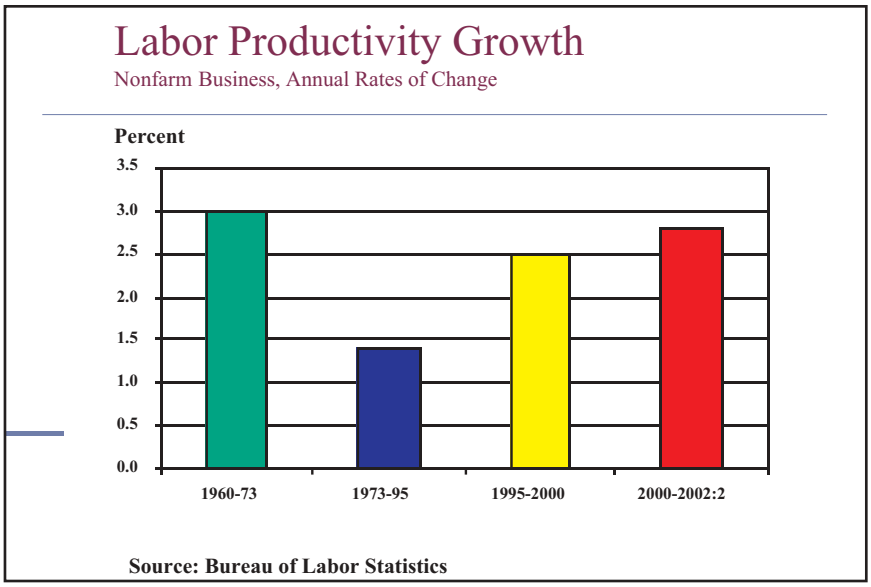
say, Is the productivity miracle going to continue? And in the last minute or so, I am going to talk about some of the implications of higher productivity.



How do we compute productivity? How the BLS computes productivity is that it compares a change in an index of real output to a change in hours worked. If the percentage change in real output is greater than the change in hours worked, then there is an increase in productivity. Let me just point out that we are talking about a growth rate. We are not talking about a level. So, something like cars-per-worker are really not the units that we measure productivity in.

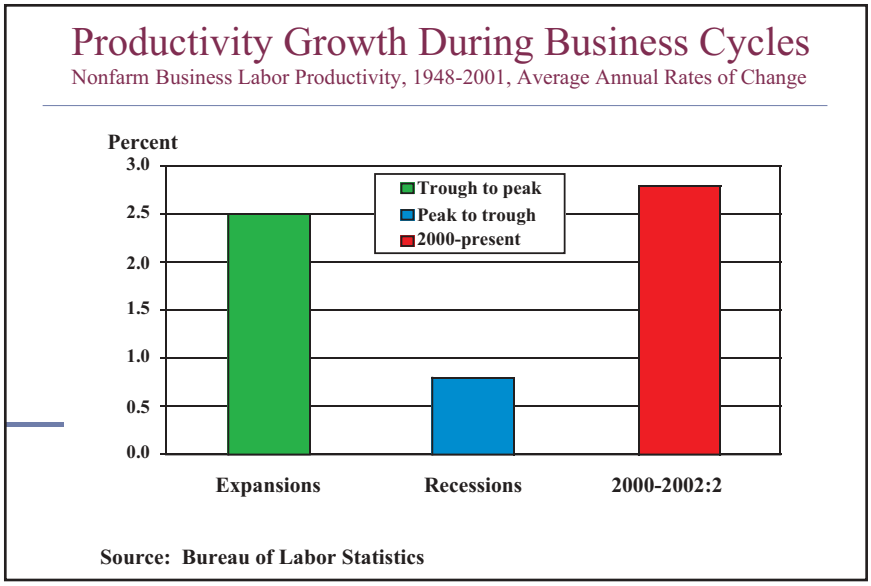
There are other conditions that you ought to think about when we talk about productivity. We do not cover all sectors of the economy. The government and the nonprofit sectors are excluded because there is really no market way to evaluate those sectors. We also do not include the farm sector because the output there is so volatile. Let me point out that the thing that we look at is

change in hours worked. That is one of the reasons it is called labor productivity. There are other measures of productivity, but labor productivity is what you will see in the newspapers and what you will hear about in the press.



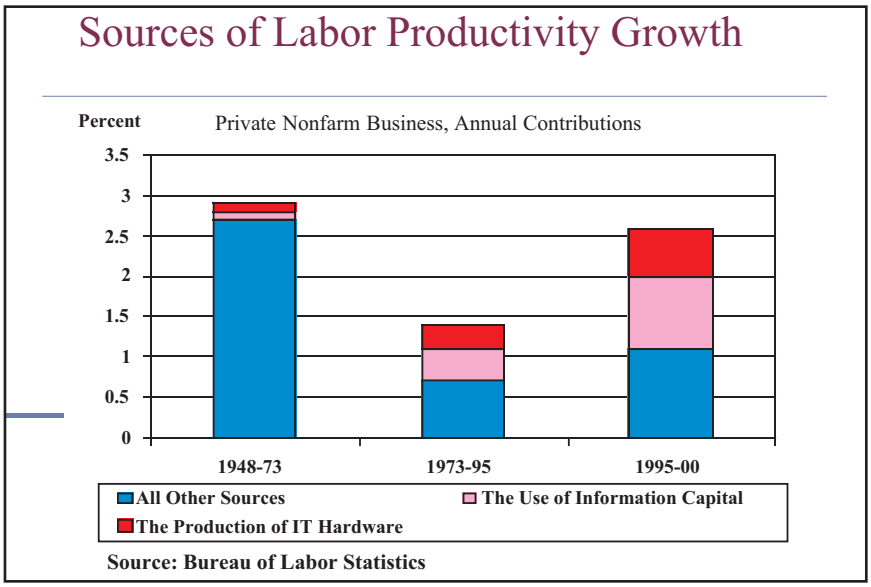
There are other measures, and the BLS looks at those and so has Steve. I think they are very important, but they are just not what you are going to see unless you are a specialist in productivity. Here is what I was talking about earlier and some of the trends. This is labor productivity growth in the non-farm business sector, which is the usual measure. I will try to talk about some of the numbers here to give you an idea of what is going on. What we have done here is divide productivity periods into basic trends in productivity. Where virtually everyone begins in this analysis is the slowdown in 1973 with the oil crisis and what the productivity speed-up has been from the year 1995 to the year 2000. The 1973 to 1995 productivity growth rates averaged 1.4 percent. The average productivity from 1995 to the peak in the year 2000 was 2.5 percent. When you talk about the productivity miracle, what

you are talking about is that speed-up in productivity from 1.4 to 2.5 percent. The basic question is, Will that productivity increase persist?

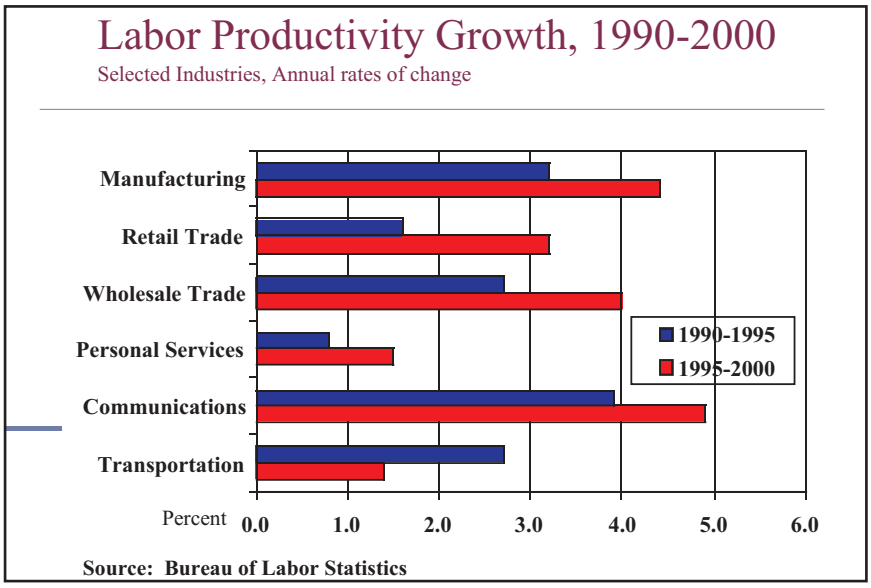


The last thing I have done is graph or show what the productivity has been since the beginning of the recession and how that has held up. So far, the results are fairly encouraging because the average productivity rate from 2000 to 2002, the first two quarters of this year, has been 2.8 percent, which is very good and in line with the productivity speed-up. In particular, it is very good compared to where we are in the cycle. I just want to show you some of those trends. This graph shows what productivity has been in expansions and in recessions. The green bar here is productivity and expansions post-war, which has been, on average, 2.5 percent. The second blue bar is the average of productivity peak to trough in all post-war recessions. As you can see, the average for expansions is quite a bit higher than recessions. Expansions are 2.5 percent and recessions are .8 percent. Next to that in the red bar, we have the most recent

productivity statistics. It is the five quarters that started since the beginning of the recession, and the average is 2.8 percent. So, particularly considering where we are in the cycle, the recent productivity, although it has been somewhat variable, has averaged 2.8 percent, which is very good when you adjust it for the cycle.



What are the sources of labor productivity? We have done some work at the Bureau to analyze where productivity growth has come from in the 1995 to 2000 period. What we are showing here is that contributions to productivity from the production of IT hardware itself is in the red bar and productivity that has come from the use of information capital by industries is in the pink bar. What you can see is that a great deal of the increase in productivity has been due to the IT revolution. Capital and the productivity of labor explain some of the productivity increase, but really the majority of it has been in the information technology area.



In this chart, we show in the blue bar the increase in productivity for several selected industries from 1990 to 1995 and then we have the 1995 to 2000 increase in the red bar. As you can see, for all of manufacturing and some of the selected other industries, the productivity increase in the 1995 to 2000 period has been substantially greater. The only exception to that is the transportation industry.

I want to point out that there is a small title here that says, "selected industries." The BLS has been increasing the number of industries for which we produce productivity data. We have done virtually all the manufacturing sector, but the service sector is quite hard. Because for some of the industries in the service sector, it is just very hard to measure the output. We are working on that and we expect to have more and more industries in the service sector covered by our productivity measures.

The Importance of Productivity

- Productivity up by 1% per year
  - Cumulative deficit down by $2 trillion over 10 years
  - Social Security shortfall cut by ? to ? over 75 years

How important is productivity? It is very important. As you heard the Secretary say earlier, productivity leads to higher real wages, to lower inflation and, generally, to better standards of living. It is also important for other reasons. What this slide shows is that a 1 percent increase in productivity cuts the cumulative deficit by $2 trillion over 10 years. That means $2 trillion in lower taxes, $2 trillion in more government service, or $2 trillion in debt reduction. We also looked at the impact of a 1 percent increase in productivity on the long-time 75-year projection that the Social Security trustees use. That 1 percent reduction would reduce the shortfall in Social Security by one-half to one-quarter. The one-half number is if you assume only productivity increases. The one-quarter is assuming that there are interactions between the variables. For instance, with productivity increases, workers may take that increase in the standard of living as more leisure so that you get a lower impact on the long-term health of the Social Security system.

In short, what I would like to say is that productivity is very important and there will be a very big difference in our lives and our children's lives if we have productivity figures that look more like 1995 to 2000 than they looked at in the earlier periods, particularly the period that began in 1973.

Thank you very much.

* * *

HASSETT: It seems from the data that there are clearly a number of factors suggesting there has been a miracle, in the sense that the miracle of productivity or the productivity advance is something that we would have said was very improbable just a few years ago. If we think of the American worker as Popeye in 1995, he opened his can of spinach. The question is, is he out of spinach or will he find some more? What does the future really looking like? I think that that is something Chairman Hubbard has been thinking about for many years, even before he entered politics. I look forward to hearing what he has to say.

"There is no single policy issue more important for the future of the country than understanding the determinants of increasing productivity growth."

- R. Glenn Hubbard, Chairman, Council of Economic Advisers

I would like to first thank Secretary Chao and AEI for having an event like this. I think that Elaine came to productivity for the same reason Willie Sutton did to the banks: that really is where the action is for the economy. There is no single policy issue more important for the future of the country than understanding the determinants of increasing productivity growth. Two small stories put this in perspective. There is sometimes wrangling in the United States on what the true structural productivity growth rate is. Just to put it in perspective for you, a difference of only two-tenths of a percentage point in structural productivity growth

every decade is about $1,000 for every man, woman and child in the country. Very small changes in productivity growth are very important. To put it more grandly, we have seen in the past decade a reversal in relative productivity growth performance in the United States and Japan. Were we to see current trends continue, that is, a very high rate of productivity growth in the United States and lower rates of productivity growth in Japan, it would take a full generation later for Japanese output to double than in the United States. These are two stories -- one small, one large -- that tell us how important all this is.

Kathleen has pretty much laid them out for you, but we have seen a substantial increase in the rate of productivity growth since the middle 1990s. A lot of attention has been paid to capital deepening and to information technology capital, in particular. I think there is a lot more to it than that. I think that we need to look more closely at the types of factors in the country that lead to the more rapid growth of total factor productivity and could help explain why we have had such marked productivity growth, even during the period of a recession and a recovery. To do that you have to look internationally. I do not think it is useful just to look at evidence from the United States.

One of the really intriguing aspects of this post-1995 trend is not just the acceleration in the United States, but how well the United States has done vis-a-vis its competitors. The acceleration we have seen has dwarfed the increases in continental Europe and in Japan and in Australia. To explain that, we cannot just turn to information technology, because Americans are not smarter than our competitors in that sense. We do not have access to broad kinds of technology that others do not have. When one talks about miracles, there is always the question of faith versus good

works. There is a question here on good works: Is the source of the productivity gain just good works that could produce certain kinds of technologies? I would suggest that that is not the case. It is instead, as is often the case, faith that wins the battle.

A recent study by the Organization for Economic Cooperation and Development highlighted very carefully and consistently the benefit of flexible labor market and capital market institutions in the United States in explaining the high rate of productivity growth. That is, we have an economy whose organization promotes more rapid economic growth. This is something we do not want to take for granted and something we need to understand.

I think we have to look beyond macro data and look more at the potential promise of industry in firm studies. I know my colleague, Frank Lichtenberg from Columbia, will no doubt speak about that. I think industry data and careful studies of the development of industries help us understand which kinds of policies, which kinds of product market competition, for example, matter the most. There has already been a lot of very suggestive work in this area, including some very recent exciting work in the service sector. I look forward to seeing more of this.

A second kind of work that is going to be very instructive here is to go to the level of firms themselves. There is an interesting effort underway at the National Bureau of Economic Research on so-called "pen" factory studies. Here, economists have much to learn from observing the organizations of successful firms. We are seeing emerging literature that identifies particular kinds of human resource management practices, particular kinds of corporate governance and management strategies associated with

growth. I do not want to highlight the conclusions of any of these individual emerging studies so much as to highlight the theme that we need to look for these institutional factors that explain productivity growth because, as I suggested, from the international evidence, I think that is where this true success is.

I would also be remiss if I did not point out what I think are significant improvements underway in our data infrastructure for understanding productivity. That which you cannot measure, you cannot really do much about. Here, the BLS is engaged in what I view as very important developments in price index work, with 50 service industries being added that will help understand productivity growth in that sector. More broadly, the government has been engaged in trying to put together a data-sharing initiative to bring together BLS, BEA and income tax data to try to get better measurement. This is not just about getting better forecasts or better numbers per se. It really has a lot to do with how well we can measure productivity growth and, more importantly, understand and learn about that productivity growth.

So if I could close where I began, I think that small changes in productivity growth are very important for a given country and can be devastatingly important, positively or negatively. To understand that requires looking beyond the usual suspects and decompositions that we do in economics, and looking much more at the institutions that promote productivity growth. I think many of the discussions in this conference should shed light on that.

HASSETT: Thank you very much, Chairman Hubbard.

Chairman Hubbard said something that I found very striking, and I would like to reiterate that he sees that a lion's share in productivity gain is coming from total factor productivity. For those non-economists, think of it this way: If you have a person who is trying to mow a lawn with a push mower, then you do not give them a better mower. It is just that somehow with the same push mower, they are mowing more lawn all of a sudden. The question is, how is that happening? How is it that they have more capital, and the worker's interaction with the capital is better? That means that the miracle in some sense is more of a mystery and requires more digging to understand why it is occurring. If it was just a matter of getting more machines to more people, then it would not be that mysterious. So our next two panelists are going to go below the level of the aggregate data and talk about what is going on underneath a little bit more.

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"I think the key question to ask about whether there is a productivity miracle is to ask yourself, could you imagine going back to the way that you did business in the mid 1990s?"

- Steve Oliner, Associate Director of Research and Statistics, Federal Reserve Board

I would like to mention from the start that all the work that I am going to be talking about in this presentation is joint with my colleague, Dan Sichel, from the Federal Reserve. Dan is with us here. I should mention also that I will be presenting results that are largely drawn from a paper that Dan and I recently published that can be found on the Atlanta Fed's website. Also, given the number of cameras here, I should say in my clearest possible voice the standard Federal Reserve disclaimer about this work. Everything in my presentation now and any of the comments that Dan and I make over the course of the day are strictly our own viewpoints. They do not represent official Federal Reserve policy

and none of the numbers that we are presenting represent official Federal Reserve forecasts. With that out of the way, let me get started.

IS THE "NEW ECONOMY" DEAD?

- "Rest in peace, New Economy. It was fun while it lasted." *Goldman Sachs, August 14, 2002.*
- In fact, the productivity revival is alive and well.
- Need to distinguish the "fairy tale" economy from the more prosaic - but important – changes in the actual economy.
- Key question: Can you imagine going back to the way you did business in the mid-1990s?

The question Kevin posed was, is there a productivity miracle? That often gets twisted a little to be a question about whether the new economy is dead or alive. Personally, I think that it is quite alive, but there are many commentators who, based on recent developments in the economy, have come to the opposite view. I have simply drawn a colorful epitaph from one of them presented by Goldman Sachs. It says, "Rest in peace, new economy. It was fun while it lasted." What is behind this is the notion that the new economy represented things that have turned out to be unsustainable. What was unsustainable in the late 1990s was the notion that the productivity revival was going to generate enormous corporate profits, which were then going to support stock prices at what turned out to be levels that could not be sustained.

Things have turned around. We no longer see every clever idea for a web-based application-getting venture capital. All of that is quite different now. The messy reality of the economy has reasserted itself.

All of that being true, the fact remains, based on the facts about productivity, that the revival is alive and well. Kathleen gave the basic statistics. It is clear that in the post- 1995 period, productivity growth, even with the economic slowdown last year, remains well above the average pace that prevailed over the previous 25 years. It is important to distinguish what I would call the "fairy tale" economy, all of the fluff that we saw in the late 1990s that is getting swept away, as it always does over time, from the real but more prosaic developments in the economy that are still with us. I think the key question to ask about whether there is a productivity miracle is to ask yourself, could you imagine going back to the way that you did business in the mid 1990s?

Personally, I cannot. Right now, because of the information technology advances that we have put in place at the Fed, I have instant access to a tremendous amount of data and analysis that I could not have gotten in anywhere close to the same real-time basis seven years ago. For me, it is very real. This question is one that hits home, that there really is something happening here that is long-lasting. So, let me spend a couple of minutes just talking about what Dan and I have done in our work.

ANALYTICAL FRAMEWORK

- View the economy from "30,000 feet" to characterize overall effects of information technology. Case studies complement our approach.
- Use a standard growth-accounting procedure to decompose labor-productivity growth into contributions from:
  - Ø Greater use of capital (capital deepening)
    - Computer hardware
    - Computer software
    - Communications equipment
    - Other capital
  - Ø Changes in labor quality
  - Ø Multifactor productivity (MFP)
    - Producers of IT capital
    - Other industries

What we do really is look down on the economy from, so to speak, 30,000 feet. I mean, we are not on the ground looking at specific industry studies or case studies. We are using detailed macro data, not just aggregate data, but macro data that look at important industries, and asking whether those data filtered through standard economic models can help us understand what has happened since the mid-1990s. We use a standard growth accounting framework, which really dates back to Robert Solow's work in the late 1950s.

We use that standard framework to focus on what is happening in the information technology part of the economy, to really shine a spotlight on that part of the economy. We use this framework to decompose labor productivity growth into its major constituent parts. The first is the greater use of capital per unit of labor-capital deepening. As I said, since we shine a spotlight on information technology, we focus specifically on computer hardware, software, communication equipment, and then lump the remaining large

part of the American capital stock into a separate aggregate that we look at, but do not focus on.

Contributions to Growth of Labor Productivity[1]

	1974-1995 (1)	1996-2001 (2)	Difference (2) Minus (1)
1. Growth of labor productivity [2]	1.40	2.25	.85
Contributions from: [3]			
2. IT capital deepening	.42	.97	.55
3. Other capital deepening	.30	.20	-.10
4. Labor quality	.27	.25	-.02
5. MFP in semiconductors	.09	.42	.31
6. MFP in other IT sectors	.21	.31	.10
7. MFP in rest of nonfarm business	.12	.10	-.02
8. Total IT contribution [4]	.72	1.70	.98

1. Unpublished update to Oliner and Sichel (2002) that includes the effect of the July 2002 revision of the National Income and Product Accounts.
2. In the nonfarm business sector. Measured as average annual log difference for years shown multiplied by 100.
3. Percentage points per year.
4. Equals the sum of lines 2, 5, and 6.

Note: Detail may not sum to totals due to rounding.

Another contributor to productivity growth is labor quality. We will not have a lot to say about that, but for the sake of completeness, I am simply laying it out. The final factor is what Kevin and Glenn refer to as "total factor productivity." On my slide, I refer to it as multifactor productivity, MFP rather than TFP. It is the same thing. It is the notion of getting additional output from a given set of capital and labor inputs. Kevin gave the example of mowing the lawn. The other more generic notion of how it arises is through scientific discoveries that improve efficiency throughout the economy, and reorganizations of the workplace that allow more output to be gained from the same amount of inputs that one had before. This is the basic decomposition. What we are trying to explain is the acceleration of productivity after 1995 compared to the relatively slow pace for the period from the early 1970s up through 1995.

For the data that we have that run through 2001, and for the

purpose of this slide also incorporate the annual revision of the national product accounts that came out this July. The acceleration, pre-1995 to post-1995, is about .85 percentage points, 85 hundredths of a percent. Our framework attributes it to two factors. One is capital deepening, the use of information technology capital throughout the economy. Even though we are now looking at the economy and saying, "Oh, there is a meltdown in the tech sector," we are not seeing the pickup in information technology spending that perhaps was expected. Looking at the long span of time from the mid 1990s through today, and not simply focusing on the current period, it remains a fact that there was a tremendous amount of investment in information technology capital. That tremendous investment, which is still being put into productive use, contributes a large chunk of that pickup in productivity growth.

The other major factors we highlight are the efficiency improvements in the information technology producing sectors and, in particular, the semiconductor sector. For us, this is really a driving force for all of that capital deepening because it was those efficiency improvements and the ability to get much more computing power at much lower quality-adjusted prices that really drove the investment boom and that really had its roots in advances in semiconductor technology. Those are two factors that we highlight as being important for explaining the revival of productivity growth.

Now, the particular numbers that I am showing here over the particular time period make it appear as though those two factors fully explain the pickup in productivity. That is partly a figment of the ending date of this set of data, which ends in the recession year 2001. If we were to go back to 2000, we would also see a

substantial pickup in multifactor productivity in other industries throughout the economy. Indeed, Dan and I believe that the multifactor productivity pickup has been relatively widespread. However, multifactor productivity is very cyclical, and if you end your comparison in a recession year as we do, only because we are trying to use the most recent annual data, what one finds is that multifactor productivity in the rest of the economy, which is the residual in our framework, looks weak. But that is not really the conclusion we want people to take away, because ending in 2000 would not show that, and I strongly believe that ending in 2002, given the very strong productivity growth of late, will not show that either.

WHERE ARE WE GOING?

- Two key issues:
  - Ø Will the pace of technical advance remain rapid in the tech sector?
  - Ø Will ever-cheaper supply create end-user demand?

- Over the past several decades, no evidence of saturation in use of computing power:
  - Ø Evident from stable to rising budget shares for different types of IT capital.
  - Ø Also evident from examples of new uses of computing power over time:

    Military and space-flight applications
    Back-office record-keeping calculations
    Analysis of real-time data
    Desk-top computing
    Convergence of computers and telecom
    Hand-held devices

The next question that we look at is, where are we going from here? This is probably a more interesting question than just the backward look. There are really two key issues that one needs to confront to figure out what a likely range for productivity growth going forward might be. One is, is it likely that the pace of technological advance in the tech sector itself, and in particular in semiconductors, is likely to remain as rapid as we saw in the

second half of the 1990s? Honestly, I think this is a question that neither Dan nor I nor anyone else really know the answer to. Much of it depends on technical scientific developments that are very hard to predict. Certainly, the historical record, as reflected in Moore's Law, indicates the successive and persistent ability of the semiconductor industry to produce more and more high-powered chips over time. There is nothing that suggests that is likely to run its course in the near future.

The other issue is, will this ever-cheaper supply stimulate end-user demand? On this point, Dan and I are certainly believers that, yes, it will be true, at least in the near future. There are two reasons to think so and they are based on historical evidence. If you look back in time, there is really no evidence that over the decades there has been any saturation in the ability to effectively use new computing power. That is really what we are focusing on. You can see that from two different angles. One is that even though the quality-adjusted prices of computing power have dropped dramatically and persistently over time, the share of company budgets devoted to buying information technology, in current dollar terms, has not fallen. If there had been saturation, you would have expected that companies would be cutting back on their IT spending in current dollar terms when prices fell. In fact, they have not. They have been buying more and more real information technology power. That trend is evident from the stable to rising budget shares for every major type of information technology capital good.

A second way to approach this question is to look at the historical record of how new applications of information technology have come through the decades - things that probably were extremely hard to predict before the fact. Going back to the

beginning, the initial uses of this technology were in the military and the aerospace program back in the 1950s and 1960s, using enormous mainframes that no one in the civilian sector would have thought about using on a major scale. Eventually, civilian uses became more prevalent. Then as computers became smaller and cheaper, they diffused throughout the economy so that we eventually moved from back office recordkeeping to analysis of real-time data, to things such as airline reservation systems, moving through the PC revolution to desktop computing where we now have computers ubiquitous through the workplace, to the convergence of computers in telecom, which I think is really the story of the second half of the 1990s, and now to the story of hand-held devices, which is still being told. So, throughout the last several decades there has been no evidence of saturation, and it is hard to see why it would happen just now.

WHERE ARE WE GOING? (Continued)

- Oliner and Sichel (2002) take a relatively optimistic view.
  - Ø Analyze a growth model with a rich characterization of the tech sector.
  - Ø Under plausible scenarios, estimate labor-productivity growth to range from 2 percent to 2-3/4 percent (annual rate).
  - Ø Estimates remain above slow 1973-95 pace because dynamic IT sector now a larger part of the economy.
  - Ø Other analysts have obtained similar results.

Finally, Dan and I take this basic assumption of no saturation and use it to develop a variety of scenarios for how productivity might develop over a period of roughly the next decade. Strictly speaking, these are steady-state results coming from a multisector

growth model. That model really does not have implications beyond a period of five to ten years because who knows what the structure of the economy is going to look like beyond there. So we think of this as a relatively short-term to intermediate-term way of characterizing productivity growth. The model has a very rich characterization of the technology sector, which we think is important for really understanding how developments evolve over time. Under a variety of scenarios that span the most plausible outcomes, our estimate is that labor productivity growth will average somewhere between 2 and 2.75 percentage points over this five-to-ten year horizon.

Again, this is not a Fed forecast. This is a result of our model. In fact, to highlight the uncertainty associated with this, we refer to it as structured guesses rather than forecasts. We are pretty confident that based on the analysis, productivity growth over the next decade or so will not revert back to the slow pace that we saw in the period from the early 1970s to the mid 1990s. While we think that there is a wide range of possibilities, 2 to 2.75 percent bounds what we think is most likely. I should note in closing that a number of other analysts using methods similar to ours, some using statistical methods that are very different, have largely come up with estimates that fall in the same range. So I would say in closing that there is an emerging consensus among analysts that takes what I would characterize as a relatively optimistic view.

Thank you.

HASSETT: Thank you very much, Steve. The one thing I wondered about is how you could be so much more productive now than you were seven years ago, given that seven years ago you shared a bay area with me! Anyway, thank you. That is very

interesting. I thought in particular the notion that there is still a lot of diffusion to happen is very, very important because it means that a very identifiable fundamental of the acceleration is likely to repeat itself in the future.

The new growth theorists have said that the computer revolution makes it easier for us to find new things, and therefore we should expect a permanently higher economic growth rate. Would you say that the evidence that you have uncovered relates to the debate about whether new growth theory is the way to think about the economy? I mean, is it the case that Dr. Romer's theories are somehow confirmed by what you and Dan have found?

OLINER: What Dan and I have found is not direct confirmation of there being a permanent information technology-related pickup in productivity growth. We tend to be very cautious about extrapolating our results out into the very distant future. I do think that there are reasons to be quite optimistic about, say, the next decade or so. Beyond that, I think the crystal ball is very foggy and the results that we have I would hesitate to say validate that point of view necessarily.

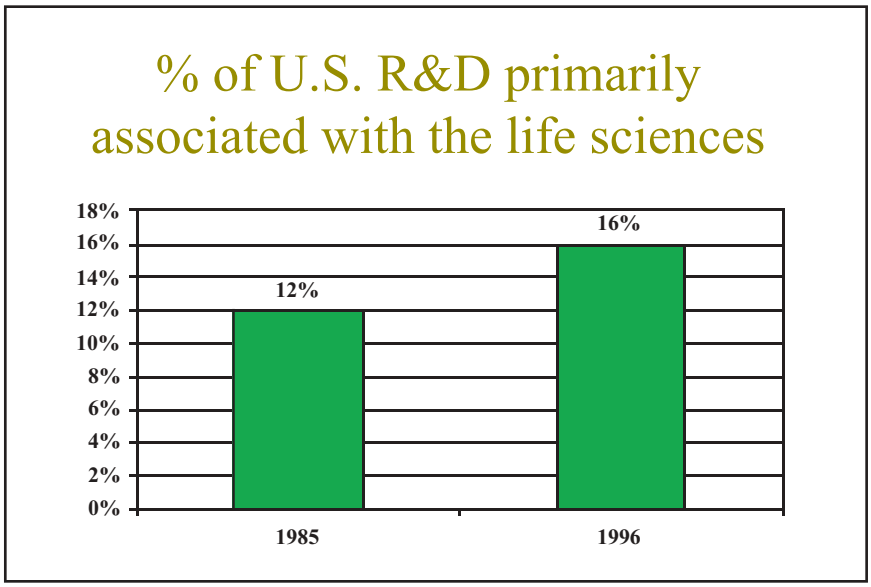
HASSETT: Thank you. I guess Frank is now ready, and I apologize for the delay.

Frank Lichtenberg, Professor,
Columbia University School of Business

Thank you. Good morning.

I am going to talk about biomedical innovation and productivity growth. We already heard a reference to Robert Solow from Steve. Solow, back about 50 years ago, did pioneering work in which he argued that technological progress is necessary for there to be sustained productivity growth. What Solow found, following work by Abramowitz and others, was that most of the growth in output could not be explained by growth in capital and labor, and that technological progress was fundamentally the engine of economic growth. In his early work, Solow assumed for simplicity that technical progress was endogenous. It just sort of happened. It was like manna from heaven. But in the last 50 years, we have made some improvements on that so-called endogenous growth model. The fundamental idea of many endogenous

growth models, such as the work of Paul Romer that Kevin just referred to, is the idea that R&D, research and development is really the source of technological progress. Hence, it is what fundamentally drives productivity growth in the long run.

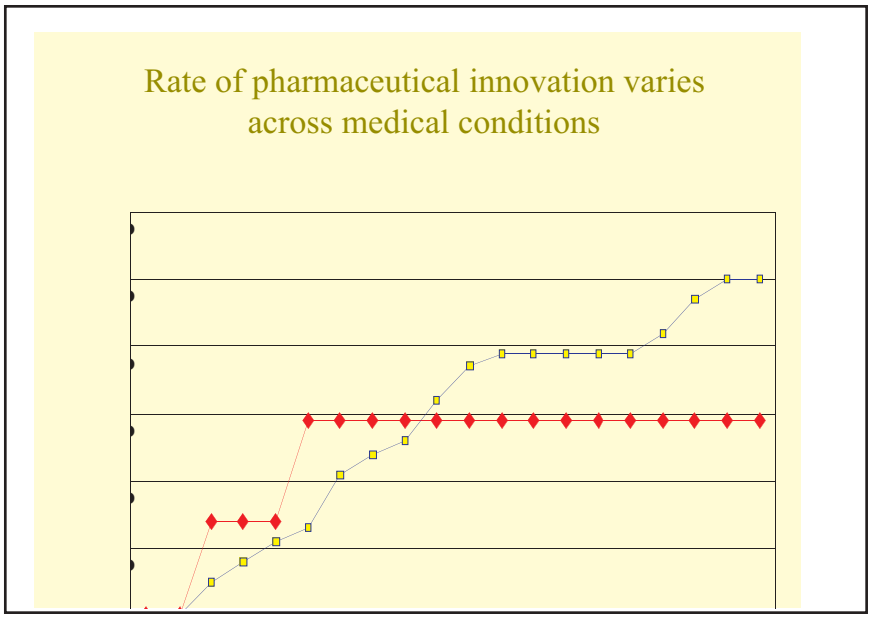


Now, I am going to talk about one particular type of research and development, biomedical research. According to the National Science Foundation (NSF), the percent of U.S. R&D that is primarily associated with the life sciences increased from 12 percent in 1985 to 16 percent in 1996. That is before the NIH budget doubled. There has been very rapid growth in private R&D spending as well. By the way, that is total R&D. If we take out defense R&D, then biomedical research would look even more important, a bigger share of the total pie of R&D. If we look at the industry breakdown of who does a lot of R&D, the most R&D-intensive sector of the economy is pharmaceuticals and biotech. Again, according to the NSF, the pharmaceutical industry spends more than 10 percent of its revenue on R&D. Ranked second would be machinery and equipment, including computers. So

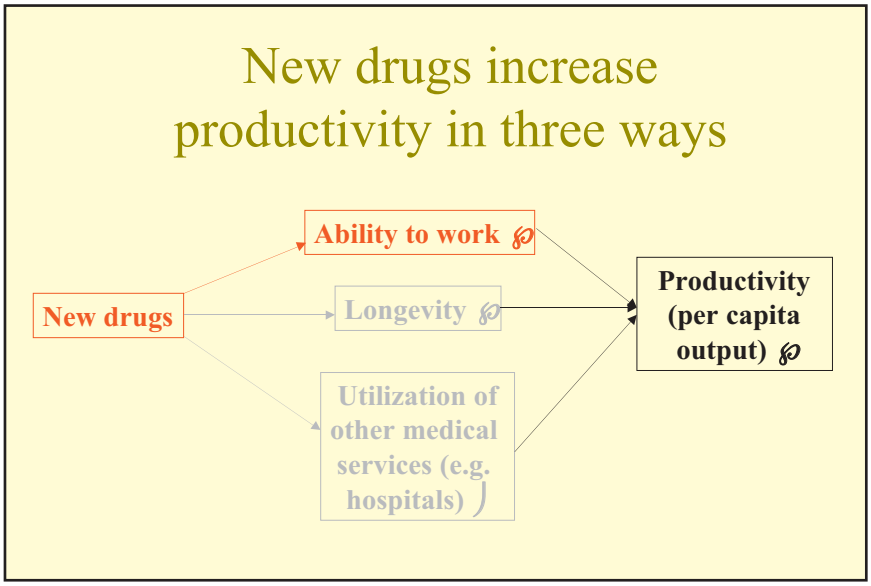
Steve just talked about information technology, which is surely very R&D intensive. But if you think computers are R&D intensive, take a look at drugs. They are much more R&D intensive.

I am going to talk about the hypothesis that new drugs increase productivity in three different ways, at least three that I have thought about and done some research on. New drugs and other medical technology as well increased productivity both outside the healthcare sector and within the healthcare sector. The three kinds of pathways that I am going to discuss are, first, that new drugs increase ability to work, they increase labor supply. Second, new drugs increase longevity. I think a meaningful comprehensive definition of economic growth should also take into account improvements in longevity and quality of life. And third, new drugs reduce the utilization of other medical services, especially hospital care, which is quite expensive. Therefore, through all these mechanisms or pathways, new drugs and other medical technology have increased productivity per capita and are likely to continue to do so.

First, let me talk about some recent research I have done that tries to examine the impact of new drugs on ability to work. The reason one can examine this in a meaningful way is that the rate of pharmaceutical innovation varies across medical conditions. There are some diseases where there have been a lot of new drugs introduced in the last 20 years, but for other conditions there have been relatively few new drugs. Now, thanks to FDA regulation, we can actually measure very precisely the number of drugs that are available to treat different conditions over time.



This chart shows the rate of increase in the number of drugs to treat two different disorders, disorders of the thyroid gland and disorders of other endocrine glands, which includes diabetes, one of the most important and prevalent conditions. What it shows is that from 1979 to 1984, there was a 30 percent increase in the number of drugs available to treat diabetes disorders. The bad news is there has not been anything new to treat diabetes disorders since 1984 or so. I have talked to endocrinologists about that and they say, "Yes, that is right. We had Synthroid in the early 1980s and there really hasn't been much new to treat thyroid disorders since then." By contrast, for disorders of the endocrine glands, including diabetes, there have been a lot of new discoveries, all during the last 20 years. By 1998, there were 50 percent more drugs available to treat diabetes and other disorders of the endocrine glands than there were in 1979. So, because diseases are heterogeneous and there is a lot of progress, a lot of innovation for some diseases and less for others, we can study the correlation across diseases between innovation and changes in outcomes.



The change in outcome I am emphasizing here is ability to work or inability to work. There is a survey called the National Health Interview Survey where people are asked, first, Do you have a particular condition? Do you have diabetes? Do you have asthma? If a person says, "Yes, I have that condition," then they are asked, "Are you unable to work because you have this condition?" Or, "If you are able to work, how many days of work did you miss last year because of that condition?" What I show in this chart is the correlation across conditions between the percentage increase in the number of drugs available to treat the condition, essentially the number of FDA approvals during the period, and the change in the percent of people who say they are unable to work because they have the condition. What we observe is a significant negative correlation. That is for the conditions where there has been the most innovation, we have seen the greatest declines in inability to work.

If one does a back-of-the-envelope calculation based on that correlation, I estimate that if we take the drugs that were approved

Estimated effects of 1983-96 new drug approvals

- reduction in number of people unable to work: 1.44 million
- value of reduction in number of people unable to work (@ $30K/year): $43.3 billion/year
- reduction in work loss days per year of currently employed persons: 98.8 million/year
- value of reduction in work loss days (@ $100/day): $9.9 billion/year
- reduction in restricted activity days of all persons: 423 million/year
- reduction in bed days of all persons: 178 million/year

between 1983 and 1996, about 25 new drugs per year, then the net effect of those new drug approvals was to reduce the number of people who were unable to work in 1996 by about 1.4 million. In other words, if there had been no new drugs, not a single new drug after 1983, there would have been 1.4 million more people unable to work in 1996 than there actually were. If we use the average annual compensation of U.S. workers, the value of that reduction in the number of people unable to work is about $43 billion a year. There are also reductions in work-lost days per year of people who are employed of about 100 million fewer lost workdays per year as a result of the new drugs that were introduced during that 13-year period. I think this provides pretty strong evidence on the first hypothesized mechanism.

Economic importance of longevity increase

- Utility, or welfare, depends on (leisure) *time* as well as goods
- Increase in longevity (from about 50 years in 1900 to 78 years in 1997) has been the major source of increased leisure time over the life cycle
- Nordhaus: "to a first approximation, the economic value of increases in longevity over the twentieth century is about as large as the value of measured growth in non-health goods and services"

The second way in which new drugs have increased productivity is via increased longevity. Many economists realize that utility or welfare depends on time as well as goods. Gary Becker and many others have written treatises about this, the idea that people value leisure time as well as goods. The increase in longevity has been the major source of increased leisure time over the life cycle. Back in 1900, life expectancy at birth was about 50 years. By the end of the 20th century, it was about 78. So people live 60 percent longer than they did in 1900. Bill Nordhouse of Yale has argued that to a first approximation, the economic value of increased longevity over the 20th century is about as large as the value of measured growth in non-health goods and services. In other words, the growth in per capita GDP underestimates true economic growth by about half. Where does that come from? It comes from a variety of sources, but one source is medical innovation and new drugs, in particular. I looked at the last 20 years of the 20th century. During that period, longevity, or mean age at death, increased by about 3.8 years, but the increase in mean

age at death varied considerably across diseases. Survival from some diseases has increased more than from others. What I found was that mean age at death increased fastest for the diseases with the largest increase in the number of available drugs.

Contribution of new drugs to longevity increase

- I estimate that the increase in the stock of drugs increased mean age at death by at least 0.39 years (4.7 months) during this period
- According to Murphy and Topel, average willingness to pay to live an additional year is approximately $150,000
- Hence the per capita value of the 20-year increase in longevity attributable to new drugs is $58,500.

So if you were fortunate enough to have a disease where there was a lot of innovation, your chances of survival increased faster than if you were in kind of a low-tech disease. I estimate that the increase in the stock of drugs increased mean age at death by about 4.7 months during this period. That is probably a conservative estimate. If we look at the trend since 1960 in life expectancy at birth, what we see is sustained increase. If I look at that chart, I do not see a lot of evidence of a slowdown in longevity growth in the last decade or so. In fact, we talk about the 1960s as being about the miracle decade. In fact, there was very little longevity growth during the 1960s. It really took off after 1970. That is partly due to the expansion of Medicare, Medicaid and so forth.

New drugs reduce other medical costs

- Although new drugs are more expensive than old drugs, *people who use newer drugs tend to use fewer non-drug medical services (hospital stays, MD visits, home health care) than people who use old drugs* (Example: Gleevec)
- The reduction in non-drug medical costs exceeds the increase in drug costs by a substantial margin (4:1 or more)
- Consistent with Grossman & Helpman (1991): "Innovative goods are better than older products simply because they provide more 'product services' in relation to their cost of production"

Finally, the last hypothesized way in which new drugs increase productivity, this time within the healthcare sector, is by reducing utilization of other medical services like hospital care. Although new drugs are more expensive than old drugs, as everyone knows, not everyone knows that people who use newer drugs tend to use fewer non-drug medical services, like hospital stays, office visits to physicians, and home healthcare than people who use older drugs. A spectacular example of this is Gleevec, which is a leukemia drug that was launched about a year ago. It only works for certain forms of leukemia, but up until the arrival of Gleevec, the only treatment for that kind of leukemia was to get a bone marrow transplant, which is enormously expensive and has a success rate of about 50 percent. Gleevec is a miracle drug for people who have that condition. It results in almost complete remission with virtually no side effects and obviates the need for a bone marrow transplant.

I have found in a couple of studies that the reduction in non-drug medical costs on average exceeds the increase in drug costs by a substantial margin. That is, people using new drugs will reduce their expenditure on other medical services by about four times as much as the increase in spending on the new drugs. That is consistent with theoretical models of economic growth.

To conclude, Solow and subsequent research has argued that R&D is the fundamental source of productivity growth. Pharmaceuticals and biotech is the most R&D intensive sector of the economy, and new drugs and other medical innovations resulting from both public and private R&D have increased productivity in several different ways.

Thank you.

HASSETT: Thank you very much, Frank.

The interesting consensus I get from Frank's and Steve's remarks is that if there is a miracle, then it is because of miracles underneath, drug miracles and technological miracles that we recognize at the micro level as being rather miraculous. I am intrigued by Steve's 2 to 2.75 percent number. I wonder, Chairman Hubbard, suppose that we come in at the high end of Steve's range for the next 10 years and we get 2 and 2.75 percent productivity growth, how does that change everything in Washington? Is that enough to grow our way out of Social Security? How does it change the world?

HUBBARD: Just look at a specific example. In the President's last budget, there is an assumed productivity growth rate of 2.1 percent, near the low end of Steve's range. If that were 2.75

percent over the ten years that is forever in Washington, that would be easily over $1 trillion added to the surplus. As Kathleen was suggesting, if you look over time for the very long period problems like Social Security or Medicare, that is truly a very significant difference.

HASSETT: So do you think the next forecast should up the estimate? Is this going to change the debate in the near term as well? How should we respond when we see productivity growth as high as it has been this year, for example? That 2.1 percent looks kind of low, does it not?

HUBBARD: I think it is important to note, as Steve did in his presentation, the enormous uncertainty surrounding long-term productivity growth estimates. It is a bit like when one looks at the entitlement programs, the enormous uncertainty about demographics over the very long term. I think caution is in order. I think the 2.1 percent that the Administration uses is within the interior of what most economists believe and I think that is a pretty safe and cautious place to be.

HASSETT: Steve, suppose that you wanted to stop productivity growth with government policy. What would you do? Is it sensitive enough to things that we do that we could actually mess it up relatively easily? Or do you think it is just this powerful underneath force that it does not matter who is setting tax rates and things like that?

OLINER: I guess we could mess it up if we really did something drastic, but I am always impressed at the resiliency of the U.S. economy. I am just thinking about the developments over the past several years that have really hit the U.S. economy with a

series of negative shocks. Just looking at the stock market, we have lost something like $8 trillion of household wealth, yet consumer spending is still growing. We have had the shocks from terrorist attacks. We have had the shocks to the capital markets from accounting and corporate scandals, and companies are out there raising money. Of course, it is more expensive because risks have risen, but the economy experienced a relatively short and relatively mild recession. While this has been a somewhat sluggish recovery, it is growing. One can imagine other economies not coming through. My sense is that the fundamental open market deregulated competitive economy that we have is enormously important for maintaining good productivity growth. Just going back to Glenn's comments, institutions really matter. We have institutions set up generally speaking in the U.S. that are very favorable. Major changes to reintroduce a tremendous amount of regulation to hamper the mobility of labor and capital would be detrimental and would certainly reduce productivity growth, but I do not think it would stop it in its tracks.

HUBBARD: There is one area for concern in the present environment, and that is homeland security. As we spend more on security as a nation, I think it is very important for government to emphasize incentive-based and standard-based regulation as opposed to command and control. That is a lesson we have learned in many other areas of regulation and is a fear or a wildcard in Steve's scenario.

HASSETT: Kathleen, do you think that the homeland security things have slowed down the economy? For example the extra hour and a half or so we spend in airports that has been picked up by the data? One would think that there are a lot of business travelers out there spending a lot more time not doing anything except having their shoes taken off for them.

UTGOFF: I keep having my laptop checks and my phone checks. GDP does not measure everything. There has been a great deal of discussion about things like improvements of our environment, and does that really show up. We are all being more safe and maybe that will show up in some of the prices that we are charging. I would hesitate to say that all the safety we are getting would be showing up in productivity measures.

HASSETT: Frank, how about in the drug sector? Has R&D held up in the recession? I know that there has been lots of talk about allowing re-importation and things like that that have been very contentious in Washington this year. Do you think that this stuff could impact R&D spending and then undermine one of the things that has been underpinning the miracle?

LICHTENBERG: I think there are some lags in collecting the data. I do not know what has happened to the R&D budget in the last couple of years. My impression is that R&D expenditures remain fairly strong. There has been some slowdown in the rate of approval of new drugs, which means in a sense R&D per drug has been going up. It is getting more and more expensive to develop and get drugs approved, the costs of innovation are going up. Therefore, in order to encourage firms to continue to engage in this, the incentives have to be there. Re-importation is one possible threat to that - the inability to price discriminate across different countries. Intellectual property is also of paramount importance to the industry. So, clearly policy has a big role.

HASSETT: I have one more question for Chairman Hubbard and then we will have time for questions from the floor. I am not trying to give you a nightmare. Suppose I am President and I say to you, "I want that 2.75 percent up to 3 percent." What do we do?

HUBBARD: I will answer the question in the spirit in which I am sure you asked it. I think the policy does matter, but we have got to remember realistic limits on policy, too. I think that even the very large cuts and marginal tax rates that we saw in the President's signature tax package probably added about two-tenths of a percentage point to long term growth for a long period of time. That was a very large change. I think what policy really has to do is make sure that we create a neutral environment for labor and capital to move around. Avoiding the big mistakes is the key thing, with continued emphasis on deregulation, on flexibility in labor markets and capital markets and, of course, good long-term tax policy. I do not think there is a silver bullet that policy has to simply have a sea-change in long-term growth.

HASSETT: Thank you very much.

We have about ten minutes for questions. If someone would like to ask a question of any of our panelists, now would be the time.

QUESTION: The integration of quality changes is important in terms of its impact on the standard of living. In your opinion, Glenn, how are quality changes best measured in terms of their impact on productivity? Given that quality changes can be measured in a variety of ways, how useful are international comparisons of productivity?

HUBBARD: I think the question of quality adjustments really is key. We know from work going back to the Boston Committee's studies how important they are for the measurement of price deflators, which is really the central issue. In terms of international comparisons, while there are differences in quality adjustments, I still think that there is some usefulness in

international comparisons because, quite frankly, the differences in productivity growth, even among very industrialized countries, are very large relative to the range suggested by quality adjustments. It is an important topic, and I know is one that continues to take time at the BLS.

UTGOFF: We have been working on that area for probably two decades or more, as pointed out in the Boston Committee. We are right now on the frontiers of that kind of research. Instead of pricing a computer, we price the underlying components of a computer, which would be memory and speed and other things, so that we can better get a handle on quality. Although it is not perfect, it is definitely moving in the right direction. There is no doubt about that.

HASSETT: It could be that they are doing a little better than it looks in their data?

UTGOFF: Yes.

HASSETT: Frank?

LICHTENBERG: I just want to say in the area of healthcare, I think measuring quality is extraordinarily important. There is a very nice study by David Cutler and colleagues a few years ago looking at heart attack treatment. If we just look at the cost of treating heart attack patients, that has gone steadily upward. However, it is also the case that people who have heart attacks do a lot better than they did 10 or 15 years ago. So if we account for the value of increased longevity, then it actually looks like the price of heart attack care is going down rather than up.

QUESTION: I wanted to follow up a little bit on this measurability question. Dale Jorgensen, who is a new-economy believer, points out that we have not done a good job yet of measuring things like telecommunications in productivity increases, which are actually running faster than Moore's Law. In areas like software we have not done a good job. Skeptics like Steven Roach say somewhat facetiously that all technology does is allow me and very productive workers to work much longer hours, never take vacations, never have weekends and maybe that explains why productivity is growing. I wonder if you think we have not been measuring successfully or accurately enough and that we might need to understand this better.

OLINER: I think the issues that Dale Jorgensen highlighted about measurement are very important issues. Certainly in the area of measuring prices for communications equipment, there are reasons to believe that the official numbers do not fully capture the quality adjusted price declines that have actually occurred. I am referring in particular to some research that one of my colleagues at the Federal Reserve has done, Mark Doms, that was incredibly detailed, taking apart that category of equipment and looking at what has happened to the prices. The prices have fallen substantially faster than the official numbers show. Really, everything that we are presenting here, all of this research, depends on a base of accurate statistics. We have heard your question and one before about the need for accurate price deflators. I could not emphasize more how important that really is.

QUESTION: Is not a lot of this a question of which base year you take, because if instead of 1973 and 1995, you take in 1992, you find the productivity has grown more slowly in 1992 to 2001

than it did in 1982 to 1992, from a recession to bottom of recession, so there is not much effect. Furthermore, in the last three years, the BLS has revised the number sharply downwards every year. Isn't there a danger that, in fact, the whole thing will disappear like a bubble when the final numbers are in in a few years?

UTGOFF: I think the final numbers are in for 1973. I am not the only one to divide up this chart in these time periods. There was a precipitous decline in productivity in 1973 after the oil crisis, and there was a speedup beginning in 1995, which led to the comments about miracles and new economies. If you divide up those periods differently, of course you are going to get different averages. I do not think either revisions or different visions of the data will really change the major facts that we have observed here.

OLINER: I agree with that comment. The choice of 1995 as a dividing line between the slow productivity and the faster period after that is somewhat arbitrary. Statistical methods that are intended to try to find breaks in a series do not necessarily pinpoint a particular quarter or year in which the break occurred, but they definitely do say in the middle part of the 1990s there was a break. So I think it is reasonable to use a year in the mid-1990s as the beginning of the period that we look at for faster growth.

HASSETT: Right. And the last few numbers are definitely high, right? I mean, they are not in dispute.

QUESTION: For Dr. Lichtenberg, the worry about the healthcare cost explosion looks, of course, only at the cost side of the ledger. What happens to that picture if you factor back in the productivity gains and the economic value of the health gains that are coming from those higher costs?

LICHTENBERG: That is the big question. I think that when one tries to do that calculation, that requires valuing outcomes - for example, valuing longevity. I gave the estimate of Murphy and Topel about what is a year of life worth. While their work is extremely good, obviously there is going to be some controversy about numbers like that. I think that there is an emerging consensus among economists who study healthcare that although healthcare expenditure has been growing rapidly, that we really are getting quite a lot for that expenditure and that we should stop wringing our hands about the slowly rising share of healthcare expenditure and GDP.

HASSETT: Thank you.

Productivity and Jobs

Panelists:

Martin N. Baily
Senior Fellow,
Institute for International Economics

Jared Bernstein
Economist, Economic Policy Institute

Edmund S. Phelps
Professor of Political Economy
Columbia University

Dick Davidson
Chairman and CEO
Union Pacific Corporation

Marilyn Carlson Nelson
Chairman and CEO
Carlson Companies, Inc.

Moderator:
Ben J. Wattenberg
Senior Fellow
American Enterprise Institute

Ben J. Wattenberg, Senior Fellow,
American Enterprise Institute

Welcome to the second panel of today's festivities. Its title, as you can see, is Productivity and Jobs. I am in favor of both. So are our panelists.

In theory, we could go home now, but it is not quite that simple. I am planning to arrange this in the following way to structure this session: I am asking the theoreticians here to go first. They are, in order, Martin Baily, Jared Bernstein and Edmund Phelps. They will lay out a broad landscape of what this situation looks like. We have two practitioners, Dick Davidson of Union Pacific and Marilyn Carlson Nelson of the Carlson Companies, who will speak about how this works.

Let us begin with Martin Baily.

"One of the things that is different now compared to the earlier slower growth period is that we are seeing more rapid productivity growth in service industries, not just in manufacturing."

- Martin Baily, Senior Fellow, Institute for International Economics

Thank you. I think there might be a few economic theorists that might not want to claim me as one of their colleagues and I am not sure I necessarily at this point in my career would put myself in that category.

I have done a little bit - not the kind of practitioner stuff that these other panelists have done, but in terms of working with a profit-making organization - to look at productivity in industries and companies. Let me comment on the issue of the acceleration

of productivity growth, roughly how much it is and where it has come from, with a slightly different perspective than the first panel. I agree there has been an acceleration of productivity growth of about 1 percent a year, up from about 1.4 percent to around 2.4 percent. A little bit less than 2.4 percent looks like the current trend. I do not see that as a cyclical effect. It looks like a structural effect. Therefore, I suspect it will continue, although we do not know. There is uncertainty, as Glenn Hubbard said, about how long that will continue. What is the right number to use for forecasting purposes? Again, I would agree with my predecessor at the Council, Glenn, that 2.1 percent is a pretty good number for forecasting purposes. It is a bit below where I think the current trend is, but it is about right where productivity growth has been from 1990 up to the present. Taking that forward is the right conservative number to use.

WATTENBERG: You are in the right place for a conservative number. That is fine.

BAILY: Good. There are different forms of conservatism, but I am not going to use my eight minutes to debate that issue with you here. There was a sort of natural story, and one you have heard today, as to what the sources of that acceleration are. It is tied to the very sharp increase in the rate of investment and information technology, which is now paying off. One of the things that is different now compared to the earlier slower growth period is that we are seeing more rapid productivity growth in service industries, not just in manufacturing. So it was natural to see that information technology is paying off in higher productivity and service industries. It was also natural to look at Europe and say that they did not experience the same increase in productivity growth. In fact, maybe it is slowing down there and

they did not invest as much in that technology. Again, that story explained the differential performance. Unfortunately, it is more complicated than that, and the role of information technology may not be as great as is currently being assumed by the people doing standard economic analysis. The kind of growth accounting that Dan Sichel and Steve Oliner do, which I have done myself, is a very useful tool, but it does not really establish whether it was the information technology capital that increased productivity growth or not. It is just a fairly mechanical exercise in growth accounting.

I think there is some evidence now coming from work that Barry Bosworth and Jack Triplett did at Brookings looking at which industries increased their productivity growth that suggests that much of that increase came not from the higher rate of capital accumulation, but from multifactor productivity growth or total factor productivity growth in those industries. I think there is some case study evidence that suggests that is the case, too, and that many industries that bought a lot of this high-tech capital did not make very good use of it.

We had a discussion of how we are not counting the telecom productivity enough. It is true that maybe we are undercounting. We are not capturing the price declines in the telecom equipment industry. But if a lot of that stuff is not being used, if the utilization of that is not so great, then we are not necessarily getting the productivity out of it. Some of the software, for example Enterprise Resource Planning (ERP) software has been described jokingly as like pouring wet cement into your business process. It hardens and then you cannot change anything. So, I think there have been some negative experiences with some of this hardware and software. I do not want to go to the other extreme, however. Information technology is a key enabling innovation, but it has to

be coupled with changes in business practices. There are many other things that businesses do that are not directly linked to information technology that allow them to increase productivity.

Now, beyond the sort of mechanics of what happened, what is it in the environment that causes productivity increase? I do not think we have a good answer as to why productivity growth slowed down in 1973 or necessarily why it accelerated, or appears to have accelerated, in 1995. I think it is fairly clear that there are some environmental conditions that favor innovation and productivity growth, and they include the high level of competitive intensity which characterizes the U.S. economy, coupled with globalization, which is another form of competitive pressure and one way in which best practice innovations can be brought to the United States from other countries, just as the United States takes its best practices overseas. I think a good regulatory environment has been conducive to that, and I would distinguish no regulation from good regulation.

There are many industries and situations where you need to get the regulatory environment right, rather than just get it out of the picture altogether. For example, in the telecommunications area, wireless telecom productivity is higher in Europe than it is in the United States because, in part, under their regulation, which is not ideal by the way, they have come closer to the optimal number of competitors. In the U.S., we have actually got too many competitors, none of which has been able to operate at optimal scale. It is a hard process to get the right level of competition and the right level of regulation to try and encourage innovation.

Let me turn specifically to the role of productivity growth in jobs. Rapid productivity growth often has a negative effect on

employment in specific companies, in specific industries and sometimes in specific sectors such as manufacturing and agriculture. It can even have a negative effect on employment in the short run during a cyclical recovery, as was the case in 1992 when we got a jobless recovery, and is to some extent true now as we are getting a recovery with not a lot of job growth and declines in some areas. Over the longer run and for the economy as a whole, I think that relationship is reversed. Over the longer run, faster productivity is good for employment.

I think we know from the 1950s and 1960s and the 1990s which were all periods in the United States when we had fast productivity growth combined with strong employment and low unemployment. That does not mean the faster productivity growth caused the strong employment, although I suspect that is true too, because in an environment where productivity growth is strong, real wages are rising and the labor market works a little better. We can function with lower unemployment rates when productivity growth is slow.

Over the longer run, there is a strong positive relationship between productivity growth and employment growth. Why would that be? I think some job loss, some job displacement is inevitable in a dynamic economy and if you have strong productivity growth, that is an environment in which incomes are growing and it is easier to create new businesses and new jobs so that you are able to replace not only the lost jobs, but generate a net job increase.

What about the policy environment? Let me comment on the point that was made in the earlier session about the dollar. I think the dollar at the moment is a negative for jobs in the U.S. economy,

particularly in manufacturing, but even overall. I appreciate the benefits of capital inflows and what they do to the United States, but I think this may be too much of a good thing. I would like to see the U.S. in an equilibrium, which had a higher domestic saving rate and a somewhat lower dollar and a somewhat lower current account deficit. I do not think we are going to get to a zero current account deficit, but we should drop it down from the 4 to 5 percent that we have been running lately.

What are some of the policies that help on that front and would help productivity and investments at the same time? I think increasing national saving is the right answer to that. The best and simplest way to do that is to run at least a budget balance, if not a budget surplus. That is the main policy that I would like to see. Not right now, by the way. We do not want to do that right now because we are still in a recovery, a weak economy phase. But as the economy strengthens, I would like policy to make sure that we have enough domestic funds to restore investment growth without running into a current account deficit, which increases our indebtedness.

I think the last thing on pro-jobs, pro-productivity is pro-growth safety net policies which include trade adjustment assistance, things like the earned income tax credit, which encourages people to work as well as giving them safety net support, and a continuation of training programs. Given how much technological change is taking place, we need to make sure that people who do lose their jobs have the opportunity to train for the new ones.

Thank you.

"In the long run, there is no question that productivity growth is not associated with higher unemployment."

- Jared Bernstein, Economist, Economic Policy Institute

Thank you very much, and thanks to AEI and the Department of Labor.

I have three points to make. The first is the notion that faster productivity growth contributes to so-called jobless recoveries at a time like the present one, which Martin briefly commented on. I think I am with him in the sense that there may be something to that, but I do not think there is much evidence. I am not going to spend a lot of time on that point, the relationship between productivity growth and unemployment, mostly because Ned Phelps is here and he can speak much more

deeply and insightfully about that. It is the second two points that I want to spend more time on because I think they are very important and potentially overlooked in our discussion today, which is focused primarily on these national aggregates like productivity growth and things like averages, average compensation, and distribution.

I think a very virtuous and beneficial cycle was engendered in the late 1990s when we had a period of increased productivity growth upon which we have been focusing, but also very low unemployment. There is a relationship between the two. Faster productivity growth reduces the rate of unemployment for lots of reasons which we can talk about. But the question among economists who argue about this is, how much and for how long? The question is, does an increase in productivity reduce the rate of unemployment that is consistent with stable prices or the NAIRU, the non-accelerating inflationary rate of unemployment? Does it increase it in a temporary sense, in a medium- or long-term sense?

This is a crucial point because in the latter 1990s, a very important reversal occurred. The combination of fast productivity growth and very low unemployment led to the first real wage and income gains for those in the bottom half of the income and wage scale in a couple of decades. We detailed these trends in excruciating detail in the book, State of Working America, but this is something that I am sure many in the room are very familiar with. Research I have done with macroeconomist Dean Baker suggests that unemployment in the neighborhood of 4 percent, in tandem with productivity growth around 2 percent, is the combination that is really essentially required if we are going to see these kinds of broad-based distributional gains that we saw in the latter 1990s. In the absence of that very potent combination, I

am afraid we may see more stagnation among those in the bottom half.

On the first point regarding the relationship between productivity growth and unemployment, there is a very simple and useful entity in economics that says the growth of employment is equal to the growth of output minus the growth of productivity. So if productivity increases, you can make the same amount of stuff in fewer hours, so of course holding output constant you have less employment. In the long run, there is no question that productivity growth is not associated with higher unemployment. We have, as Secretary Chao mentioned very clearly, had long-term trends in growing unemployment, in growing productivity, and no real trend in unemployment.

In the short run, there is the question of whether the productivity growth acceleration in the latter 1990s is responsible for the jobless or slow growth recovery we are currently moving through. One thing that is perhaps somewhat under-appreciated is that for all these great trends - and I am totally onboard with all of them - is the case that productivity grew 1.1 percent in 2001. So, it decelerated significantly. This is not any change in regime. This is weak demand, cyclical downturn and that is what is driving the slow job growth - the unemployment rate stuck in the high fives and essentially this jobless problem we are facing now. I do not think it is really a function of faster productivity growth.

Second point: Productivity, unemployment and the NAIRU, or the unemployment rate that is associated with stable inflation. For lots of reasons, increases in productivity are associated with decline in unemployment, particularly over-expansions. There are efficiency gains that you have heard about, these lower prices, unit

labor costs fall, and then you have declining inflation for a given unemployment rate. No less than our lunchtime speaker has cited the importance of accelerated productivity growth in allowing the unemployment rate to fall to levels that many economists thought were sure to be inflationary. That is a very positive thing that happened and I will show you some of the benefits in a second. The question is, how persistent?

Lawrence Ball and Gregory Mankiw did a very good paper on the relationship in part between the unemployment rate and the NAIRU. They show a very close relationship between the acceleration in productivity growth and a lower rate of unemployment that could be sustained without price pressures. Their research suggests that this change, this productivity-induced decline in the NAIRU or the rate of unemployment that we can sustain without price pressures, is not all that temporary. It is pretty persistent. In that sense, it seems to last for periods of at least five years or longer.

Let me shift into the most compelling part of this cycle I am describing where faster productivity lowers unemployment and leads to reversal in some of the negative trends that have concerned many of us at EPI. Secretary Chao very convincingly talked about the benefits of increasing productivity in tandem with increasing real compensation. It is clear that productivity does increase with real compensation over the long term, for the most part. What happened in the latter 1970s and persisted throughout the next 20 years or so was the divergence in productivity growth and median compensation. This is the well-known and documented increase in the growth of economic inequality. There was a significant divergence between not what the average worker was taking home relative to productivity

growth, but what the median worker was taking home. The median was drifting away from the productivity growth trend and that meant that the fruits of productivity growth were flowing less to those in the bottom half of the income scale.

Here is a tale of two different recoveries that make this case. From 1983 to 1989, the last six years of that recovery, you see productivity growing about 8 percent or so slower than it did in the last recovery, but you see the wages of male and female low-wage workers essentially flat. If you switch to an analogous period over the 1990s, the last six years of the 1990s recovery, you see productivity growing faster, about twice as fast. It grows about 15 percent. And you see the wages of male and female low-wage workers growing in tandem with the increase in productivity growth.

One of the important missing ingredients from the 1980s recovery versus this one was very low unemployment. Changes in the unemployment rate tend to have a bigger bang for workers who are further down the wage scale. You can see a staircase function going down where the gain that you get from lower unemployment feeds into real wages at a much higher rate for low-wage workers than for median- or high-wage workers. For those at the bottom of the wage scale, a decline in unemployment associated with this increase in productivity growth means much more in terms of living standards.

These are complicated processes, but in work we have done trying to statistically untangle this, we think we establish that given some of the problems that have beset low- wage workers, low- and middle-wage workers and the lack of their bargaining power, in the absence of unemployment in the 4 percent

neighborhood and productivity growing at 2 percent or higher, we are unlikely to see the kinds of advances that we saw.

In the last five years of the recovery, unemployment was low. We were approaching 30-year lows. We reached full employment for the first time, I would say, in decades. The growth rates of household income were pretty even throughout the income scale. They grew about 2 percent per year for the bottom 80/95 percent. They grew a little bit more quickly at the top, so the inequality problem persisted, but it was dampened significantly as income growth was broad-based and pretty even. When we hit the recession and unemployment went from 4 percent in 2000 to 4.8 percent in 2001, look at the step function and you end up with income losses for the lowest income households of 3 percent, the middle income households of about 2 percent and very slight gains at the top - a very different pattern associated with higher unemployment in the course of the recession.

My closing point is this, the unemployment rate that year was 4.8 percent; 4.8 percent is four-tenths of a percent below what the Congressional Budget Office says is full employment. They say it is 5.2 percent. I think that is a mistake. I think that we have shown that there is a fairly wide range and I would say a pretty unreliable range of estimates of what really means full employment. I, for one, do not see anything in either the economic literature or the data which I peruse on an hourly basis that would lead one to believe that we would be unable, moving forward, to sustain full employment rates around 4 percent unemployment, especially considering the change in productivity growth regime that we have heard about so far.

Thank you.

"My own statistical analyses have consistently estimated that faster productivity growth tends to dissolve some unemployment."

- Edmund Phelps, Professor of Political Economy, Columbia University

I am remembering the early 1990s when I was still knee deep in some research aiming to understand Europe's very high unemployment rate which had emerged in the mid 1980s. In those years, I was continually dismayed to see commentaries in the press implying that the answer was obvious: slowdown of productivity growth in Europe. In fact, high unemployment and slow productivity growth became synonyms in the financial press about that time and I think that is to some extent true today as well. I published a book in 1994 in which I did not quite get it right, did not fully come to grips with that position. But eventually in the

mid-1990s, I came to the conclusion that there was something to that thesis.

In my opinion, they were not right for the right reasons, but they were right that slower productivity growth was one important cause of the rise of joblessness in Europe. I think that extends to market economies in general. Now, I said that I do not think they were right for the right reasons. Why is that? The commentaries typically reasoned that if a nation's monetary policy acts to reduce the unemployment rate, money wages will accelerate to a faster growth rate and that will cause inflation, other things unchanged. Yet, if productivity has also just accelerated by the same amount as the acceleration in the money wage rates, then there will not be inflation.

So the Central Bank can cheerfully go ahead and reduce unemployment, QED. But in my view, maybe some of you will disagree, that is simply assuming what is to be proved, that the equilibrium unemployment rate, usually called the national unemployment rate or NAIRU, the rate consistent with zero inflation, or a non-rising inflation, that national rate of unemployment is decreased by an increase in the trend rate of growth of productivity, and thus the trend rate of growth of real wage rates. It is a misunderstanding of what the Phillips curve is all about, which is about the link between the rise of money prices and the unemployment rate and the link between the rise of money wage rates and the level of the unemployment rate. In both cases, given expectations about price increases and wage increases, you cannot use it in the way that these commentators were trying to do because expectations will change.

So, I come back to the question: Is the natural rate of unemployment pulled down by faster productivity growth? And

if so, why? In other words, how does it work? Well, I work with three sorts of models. I will not enumerate them, but I think the answer to those questions is loud and clear in two of them, and I am going to avoid like the plague the third one. I use these models to analyze the determination of the behavior of the natural rate, its ups and downs and its implied path over the future, barring new shocks. One of these models is a model in which the economy is an open economy and it is small, next to the rest of the world. It is an economy in which the main business asset of a firm, every firm, is its investment in its stock of employees, just as Bill Gates is always saying that Microsoft's big investment is in its employees. In this model the sudden expectation of productivity growth, starting with no productivity growth at all, suddenly emerges and there is productivity growth, which is immediately expected to continue.

The sudden expectation of productivity growth over the future implies a stream of higher and higher gross profits per employee over the future, which implies that a higher value per unit will be placed on the trained experienced employee in the steady growth future when the unemployment rate has settled down to its new level, whether that is higher, lower, the same or whatever. An additional employee is abruptly increased by the expectations of this future trend rate of growth of productivity, while the opportunity cost of training that new hire by pulling workers off the production line and allocating them to training the new hire is not yet increased because those guys on the production line have not seen yet a quantum increase in productivity. They have only seen the beginning of a steady rise in their productivity because the benefit of a new employee has jumped way up, while the opportunity cost of taking a raw recruit and transforming him into a new functioning employee has not increased at first hiring.

If I can just have one tiny crack at explaining this point. Essentially firms are advancing their hiring in time. They are investing ahead of demand because hiring sooner now costs less than hiring later because later you would hate to spare those employees from the production line to do the hiring. There is a theoretical case for believing that if productivity growth speeds up and firms expect that to continue, employment will rise to a higher level. Is there evidence for this kind of mechanism? I am a little surprised that everybody here takes it for granted that there is overwhelming evidence of that. Sure, there are instances of that. There are episodes, but I think it does require more careful study.

Let me just mention my own work. My own statistical analyses have consistently estimated that faster productivity growth tends to dissolve some unemployment. I, at least, am pretty sure that the huge productivity slowdowns, first in the U.S. in the 1970s and then Europe more markedly even a little later and then Japan in the 1990s, do help to account for an appreciable part of the rise of the unemployment rate that followed.

I want to make two caveats and then I am done. First, those big slowdowns that I just referred to in the U.S. in 1973 later reversed in 1995. In Europe and Japan, those were mind-numbing 7G decelerations of productivity. I would not predict that going from the 1.5 percent productivity growth rate that we talked about from 1974 to 1995, to 2.5 percent productivity growth or even 3 percent productivity growth would be enough to drive the unemployment rate appreciably below 5 percent in the present setting. In some estimates I have done, a one point increase in the growth rate of productivity, such as from the 1980s to the 1990s, is worth a bit less than .5 percent on the unemployment rate.

Second and last point and last caveat, the story of the late

1990s boom, it seems to me, is less faster productivity growth as measured and observed, than it is expectations of one time opportunities in the months and years ahead requiring new kinds of investment. It is in the head. It is not in the recorded history of the period. It is the occasional expectation or speculation on a big surge of productivity of some concrete kind and resulting profitability that drove the big booms in the 1920s and the 1990s. It is not a change of modest size in the trend rate of growth of productivity.

WATTENBERG: Thank you very much, Ned.

Now, so much for the theory. We are going to hear from our two practitioners, beginning with Dick Davidson.

* * *

"…Fewer people using better tools and methods can obviously do a lot more work and we have been proving that for 140 years."

- Dick Davidson, Chairman and CEO, Union Pacific Corporation

I am happy to be here and speak as a practitioner this morning. I never think of myself being a practitioner, but I would just say that there is no question that productivity improvement in our business at the Union Pacific Railroad is the main reason that our growth prospects for this coming century are so bright. You might say to yourself, "Well, how can that be? Aren't you an old company that was actually founded by Abraham Lincoln back in the 1860s?" That is true. We are. You could say, "Well, what could we possibly know about continuing to increase productivity after 140 years of being in business?" Well, I can assure you that I can answer that question.

I want to give you a little bit of history about our company. Today, the Union Pacific Railroad system is made up of 33,000 route miles of railroad. It is like a 33,000-mile factory or assembly line without a roof on it, so we have different challenges than a lot of other companies do. Our operations, which are the largest in North America, spread across 23 states, stretching from the Mississippi River to the Pacific Ocean and all the way from Canada to Mexico, in some respects into Mexico because we have an ownership position in one of the recently privatized Mexican rail systems there as well. I can tell you a lot about productivity as compared to government ownership or private ownership, as we have seen it firsthand.

We also serve every Gulf Coast and West Coast port, which with the longshoremen strike has presented us with some recent challenges. Our company has about 48,000 employees and we serve well over 25,000 customers, which includes nearly every manufacturing company in this country. Our history really encompasses the history of the Western United States.

President Lincoln, as I said, created the company in 1862 to unite the nation, to develop the midwestern part of the country by connecting the East Coast with the West Coast. The picture that people most frequently associate with that was the driving of the golden spike at Promontory Summit in 1869. When that railroad was built, it took about 20,000 people using totally manual labor, picks and shovels and mules, to build the railroad and it took well over four years to build 1,800 miles of track.

Today, we have less than half that number of people working in our engineering department that maintain our entire 33,000 mile network, which has huge infrastructure connotations to it. We have about 450 miles of bridges, 67 miles of tunnels, 160 million cross ties on the track, on and on. In a typical year, we renew about 1,100 miles of new rail, plus between three and four million of those cross ties. So, fewer people using better tools and methods can obviously do a lot more work and we have been proving that for 140 years.

If you go back to World War II, the railroad industry as a whole in the United States had 1.7 million people working there. Today, that number is closer to 250,000 people, but these people are accomplishing multitudes more work than was done back then. Productivity during that timeframe has increased 1,200 percent since World War II. You might say, "Well, how can you keep doing things like that in such an old industry?"

The way we look at it, at the Union Pacific there are two main drivers. The first is technology. I think the way that has been encompassed in the railroad business would probably surprise an awful lot of people about how technologically advanced our company is. The second reason is the adoption of quality principles and processes in the way we run our business. Put another way, we have consistently increased productivity of the five critical resources it takes to run the business - that is our employees, the locomotives that power our trains, the freight cars, our main track capacity and terminal capacity - by running a technologically advanced and quality-focused business.

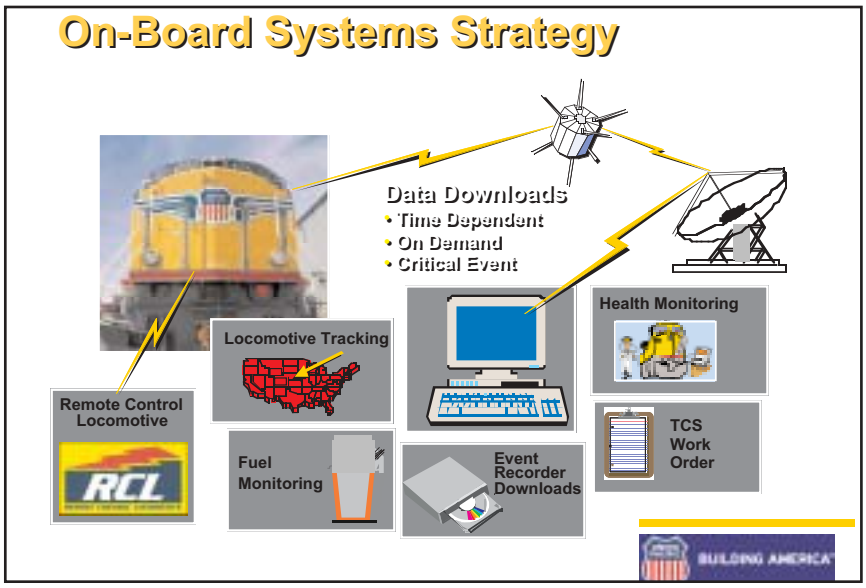
Now, the slide that I am showing here gives you some idea of the technology that we have ingrained into our business. We have 30,000 miles of fiber optic cable buried alongside our track structure throughout the western United States. Most of that capacity is used for commercial purposes by companies like AT&T, MCI, Qwest and all the major players. We preserved a couple of those fibers for our own use when it was installed. So we have one of the most modern, cost-effective communications systems in the business today. We use that fiber optic capacity to support our telecommunications network and do such simple things as manage the operation of our 2,500 freight trains that we have out there running at any time.

The next slide shows our Harriman Dispatch Center in Omaha, Nebraska. We control every one of our train movements from this central point in Omaha. The reason that we were able to do that is because of computer technology and communications technology, which have just came into being in the last 10 or 12 years. In fact, this center was inaugurated in 1989 and today it has about 900 employees, replacing numerous regional centers that we had scattered around the Western United States. Just prior to the implementation of that Center, we inaugurated a national customer service center in St. Louis, Missouri. This facility replaced literally hundreds of offices that had been at various points around the system where we had people, just like the old Wausau, the insurance advertisement, where they were in the depot dealing with a customer, literally with a paper and pencil. Today it is all done through technology. It just takes seconds today. When a customer calls in with a request for service, that customer profile pops up on the screen. By the time the customer tells the service rep who it is, he has all his requirements laid out right in front of him.

In the equipment area, I mentioned our coal business because it has been such a revolution in the way we have improved productivity. It is the single largest commodity of the six commodity groups that we handle. It represents about $3 billion a year in revenue for us. By the way, before you think, "Coal, what does that do," 55 percent of the electricity in the United States is generated from coal. It is a very important part of the economy. We have improved the productivity of our coal transportation by one-third in the last decade. To do that, we have introduced larger, lighter, aluminum freight cars to move the coal and we pioneered the use of distributed locomotive power. That is an innovation where you no longer just have locomotives on the front of a freight train. You put them in the center of the train or the rear of the train so you can distribute the forces, which is very important when you are going over mountainous territory, so that you can handle more tons safely.

Another example of how technology is changing our company are, that we use global positioning satellites to monitor the location

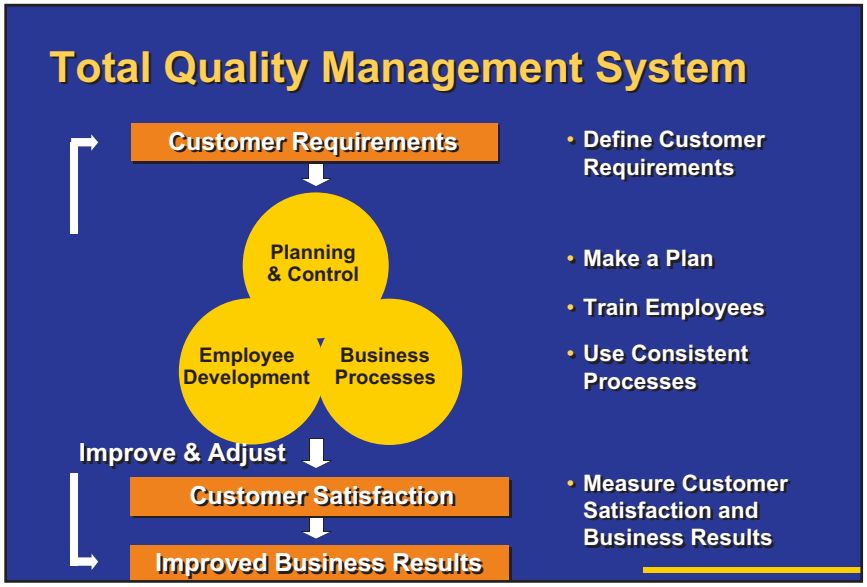
of our locomotives, and we own 700 of them. Each one of those assets today is about $2 million apiece, so you can see what kind of capital intensity we are talking about, so it is very important that we improve utilization.



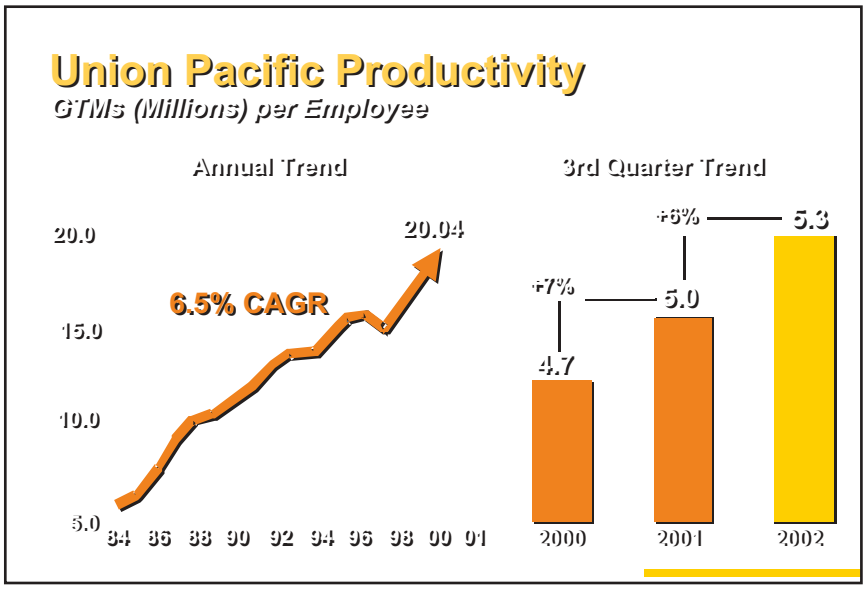
All of our new locomotives are computerized, allowing us to monitor electronically all the critical systems, including how the engineer is handling his train. Is he doing it as well as he can? The newest onboard innovation is our ability to control locomotives remotely. The Canadian railroads pioneered this, but it is being implemented in our company now. By the end of this year we will have eight of our terminal locations implemented, and over the next couple of years, it will be done system-wide. That will help us save about $70 million a year by eliminating the requirement for an engineer on our locomotives in our yard and terminal operations. Casey Jones fans might have been disappointed when back in the mid 1980s we got rid of cabooses on freight trains. I was disappointed because when I went to college, I spent about four years working on those cabooses. But today when a train

goes by and you look at the rear end, there is just a little flashing device back there called FRED, which is flashing rear end device. That little electronic device relays the same information to that engineer on the head end so that he can handle the train, just like he did when you had a conductor or a brakeman back there giving him the same information.

Let me make a quick comment about quality before you shut me off. That is the second key component in our improvement in productivity. We have been a total quality management company since 1987. As much as anything, that has allowed us to continue to improve our processes in productivity. In fact, next Monday a team of quality experts will be in Omaha, Nebraska representing the Malcolm Baldrige National Quality Organization. They will spend a day in Omaha and then fan out all over our system to study the quality initiatives that we have developed and implemented over the last 15 years. It is the third time we have been a finalist, and I am hoping that the third time is going to be a charm.



But that is not the real reason that we apply for the award and follow the Baldrige principles. We use those processes to help us audit ourselves against the very best business practices in America. That makes us a far more productive company, because after we get this feedback, we are able to address the issues that the examiners identify as most instrumental in giving us a focus on the right areas of improvement. I am proud of what our people have accomplished. I think we have utilized our great franchise and a steady stream of technology advances and our quality processes to become one of America's most productive companies.



The last slide is a proof statement of what I have been talking about. This slide demonstrates that beginning in the mid 1980s productivity, as measured by gross ton miles handled per employee at our company, has increased at a compound annual rate of 6.5 percent. That is remarkable. I mean, those numbers are far greater than what I have been hearing this morning. We have every reason to believe that we can keep that stream of productivity moving forward at that same level year after year.

We show that we have been experiencing that same growth in the most recent quarter. I guess I will make you all insiders because we are going to report our earnings tomorrow to Wall Street, but in the third quarter we had 6 percent improvement in productivity. The senior management of our company thinks that that can go on forever.

WATTENBERG: Thank you, Dick Our final speaker is Marilyn Carlson Nelson.

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"Our job is to do it better, faster and cheaper. You say, 'Then what?' And we say, 'Then anyone, anywhere and whenever.' That is the job that we have as an American services company operating in the global marketplace."

- Marilyn Carlson Nelson,
Chairman and CEO,
Carlson Companies, Inc.

I am the CEO of Carlson Companies, which is a large privately-held company. We are a service company, as contrasted to the manufacturing company we have just been hearing about. We actually do own, manage, and franchise around the world in 160 countries. There are over 180,000 people under our flags. About 50,000 of those work directly for us at Carlson Companies. The consumer services are travel, hospitality, restaurants and cruise ships. The corporate services side of the business is marketing services, relationship marketing, which really is

helping companies improve the productivity they expect to get from their consumer relations management technology; and also Carlson Wagonlit Travel, which is business travel services which allow people to aggregate their purchasing and give them information where technology is driving for more and more self-service.

I think despite all the complexity of what we have heard this morning, for us it is pretty simple. Our job is to do it better, faster and cheaper. You say, "Then what?" And we say, "Then anyone, anywhere and whenever." That is the job that we have as an American services company operating in the global marketplace.

Just some quick headlines. We have been very quick to shed workers, even though we were a private company. Obviously we, like others, deal with debt. So we had debt covenants and coverages. We were quick to shed workers and we have been slow to hire them back. Those with jobs are working harder and more efficiently with better technology. We are getting gain from application of the technology that we purchased. We are finally squeezing the assets that we invested in anticipation of Y2K where we did a lot of not only rehabbing old technology systems, but putting in a lot of new ones, which we are finally starting to get payback from. The margins have to come from productivity gains, but we are not able to truly realize all those margins because of the increasing cost of healthcare and insurance, which in the services businesses are pretty tough. So if we are going to continue to employ people in the services, we are going to have to get productivity in order to even dream of maintaining margins in these businesses.

You can tell that we are keenly interested in the topic of

productivity. Achieving productivity is the only way we have been able to save our profitability under the extremely difficult conditions that we faced in the last 18 months. We felt that in our business, we had the perfect storm. We had the slowing economy and we watched air travel suspended for 11 days, and bookings in hotels and travel agencies and cruise ships remained flat for months. Even the local restaurant businesses, the white tablecloth restaurant business, all but disappeared because the business traveler disappeared for a while. We actually exited that business because we were not able to get more productivity. We stayed in the casual dining business and have actually made an acquisition in the quick casual sector, which is growing and where we do have dramatically better productivity.

Once again there is a drive in the services toward more and more self-serve, which is improving productivity as long as the market will tolerate it. We have had to make very difficult decisions. Certainly, downsizing our workforce was the hardest. We had to cut the variable costs almost immediately. One decision that we did not make as a private company was to discontinue investment in technology. On the contrary, we have been investing in technology and process redesign to boost our productivity. It may surprise you that a service company, as Carlson is, with the relationship marketing division, hotel brands, travel agencies and restaurants, would rank number five on Information Week's list of top 500 technology leaders, but we did just that last month, surpassing such companies as Gateway, Oracle and Sun Microsystems. The rankings are based on a study that examines such areas as technology deployment, IT budget, technology strategies and e-business. We scored very high on all.

We have adopted cross-company technology initiatives,

including data review and coordination across our product lines to better understand consumer behavior. We have added enhancements to the management of our human resource data and we have a new storage area network that employs Internet protocol, allowing a tremendous amount of data to travel further at any moment and reduce the cost of storing information. This allows us not to have to choose between centralizing and decentralizing. Rather, we can do both to get the greatest possible efficiency and productivity.

We have made significant technology investments in the customer contact centers of our travel operations, which operate in a highly automated service environment, to be very responsive to process and technology improvements. Talk time, transaction cost, wait time, cost per transaction - these are all metrics of our customer contact centers and they all impact strongly on profitability.

We, too, have been following the quality discipline for quite a long time. As many of you probably know, the philosophy came out of the manufacturing environment and it is just possible that part of the productivity in the mid-1990s, the increases that people saw, was that some of us in the service sector began to look at quality processes and adopt Six Sigma as well. We were early adopters in our industries and we have been extremely pleased with the result. As you know, Six Sigma is a metric that out of a million opportunities, we should only go wrong three or four times. I have to tell you, my husband is a surgeon by training and he always finds it difficult to think in terms of any errors being a goal, but in a transaction-based business, that is extraordinary service.

I want to emphasize that in my view productivity

improvements are not just the result of added technology and streamlined processes, but are also due to a more highly motivated and empowered workforce based on the tools that we are giving these people.

WATTENBERG: How many people do you employ?

CARLSON NELSON: We had about 50,000 before we downsized or had our RIFs. We are now at just under 40,000.

We actually are finding that productivity and morale go hand in hand. I feel very strongly that people, in our case we call them experts who care, represent the one advantage that a competitor cannot imitate, which is why we have been committed to creating a great place for great people to do great work. What we discovered early on in the Six Sigma process is that employees are discouraged and demoralized by unnecessary, redundant, sometimes inane tasks or re-work. This takes time and energy from doing great work and people all over the world appreciate doing great work.

Again, productivity is important for us because it is related to being able to be a great place for people to work, which is critical in the service industries where it is competitive and we are competing for workers, so we must be a great place to work. But in order to afford that, which means excellent benefits, daycare and other products and services, we have to be productive. So right now we have approximately 20 black belts around our empire, several hundred green belts. These are people who have been trained to apply Six Sigma philosophy to their own full-time positions. At the end of the year 2000, our people will have gone through a second round of quality process training.

In our customer contact centers, each agent is now handling 21

percent more calls than they were last year. Our agent turnover rate is less than half of the industry average and enterprise-wide we have best-in-class Gallup employee satisfaction scores. All of our business units are starting to see steady sales increases. People start traveling again and businesses begin looking at how to apply customer relationship management to their own marketing skills. In some instances, we are finding that productivity does not necessarily reduce the workforce in total, but it creates a demand for positions elsewhere because the business continues to grow in other ways.

One thing we know for certain is that no matter how we desire to minimize job loss, American enterprises cannot afford to maintain positions to fit people's skill levels. People have to grow their skills to fit the new positions. I think American workers get that, and that is one of the reasons for the dramatic increase that we have seen in company training classes, university extension courses, tech classes, night classes and weekend colleges. Employees are making the investment in their futures so they can evolve along with our industry to maintain and grow their job level and their productivity.

I believe there is a responsibility on both ends to learn and to teach by design and rigor. That is the reason we created Carlson University. It differs from traditional training. It is dedicated to training that is aligned with our strategy and aligned with not only our productivity, but our value-creation goals. I believe that companies that organize themselves to support a lifelong learning culture will benefit by creating a highly skilled, flexible, productive, more competitive workforce. Those of us playing in the global arena know that we are not just competing with the best and the brightest down the street. We are competing with the best

and the brightest in the world.

U.S. productivity has always been the envy of the world and, as we are discussing here today, it continues to be the wild card in the economic recovery. What we have seen at Carlson Companies is that the technology and process tools that make possible higher productivity also bring the business and product innovations that are more satisfying for the employee and the customer alike and can be counted on to help us grow our business in new ways ultimately to create new jobs and continue the momentum that our private company has enjoyed for the last 65 years.

Thank you.

WATTENBERG: Dick Davidson, you said in your

American/Mexican relationship that you get a real sense of the difference between government and private operation. Could you give us your take on that?

DAVIDSON: I would be glad to. When the Mexican government back in the early 1990s decided to privatize the rail system there, they had over 100,000 employees doing perhaps 5 percent of the volume of work that we were doing in the United States at our company alone with about one-third of that workforce. Since privatization, the government in the privatization process made it easy for employees to separate. They offered an economic enhancement to them to leave the company. We have seen about 17 times-over improvement in productivity there.

We have supported that same fact here in the United States. As long as we were totally regulated by the Interstate Commerce Commission for nearly 100 years, our productivity did not see much growth either. In fact, 25 percent of American railways were bankrupt in the 1970s. It was heavily regulated. We had substantial deregulation in 1980 and that was essentially the timeframe that I talked about, the 6.5 percent compound annual improvement in productivity. Regulation and government ownership really do not work very well when you are striving for productivity growth.

QUESTION: For Mr. Davidson, I guess this will tell you what is on Washington's mind these days, but what happens if somebody blows up that central hub in Omaha?

DAVIDSON: That is a great question. As a matter of fact, it is

something we spend a lot of time thinking about. Today we have two separate computer centers. We have one in St. Louis and one in Omaha and they are capable of backing each other up. Today it would be a matter of relocating some employees and picking up the effort in St. Louis. Now, we are so smart on centralizing all of our essentially support facilities in Omaha in the near future, we are going to be in a new building there and close the St. Louis office to enhance productivity in 2004. But we will have an offsite backup center for our control center that we have in Omaha. We are already planning for it and we will have a redundant facility.

BAILY: I hope you have good security, too. That is the other thing I wanted to ask.

DAVIDSON: That's right. We are closely tied in with all the national security agencies. In fact, I am on the commission that was just appointed by President Bush on the National Infrastructure Security Council. We are in constant contact with all the security agencies and it does get to the point, it has twice in the past, where we actually have armed guards at our more critical infrastructure.

WATTENBERG: Does the increase in security on your part lower productivity? It must.

DAVIDSON: It does. It increases our cost, obviously, but it is one of those investments you have to make to guard against an even greater cost if you incurred it. Having said that, it is not significant in terms of a financial impact on us. I mean, it is significant in my mind, but as far as our investors go, it is not significant enough where they should be concerned about it. But is a cost of doing business and it went up a lot after September 11.

CARLSON NELSON: I would like to comment on that, because we spoke earlier of multifactor productivity. Clearly, that is one of the reasons we are having a difficult time actually getting growth out of the productivity that we are gaining. We are getting productivity from our employees, but we are also spending on redundancies, hot sites, additional security, and privacy issues - all of which reduce, ultimately, the productivity of your entire operation and impact your margins.

QUESTION: I wonder if anyone at the Labor Department has done an estimate of the effect on productivity of all of these security measures. I know it came up in our last panel, but I think it is an important topic for future research. It is fun when we identify those as well. That is not going to influence the quality of my question, but there seems to be a disconnect between the firm-level experiences. I figure a productivity gain of 6.5 percent versus the macro or the aggregate productivity measures we are looking at 2.1, 2.5. When you look at this discrepancy, are we suggesting that our productivity glass is half full? In other words, as more companies accept your best practices, that we will see productivity figures of 6.5, 7 points or whatever it might be, are we suggesting that our productivity glass is half empty? We are working with a really poor set of data at the macro level.

BAILY: The railroads are certainly an area where measured productivity, as evidenced by the comments made earlier, has been very rapid and is attributed in part to deregulation, then what the companies have done with the opportunities and technology that provided them. Unfortunately, if you look at a lot of other industries, you do not see the same record. That may be because of bad measurement, but I think a lot has been done by BLS and

other agencies to improve the quality of measurement.

We are still not doing a great job in some industries, particularly in some service industries. But I do not think, even if we had the best possible measurement, we would expect to see 6.5 percent across the board. That is not a rate that I think has ever been achieved for the economy as a whole in the United States. We certainly could go higher than the roughly 2.5 percent we are at now, but the highest extended period rate of productivity growth we have had in the U.S. has been about 3 percent. If we get to that, I would be pretty happy.

CARLSON NELSON: On the multifactor productivity question, an example for us of why we were having difficulty getting the margin improvement that the productivity, yields and why there could be a disconnect would be in our home campus. We have over five million square feet of unused space now because we have consolidated and moved more of our services into a shared services environment, but we essentially have not been able to sublet an enormous amount of space, which obviously impacts our overall productivity. The same thing to some extent has happened with some of our older legacy systems, which were designed for a different size workforce than we have. The processing per employee, that particular cost, has increased despite the fact that we have downsized the employee base itself. I think that might be relevant to some of the differential between the productivity we are gaining from the employees themselves in terms of their direct work and the other factors that it takes to produce our outcomes.

QUESTION: How has that increased tenure rates at your companies?

DAVIDSON: Tenure is not necessarily a bad thing. I have 43 years in the railroad industry, so I am all for tenure. We spend an awful lot of money on training, probably $100 million a year or more, at least 40 hours of training for every employee in the company annually. Marilyn said it earlier, you have got to continue to do that.

Deming was the first person that really identified that you

have to reinvent yourself continually or you will not make it. That applies to everybody. Our retention is phenomenal. We have probably about a 2 percent attrition rate annually. We have a quality measure, believe it or not. It is in category five. We have a leadership index on how well we do attracting employees and we have no trouble whatsoever because we pay in the upper 2 percent of the American blue collar workforce according to BLS.

The average seniority of our people is well over 20 years, so we have almost no attrition. Sometimes it is not fast enough, quite

honestly. We have to offer inducements at times. As our productivity increases, we offer early retirement or a soft landing so we can accelerate attrition at times, but our retention and job satisfaction are quite high.

CARLSON NELSON: The question was specific to the training. One of the issues that we face in the service sector is that if you are known for doing a good job of training and for being successful, people recruit against you. Being a private company, for a while it was hard because they recruited with us at the higher levels. They recruited with stock options, which we expense. Since we are private, we have a phantom stock plan, so of course we have to carry it. So maybe the playing field is going to be a little even.

In retail-type businesses, I am sure many of you know that is where I think Secretary Chao's observation is particularly true. You do have huge turnover. It is not unusual for retailers to have 120 percent turnover a year, which makes it very hard to invest in the training and so on. In that area we do find that we have to train and retrain, and in those entry-level jobs we have to take on a lot of the training that has not been taking place in the school systems, which is a problem for us. In some cases, English as a second language; in some other cases just timeliness, cleanliness.

That said, the slowdown in the economy has dramatically impacted our turnover. We are ahead on all of our metrics in terms of retention in all of our businesses and suddenly employees are paying much more attention. I think it has actually improved morale and commitment without question.

We are certainly not hiring in anticipation, except with highly specialized individuals. We cannot afford to have anything but A

players on the bus. We did what GE has done. I do not believe in doing it regularly, but we did force rank at the time when we needed to reduce our force.

WATTENBERG: What does "force ranking" mean?

CARLSON NELSON: It means we actually had all of our executives and supervisors rank their personnel so that the reduction was based on mediocrity, not on length of time with us, not on any other measure other than their ability to contribute to our existing success and our future success.

It is an imperfect science, but the fact is that by clustering people in terms of A, B and C players, we let the C players go first, then the B players. If we ended up with a group of what we had decided were B players, then those are the people that we are replacing with as close to A players as we can get. We are upgrading the force that we do have.

PHELPS: If I may interject, the question was, do you have a sense of hiring A players sooner than you would otherwise do when you have rosy expectations of rising gross profits per employee? If not, why not?

CARLSON NELSON: There is too much uncertainty in this environment to say we have rosy expectations.

DAVIDSON: I do not know how deep red our rosy is, but we do have great expectations for our business. Actually, that is a great question about hiring for anticipated future vacancies because you have to take into consideration productivity advances. That is quite true. We have applied our quality

principles, even the Six Sigma process to trying to get this right, because our employees are probably different than most other employees in the world because you have such vast capital resources that our employees are in control of, like a locomotive engineer on a freight train. You have literally tens of millions of dollars worth of product and equipment that one person is responsible for, so they have to have intense, immense training so they can do it safely. Now, we are improving the productivity of our locomotive engineers.

You heard me say earlier that with this remote control technology we will eliminate 1,000 to 1,500 jobs over the next three or four years. Obviously, we will be replacing on a one-for-one basis, but we do have to get it right that we have a trained, highly qualified employee in place when those vacancies occur.

It is something that we review at the senior-most levels of the company, when that hiring and training should take place. We try to get it as close, obviously, to the departure of the incumbent on the job as we can, but it is more important that you have a trained, highly skilled employee in place when that guy leaves. You just cannot operate without it. It is one of the quality processes we use to try to synchronize as well as we can.

WATTENBERG: Thank you so very much.

* * *

INTRODUCTION

"Chairman Greenspan is known as the economist's economist. He is one of the most widely respected and honored men in his field and in of our country as well. His views are particularly appropriate to our conference because the Chairman recognized early the correlation between productivity growth and economic growth."

- U.S. Secretary of Labor Elaine L. Chao

I am delighted to introduce a very special guest today, for the third time since becoming Secretary of Labor, I have the honor and

the privilege of introducing the Chairman of the Board of Governors of the Federal Reserve System, Dr. Alan Greenspan. Chairman Greenspan has been kind enough to address the Summit on the 21st Century Workforce that I convened immediately after becoming the Secretary of Labor last year. Then, last winter, he spoke at the Department of Labor's National Summit on Retirement Security. He has been very gracious in giving his time to those of us who are concerned about the human face of the economy; jobs and workers.

As many of you know, Chairman Greenspan is in his fourth four-year term as Chairman of the Board of Governors of the Federal Reserve System. His steady leadership has earned him the trust and confidence of every President since Gerald Ford. He has not only served as Chairman of the Council of Economic Advisers, but as Chairman of the National Commission on Social Security Reform. I suspect most important for our audience today is the fact that Chairman Greenspan is known as the economist's economist. He is one of the most widely respected and honored men in his field and in our country as well. His views are particularly appropriate to our conference because the Chairman recognized early the correlation between productivity growth and economic growth.

As transcripts of the Federal Open Market Committee indicate, Chairman Greenspan was one of the earlier identifiers of the emerging acceleration of productivity during the 1990s. We are fortunate indeed that Chairman Greenspan has agreed to give us his views on this very important issue. Please join me in warmly welcoming the Chairman of the Federal Reserve Board of Governors, Dr. Alan Greenspan.

ADDRESS

"Whether output is measured from the expenditure side or from the independently estimated income side of the national accounts, and whether hours of work are measured from the survey of establishments or the survey of households, the same basic result is clearly evident: an impressive gain in output per hour over the past year."

- Alan Greenspan, Chairman, Board of Governors, Federal Reserve System

Thank you very much, Madam Secretary. It is always interesting to appear in this room whose configuration is

particularly appropriate for economists who are practiced in speaking out of both sides of our mouth. In any event, I very much appreciate those very kind remarks.

The increase in non-foreign business output per hour over the past year will almost surely be reported as one of the largest advances, if not the largest, posted over the past 30 years. We at the Federal Reserve, along with our colleagues in government and the private sector, are struggling to account for so strong a surge. We would not be particularly puzzled if the increases in output per hour were occurring during a period of very rapid economic growth, such as has often attended recoveries with steep recessions. Historically, such recoveries have allowed overhead and maintenance employee hours to be spread over a rapidly increasing level of production, but during the past year, we have averaged only modest economic growth.

The reported estimates of output per hour do not appear to have resulted principally from faulty data or measurement error. Whether output is measured from the expenditure side or from the independently estimated income side of the national accounts, and whether hours of work are measured from the survey of establishments or the survey of households, the same basic result is clearly evident: an impressive gain in output per hour over the past year. This conclusion is buttressed by recent sizeable increases estimated for labor productivity for the manufacturing sector derived from a data system that for the most part is independent of the national accounts. To be sure, because the productivity feast of recent quarters has been so difficult to explain, many analysts expect a productivity famine in the period ahead. Others, however, are not so pessimistic.

Regardless of how events unfold, we will need to confront difficult questions posed by the recent performance of

productivity if we are to properly evaluate economic developments going forward. Indeed, if the recent surge in measured productivity is not a statistical mirage or if it is not expunged by data revisions, then we need to ask about its possible causes. Truly, over the past year corporate managers, confronted with tepid demand and a virtual disappearance of pricing powe,r have struggled to maintain profit margins. With price increases largely off the table and demand soft, lowered costs have become the central focus of achieving increased profitability.

On a consolidated basis for the corporate sector as a whole, lowered costs are generally associated with increased output per hour. Much of the recent reported improvements in cost control doubtless have reflected the paring of so called fat in corporate operations - fat that accumulated during the long expansion of the 1990s when management attention was focused primarily on the perceived profitability of expansion and less on the increments to profitability that derived from cost savings. Managers who refocused are pressing hard to identify and eliminate those redundant or nonessential activities that accumulated in the boom years.

Now, with margins under pressure, business effectively has been reorganizing work processes and reallocating resources so as to use them more productively. Moreover, for capital with active secondary markets such as computers and networking equipment, productivity may also have been boosted by a reallocation to firms that could use the equipment more efficiently. For example, healthy firms reportedly have been buying equipment from failed dotcoms. Businesses also may have managed to eke out increases in output per hour by employing their existing workforce more intensively. Unlike cutting fat, which permanently elevates the

levels of productivity, these gains in output per hour are often temporary as more demanding workloads eventually begin to tax workers and impede efficiency.

Perhaps the return to a low inflation environment in recent years in itself explains the intensification of competitive pressures, which has been a spur to the growth of productivity. Indeed, the data do suggest a relationship between inflation and productivity growth over the long run. But that statistical relationship is modest at best and inferring causality is complicated by a circularity that arises because increased growth in output per hour depresses unit labor costs and, hence, prices.

Taken at face value, historical relationships suggest low

inflation would explain very little the most recent surge in output per hour. To be sure, while lack of pricing power and associated competitive pressures may have initiated much of the cost cutting and organizational changes that have occurred, it will ultimately be the quantity of fat in the system and the opportunities for

productive reorganization that will determine the potential gains in productivity.

Only in retrospect, if then, will we be able to ascertain how much of the past years elevated growth in output per hour was transitory - that is growth that resulted from cutting of fat, reorganizing operations and more fully exploiting technologies already embedded in the existing capital stock. Such improvements, even though they are long lasting are, of course, a level adjustment with no necessary implications for productivity growth going forward. Moreover, there is an upper limit to the amount of output that can be produced from an existing facility, even in the short run, no matter how intensively it is employed and how much fat is taken out of the system.

Corporate management cannot unendingly reduce cost without at some point curtailing output or embodying new technologies through investment to sustain it. The recent upsurge in the growth of output per hour has understandably renewed interest in the relationship between investment and so-called adjustment costs. Firms do not necessarily reap the full benefits of their capital investments immediately because of the disruptions to activity that can be initially created when new equipment is installed. These disruptions may include learning to use the new equipment and software or getting the new machines to mesh with existing systems.

Thus, although capital investment ultimately boosts output per hour, these adjustment costs temper the initial benefits to increased production obtained from new investments. It is likely that as capital spending fell over the past couple of years, so did the disruptions that accompanied its installation. Moreover, the

dislocations associated with the substantial investment of the late 1990s and 2000 are also likely to be waning.

This lower level of disruption provides a boost to growth in output per hour for a time. How much remains is an open question. The quantitative evidence on the magnitude of this effect spans the range from significant to small. The ability of businesses to boost productivity with what seems to be minimal new capital investment over the past two years suggests that output per hour growth in the latter years of the 1990s likely trailed the growth in underlying productivity in those years. If this inference is accurate, part of that earlier growth in underlying productivity is being reflected in today's gains in output per hour. The difficulty in explaining the recent past is most evident when we decompose gains in output per hour into the contribution from changes in worker quality, the amount of capital used by workers, that is capital deepening, and the contribution from all other factors - a notion that economists label multifactor productivity.

By definition, multifactor productivity includes technical change, organizational improvement, cyclical factors and myriad other influences on output per hour apart from capital investment. With capital spending sluggish over the past year and no evident acceleration of worker quality, it is likely that growth of multifactor productivity accounts for an appreciable portion of the rise in output per hour. Based on historical experience, it seems improbable that all of the large rise in multifactor productivity could be attributed to cyclical or transitory factors. Conversely, it seems very unlikely that all of the increase in growth of productivity could be attributed to structural influences. The truth, presumably, lies between these two extremes, but where has yet to be determined. At minimum, however, it seems reasonable

to conclude that the step-up in the pace of structural productivity growth that occurred in the latter part of the 1990s has not as yet faltered. Indeed, high growth of productivity over the past year merely extends recent experience.

Over the past seven years, output per hour has been growing at an annual rate of more than 2.5 percent on average, compared with a rate of roughly 1.5 percent during the preceding two decades. Although we cannot know with certainty until the books are closed, the growth of productivity since 1995 appears to be among the largest in decades. Our nation has had previous concentrated bursts of technological innovation. In those instances, business practices slowly adapted to take advantage of the new technologies. The result was an outsized increase in the level of productivity spread over a decade or two, with unusually rapid growth rates observed during the transition to the higher level.

For example, as the benefits that attended the development of the electric dynamo and the internal combustion engine more than a century ago became manifest in both the capital stock and the organization of production, the growth of labor productivity surged. From an average annual rate of 1.75 percent in the late 19th and early 20th century, it jumped to 3.75 percent rate in the decade following World War I. Productivity growth then returned to a 1.75 percent pace. Then, for the quarter century following World War II, productivity growth rose to an average rate of 2.75 percent before subsiding to a pace of 1.5 percent annually from the mid 1970s to the mid 1990s.

Arguably, the pickup in productivity growth since 1995 largely reflects the ongoing incorporation of innovations in computing and communications technologies into the capital stock and business practices. Indeed, the transition to the higher permanent level of productivity associated with these innovations is likely not yet completed. Surveys of purchasing managers in recent quarters consistently indicate that an appreciable share reports that their firms still have a considerable way to go in achieving the desired efficiency from the application of technology to supply management.

If the backlog of unexploited long-term profitable technologies remains high, it should be assumed that once currently elevated risk premiums and the heightened cost of equity capital and some debt recedes or cash flows expand, new productivity-enhancing capital investment will pick up. Further evidence that firms still have not fully adapted their operations to the latest state of technology also is provided in a recent study that attempts to measure the technological gap that is the difference between the productivity of leading edge capital and the average productivity

embodied in the current capital stock. This gap is estimated to be quite wide currently, which suggests that there are still significant opportunities for firms to upgrade the quality of their technology and with it, the level of productivity.

A paper presented by Stephen Oliner and Dan Sichel this morning also provides a basis for arguing that a significant portion, and possibly all of the productivity revival of the mid 1990s is sustainable. Based on an analysis of a multi-sector growth model, their work suggests that a range for sustainable growth in labor productivity over the next decade is 2 percent to 2.75 percent per year. Jorgenson, Ho and Stiroh use a similar methodology and find a range from a little less than 1.5 percent to about 3 percent with a central tendency of around 2.25 percent. These estimates are clearly plausible, but history does raise some warning flags concerning the length of time that productivity growth continues elevated.

Gains in productivity remained quite rapid for years after the innovations that followed the surge of inventions a century ago, but in other episodes, the period of elevated growth of productivity was shorter. Regrettably, examples are too few to generalize. Hence, policy makers have no substitute for continued close surveillance of the evolution of this current period of significant innovation.

In summary then, given the difficult adjustments that our economy has been undergoing, long-term productivity optimism may currently seem a bit out of place. It may appear even more so in the months ahead should output per hour soften following this period of outsized gains. Nevertheless, it is both remarkable and encouraging that despite all that has transpired over the past

couple of years, a significant step up in the growth of productivity appears to have persisted.

Thank you very much. It has been a pleasure being with you today.

* * *

The Future of Productivity

J.T. Battenberg III
Chairman, President, and CEO
Delphi Corporation

Greg Bentley
President and CEO,
Bentley Systems, Incorporated

Phillip Bond
Chief of Staff and
Undersecretary for Technology
Department of Commerce

Henrietta Holsman Fore
Director
United States Mint

George Halvorson
Chairman and CEO
Kaiser Permanente

Moderator:
James K. Glassman
Resident Fellow
American Enterprise Institute

James Glassman, Resident Fellow,
American Enterprise Institute

We are going to have a panel discussion today. There are five panelists. I noticed in the morning session there were nine panelists, of which two were not economists or academics or people who deal in these kind of airy subjects.

Ronald Reagan had the best definition of economists. "Economists," said Ronald Reagan, "are people who see something work in practice and wonder if it would work in theory." Well, our panelists, with one exception, practice productivity every day.

J.T. Battenberg will start.

"…We have proven that a caring company, where healthy employees report in a safe work environment every day, has certainly enabled us to establish higher productivity and better quality."

- J.T. Battenberg III, Chairman, President, and CEO, Delphi Corporation

Good afternoon. I am really looking forward to sharing and hopefully making this a very constructive session. Just a couple of words about Delphi. If you are not familiar with us, we supply all the car and truck makers in the world, about 32 of them, and also non-automotive customers like Nokia, General Electric, Boeing, and others. We do electronics, IC fabrication, satellite radios, sensors, telematics, mobile media, fiber optics, propulsion systems, gas, and diesel. That may give you a flavor of our work. Our revenues this year will be about $27.5 billion. Our employee

accounts were about 216,000 when we started the recession. It is now at about 191,000, so we have taken out about 25,000 to 26,000 people during the recession.

Ten years ago, I was at a General Motors board meeting sitting next to a young man, Paul O'Neill, who, at the time was chairman of Alcoa. He asked me, "What are you working on?" I said, "I'm working on quality and productivity." He said, "Wrong things." I said, "Well, that's what I've been working on all my life, quality and productivity." He said, "You should work on safety. Safety is the basis of everything in a corporation, and if you focus on safety, then quality and productivity will come."

That had a profound impact on my thinking over the last 10 years. My thesis today is basically Paul's thesis: If you improve your health and safety metrics, than you will improve your productivity and quality. That sounds intuitively obvious, but I have had the opportunity to plot a correlation for 10 years on that thesis and I thought I might share that with you. After looking at 10 years of data and correlation, we have proven that a caring company, where healthy employees report in a safe work environment every day, has certainly enabled us to establish higher productivity and better quality.

Let me provide you with a little background from my General Motors experience that might make the case very compelling. Delphi, of course, is an IPO out of General Motors that occurred in 1999. While we were at General Motors, we had one of the best safety records in the auto industry, but we had never really compared our safety records outside our own industry. We looked good as long as we were comparing ourselves with ourselves. Paul urged us to look outside of the industry, and

when we did we found out that our lost workday rate was twice that of all others in the industry and it was six times higher than the mining industry - quite an eye-opening experience. We were at 3.2 lost workdays for every 100 employees, and we were experiencing 20 recordable injuries or illnesses for every 100 employees. Quite deplorable and quite sobering, but they were important facts that caused us to explore the health and safety practices of the leading companies of the time. In the early 1990s those companies were DuPont, Alcoa, Allied Signal, and Boeing. Those are the companies that we began to study. We started that study with a partnership with our largest union, the United Autoworkers.

Together, we came to the following conclusions: an injury and illness-free workplace is, in fact, an achievable goal; Delphi had an opportunity to be a leader in employee health and safety; the benefit to Delphi in terms of employee well-being and attitude and competitive advantage would be immeasurable; it was the right thing to do together; and it would be a long journey.

We thought maybe five or six years. It has been about 10 years. We also acknowledged that a shift in leadership attention was required urgently. Until that time, health and safety was perceived as a minor department of our human resource activity. We realized that we would never have a healthy and injury-free work environment unless leadership took the responsibility. So we developed a health and safety policy and identified roles for our leadership, including demonstrating a caring attitude, being visibly committed to the health and safety process, and putting safety first on any meeting agenda that we had in the company. Health and safety suddenly became important to the chairman and the head of the UAW, and it became important to everyone else. The culture change started through the 1990s.

We realized that transition was also needed in our quality arena. Our quality measures in 1995 showed that we averaged about 800 defective parts per million produced, which indicates a quality well below what customers were expecting. Those quality levels were driving warranty costs to the tune of nearly 700 warranty incidents per thousand vehicles, and that was cost against the bottom line. An important outcome of our learning process is that we aligned these two important activities to better communicate with our employees and to drive equal importance on both. Our safety mantra was, "Nothing we do is worth getting hurt." And for quality, we began saying that, "Nothing we do is worth jeopardizing our quality or our customer." We said, "Safety can be managed." And for quality, we began saying, "Quality doesn't just happen; it too must be managed." As the old saying goes, "Actions speak louder than words," so let's look at results.

Since refocusing on safety in 1993, Delphi has been successful in reducing its lost workday case rate by 88 percent. That means on an annual basis, 4,700 fewer employees are hurt and unable to come to work. There was a similar positive trend in total recordables. We saw an 86 percent reduction from 1993 to 2001. That means for us 28,000 fewer employees are injured each year.

With the same leadership focus on quality, we have seen outstanding results. In 1995, we had 800 defective parts per million. Last year that number dropped to 23. This year, as we close out the casebook, it will be below that. Similarly, in 1995 we had 690 warranty incidents per thousand vehicles; in 2001 that number dropped to 291, and this year it will be dropping even further. What does that mean to the bottom line? Or said another way, what then happens to productivity? We just received the Occupational Hazards Magazine designation as one of America's

safest companies to work for, and the National Safety Council gave us the Outstanding Achievement Award. That translates directly into productivity.

From 1999 through 2001, or a period of three years, we saw our productivity as measured by the number of hours worked per $1,000 of revenue improve by 32 percent. That is over 10 percent a year. Unfortunately, much of that productivity is eaten up by the deflationary environment that we are in, which is causing price decreases, increases in healthcare, increases in pensions and increases in insurance. We are able to get the productivity increases at the gross level based on hours worked to help pay for some of the headwinds coming through the industry today, but the productivity trend will continue. It must continue and the organization is committed that it will continue. We are also working on other programs, but we are convinced that having employees that come to work and are not injured, employees who do not worry about being injured at work, has a tremendous impact on quality and a tremendous impact on productivity.

Let me conclude with the message that we have learned in the last 10 years that might be applicable for a productivity conference. I think there are really four key lessons here. First, senior management and senior union officials together must give attention in order to change a culture. That is true whether it is a quality culture, a health and safety culture, or a productivity culture. Second, moving the needle on one of the metrics usually helps improve the other metrics. We certainly saw productivity improvements go up when health and safety improved, and productivity gains go up as quality goes up.

The third lesson was aligning efforts and helping employees understand the connection. I cannot over-emphasize aligning efforts. We found that by drawing a line from health and safety to quality, our employees could understand the importance of improving our products. Finally, productivity may be viewed with suspicion by employees and unions, but caring about the health and safety of your employees or caring about product quality are concepts that we can all embrace and that help drive productivity improvements. Our employees take a great deal of pride in a work environment that is safe, healthy and productive. Pride is certainly difficult to measure, but is something we do all the time.

GLASSMAN: Thank you, J.T., for a fascinating presentation. Let me ask you one question. You say you began this safety campaign after talking to Paul O'Neill. I think anyone who talks to Paul O'Neill for more than a minute or two will hear his evangelism on safety, but this is a conference about the mystery of increased productivity in recent years. Is it your sense that there are other companies concentrating on safety that started in the last five years or so?

BATTENBERG: Certainly Alcoa. DuPont has been very effectively utilizing safety as a driver for probably 15 or 20 years. If you look at the magazine article that I just referred to, they list the 20 most progressive companies in America relative to health and safety. That will give you a good lead as to who those 20 companies are and what they are doing. There are certainly a lot of them.

GLASSMAN: Thank you very much.

"I believe there is a case for confidence that we will continue to find new sources of economic contributions that do not depend on further breakthroughs in technology, but our resourcefulness and ingenuity in applying it."

- Greg Bentley, President and CEO, Bentley Systems, Inc.

Two confessions. First, I am a CEO. Second, Bentley Systems is a software company. I am thankful the conference deals with the whole 21st century, so we will have plenty of time to redeem ourselves. One gratifying aspect of the work we do at Bentley is that our software directly relates to, in fact enables, our real world infrastructure. We are the largest company in the world dedicated to software for the architecture, engineering and construction, that is, AEC - a physical infrastructure, roads and rail, public works, industrial plants, utility networks, and commercial buildings.

Our annual revenues are over $200 million. We are profitable and have never had material layoffs. We are majority-owned by our 1,300 employees. After 18 years, we filed for an IPO on the New York Stock Exchange in April of this year. My four brothers who founded Bentley Systems are, respectively, chemical, electrical, mechanical and systems engineers. Since my background is finance and decision sciences, naturally I do not get any respect at home. I am way out of my league today as far as economics. I will limit my observations to our own company's experience.

Before delving into the whole century, I think we have to address the question of the day: If IT has been correctly credited with much of the productivity improvement over the last technology generation, does our industry's current poor financial performance mean that the economy is bound to suffer a corresponding downturn in productivity growth? To the contrary, perhaps like the Secretary, I am convinced that IT's productivity contributions are constant and sustainable. The deployed hardware and software is indeed continuing to add value at a rate that I think is accelerating. But unfortunately for most technology vendors, they have a disconnect in their business models. Software companies, especially, rely primarily on one-time sales of up-front perpetual licenses. In the case of design software like ours, these revenues typically depend literally on the demand for new seats within our user organizations. But these organizations rarely wish to add new seats, especially with software helping them to make their existing seats more productive. For those seats, of course, the software vendors were already paid up front, so they have no economic stake in that ongoing productivity growth.

The evident and inevitable solution, though at the cost of upfront revenues, is for vendors to adopt subscription formats which permit us and incent us to participate economically in the productivity growth that we are confident of being able to support. A further advantage is that the IT improvements would naturally be delivered in manageable incremental streams rather than disruptive upgrades, so the users, the vendors, and investors all ultimately benefit.

As a private company free from quarterly license sale pressures, we have been able to take advantage of our discretion to largely convert to the subscription business model already. Mainly for that reason, our revenues have continued to grow even this year, along with our users' productivity, and there is no point of diminishing returns in prospect. Our AEC users have been relatively conservative in expenditures and adoption of IT, but some inhibitors are inherent. Each product is ultimately local and most are one of a kind. But the dotcom investors nonetheless saw in this the potential for revolutionary advances through online collaboration and e-procurement, and nearly $1 billion were funneled into efforts toward Internet solutions for construction. Does the demise of all of those dotcom startups imply that their promised radical productivity gains are impossible? My answer is emphatically no. Even the short-lived fascination with B-2-B e-commerce served a useful purpose by highlighting costly inefficiencies and points of friction that could be minimized through intelligent information transactions.

So here is a striking indication of the potential for productivity improvements over the life cycle of design, construction, and operation of these infrastructure assets that is the world's largest economic sector. Even today, the principal outputs generated from

the digital models of the sort you saw as I began, which represent and capture the creative and expensive work of our architecture and engineering professions, are merely the traditional paper drawings provided for contracting and construction, and which do not even cater for intelligence search and querying. Typically, asset owners and operators do not even care to receive these least common denominator drawings, since they do not accurately represent what was built, and the models themselves are marooned before construction.

In actuality, these models clearly comprise indispensable content that could support schedule simulations, code-checking, design reviews, interference detection, energy analysis, interactive estimating, indicative bidding, digital signatures, facilities management, asset tracking, move management, change management, renovation and retrofit, just to mention some of the applications already from Bentley. That digital model gains information content and value over the asset operation's life cycle, maximizing the return not only on the people who do those things, but on the investment and the asset themselves. For instance, consider the usefulness of these virtual models of our critical infrastructure, all of which are documented in some digital form depending on their vintage for the homeland security applications of vulnerability assessment and consequence management. What could contribute more to protect our whole economy's productivity? That is just one example of unanticipated future dividends from these IT investments.

I believe there is a case for confidence that we will continue to find new sources of economic contributions that do not depend on further breakthroughs in technology, but our resourcefulness and ingenuity in applying it. With all that existing productivity

headroom, what happened to the bubble's revolutionary expectations for disruptive technologies? We should not be surprised, just as Chairman Greenspan said, that bottlenecks encountered have had to do with institutionalized business processes. For one thing, the various disciplines and contractual phases throughout AEC projects each work with different discrete vocabularies. That was never a problem when the medium of exchange was paper, but when interpretation needs to be mechanical, it stops dead the straight-through processing premise of e-commerce. The new standards required will, at best, emerge slowly compared to the rate of technology change.

A more perverse institutional obstacle is that the design professions are compensated based on hours expended, with scant short-term incentive to increase their own productivity, let alone the productivity of the content or the assets they create. So while the envisioned breakthroughs can be eventually feasible, their realization depends upon changes in business practices that, while duly underway, are at best evolutionary. So recognizing that those changes, for instance in AEC, will not occur overnight, but rather over decades does not justify any attitude of capitulation since the productivity benefits will be literally manifold, and are certain to be ultimately accomplished and better.

It is interesting for me to reflect on the pace of IT evolution, even for an enterprise like Bentley Systems. It happens to be just about technically possible for a software company to be a comprehensively virtual enterprise, with marketing and distribution and technical support all online interactively, with huge efficiency gains. But even as motivated and presumably savvy as we might be, it realistically requires multiple steps over multiple years for us to conscientiously adapt our internal systems

and workflows. Rather than be discouraged that we are not already there, I find it reassuring, as does the Chairman, that we will be able to confidently anticipate future progress against a known roadmap for enterprise productivity.

I think the fact that the software industry is also remembering that it grew from scratch in the U.S. to now dominate world markets has some other applicable lessons for broader public policy. The first lesson is that open, two-way trade pays off. Software's relatively favorable trade regime has been crucial in enabling it to flourish. At the forum in Waco, I represented the software industry on the trade and agriculture panel. With all due respect to agriculture - and I live on a farm - I think the attendees may have been surprised to hear that software is an even larger trade surplus engine for the U.S. economy.

The package software industry's trade surplus grew from $13 billion in 1977 to over $22 billion in 2000. Typical for our industry, about half of Bentley Systems' revenues are from export. For instance, in this year and last, China is already our company's fifth largest market for new software sales. As software gravitates entirely to the borderless online environment, everyone in the world who stands to gain from our continued R&D has a stake in making sure that trade remains free, while intellectual property remains protected. The one other policy lesson from software's success is the virtue of avoiding regulatory shackles, though I grant in the case of IT this was accomplished somewhat fortuitously as a consequence of constant and rapid change.

Could it even be imagined that the entire world would agree to a moratorium on taxation, as actually happened for the Internet? As a close-to-home example of the cost of regulation, I

am sorry I missed the morning session due to the demands of my other seemingly full-time job as an audit committee chairperson for a New York Stock Exchange IT company. Mind you, no one is complaining about doing whatever it will take to restore investor confidence, least of all anyone in the software sector, but last month Bentley Systems finally withdrew our IPO registration. Although negative market economics were probably a sufficient factor, frankly the larger issue was the weight of the new and still somewhat unknown regulatory burdens for public companies. The result is that we will not make new investments and employment additions as fast as we otherwise would. There is a real, if indirect, cost to the economy.

So my final observation verges on the political. If the IT industries are finally prepared to forswear the extremes of either unreasonable exuberance or post-bubble cynicism in favor of achievable and incremental evolutionary progress, cannot we believe that we now have a rare window of opportunity where perhaps all significant constituencies can embrace long-term thinking? In particular, in preference to disruptive technologies, if we invest in a stable and predictable policy environment with a premium on two-way trade and a discount on stultifying regulation, we can indeed patiently realize sustainable technology-driven productivity increases and their dividends.

Thanks.

GLASSMAN: Thank you very much, Greg. You seem to reflect what Alan Greenspan was saying about the learning process. In other words, the software is out there, the technology is out there, and we may now be seeing the results of people learning how to use what they bought years ago.

BENTLEY: I had not thought about it as an adjustment period, as he described it. And I can get impatient when we work with the owner/operators and the engineers of all these assets as to why there is this gap between the technology-leading adopters and everybody else. What brought it close to home for me was to think about my own company and everything we could do, but we do not yet do. You cannot get there faster than we are getting there now. It will take a while, but it is worth it and it all has to do with the existing stock of technology. So I support the premise that I heard for the first time today. Thank You.

"I believe the future of productivity will hinge, certainly not in whole, but in good measure, on the speed to adopt new technologies for individuals in every conceivable kind of business."

- Phillip Bond, Chief of Staff and Undersecretary for Technology, U.S. Department of Commerce

I want to start by saying congratulations to Secretary Chao and her great team and her staff, Steven Law, Shelley Hymes and their colleagues, and all the great work they did to bring this together on a fundamental issue that ultimately is about quality of life. This is about affecting positively the lives of individual citizens in this country and I think it is fundamentally important.

I want to pick up hand-in-glove with the speaker we just heard and talk about this new kind of productivity shift or floor that we may have and its relationship to technology. As we begin to see information processing equipment and software orders rebound, that can only be good news for future productivity. I think the question that Chairman Greenspan and others have alluded to is, "Why the shift, and what does it mean for the future?" I gather there is some consensus here today on the answer to why, that it has much to do with technology and IT, its increased pervasiveness, people learning how to use what has been at their fingertips, and a consensus that we have proven that availability does not equal capability; or as our friends in telecom know, that deployment does not equal employment. People need some time to realize the full utility of the technology that they have.

What I would like to make my primary assertion is that I believe the future of productivity will hinge, certainly not in whole, but in good measure, on the speed to adopt new technologies for individuals in every conceivable kind of business. In a way, this is saying that the President's first priority in education is a national productivity priority. Education and training are at large. Obviously, capital will flow to those who are fastest to adopt and successful and most efficient. Slow adopters will find it harder to attract that capital, thereby harder to invest as they need to in productivity-enhancing technology, less growth, less investment for discovery.

With that as my predicate, let me observe that I see some challenges and some positive indicators to becoming the fastest in speed to adopt. Among the challenges, Chairman Greenspan referenced a study on the delta between the technology and best-in-class, and the average technology on shop floors kind of IBM versus the shoe store on Main Street. Where that was a 15 percent delta in 1975, in the year 2000 it was about a 40 percent delta according to that study. So that is a challenge. There is a gap between the best and the average that needs to be addressed. Another challenge that we stumbled across at the Department of Commerce in a roundtable we had on small business and innovation was the somewhat obvious point that it is not plug-and-play. You do not simply go buy a new piece of equipment or a new piece of software and next month or next quarter realize the productivity bump. There is a time challenge there.

Another challenge is that education across the country at all levels is still not coming close to using the full capabilities of technology. This is especially true in public education. I was pleased that at a recent event at the Department of Commerce that we did with the Department of Education, the National Education Association embraced that completely and said that is right. We need radical new changes in the adoption of technology in education. Another challenge is that new entries, new companies, new countries without debt can go right to the leading edge, if not the bleeding edge, and become significant challengers almost overnight to attract capital and employment and growth. Among the positive indicators, one is this coming generation. Kids have grown up with technology at their fingertips, surrounding them in many cases. Ninety percent of American children between the ages of 5 and 17 use computers. That can only be good. Seventy-five percent of 14 to 17 year-olds and 65 percent of those 10 to 13

moving all the way down to 10 year-olds are using the Internet regularly. They have grown up with technology. They think differently. That, too, can only be good for the future.

We continue to lead the world in IT and telecom technology and also in scientific discovery, and in each of those change is accelerating. This could be either good or bad news, depending on your perspective, but there is emerging consensus that even Moore's Law is accelerating on the computing side. My friends in the telecom industry say that change - their ability to move bits - is advancing at twice the rate of Moore's Law. Then in scientific discovery, thanks to the Internet and other things, we now have unseen levels of collaboration between our best minds around the world. As Marty Apple from the Council of Scientific Society Presidents here will tell you, the rate of discovery should accelerate in the future too.

Another positive indicator starting here in the federal government under President Bush and across the country is the increasing seriousness about e-government - the packaging of information that can make business more efficient. You see small business beginning to get engaged and think more about not just using the computer to run their payroll, but getting online, plugging in with Wal-Mart, becoming more efficient as a vendor or retailer.

Because of the importance of speed of adoption, a fundamental challenge is achieving and sustaining high productivity in the future by becoming a nation of lifetime learners. We have started to make progress on K through 12, but this is a challenge for all of labor, all of commerce, and all of education. You heard a flavor of this from the Union Pacific story earlier. Again, on a multi-agency

basis, we brought together some visionaries over at Commerce and put together a booklet that you can get on the web called 20-20 Visions, a number of leading visionaries in technology talking about what the future of education and training could look like if we used the fully emerging technologies, immerse technologies, for training and education. So I think that is going to be the challenge. As a nation, if all of education, all of business training, entrepreneurs and small business move to that kind of future, we will lead the world in speed to adoption and maintain leadership in productivity and economic performance.

GLASSMAN: Thank you, Phil. We heard from Greg that one of the best things that government can do to encourage productivity growth is to get out of the way. Could you tell us thing that you would like to see happen, one piece of legislation or regulation that should be enacted or removed that would really improve productivity?

BOND: We have some initiatives underway at our Patent and Trademark Office, just to pick an easy example, to reform, modernize, and harmonize around the world. That alone, for America's innovators, would be a significant help to keep the feed stock of productivity going, which is really what our innovation is, and ultimately the American advantage in the world economy. As a culture, that is what we do best.

GLASSMAN: Thank you.

Henrietta Holsman Fore is the Director of the United States Mint. Before that, she was CEO of Holsman International and President of Stockton Products. I have a suggestion, by the way to improve productivity: get rid of the penny. She will have much more interesting things to say.

"Quality of life is exceedingly important to all of our employees. Whether it is a sniper or whether it is September 11th, people are rethinking their personal priorities. We need their minds, their hands, and their hearts all at work."

- Henrietta Holsman Fore,
Director, United States Mint

We can solicit input and ideas on our nation's coinage at any time. So, thank you, Jim.

When we look at productivity, we look at Adam Smith's pin factory. It could have been a national mint at that time. If we look at the national mints today, the United States Mint is the largest in the world. We had revenues last year of $2.5 billion, profits of $1.5 billion, and 2,600 employees. We have four mints plus Fort Knox.

We produce one-sixth of the world's circulating currency, but it is a monopoly. How do we deal with that? We are the 30th largest e-tailer in the world. We are selling about $4 million a day, and more than 100,000 hits. People are asking everything from when is the penny going to be eliminated or what is the penny made of, to how many half dollars are you producing this year, or may I buy a proof set for my grandchild. Those are all part of what we have to calculate in terms of productivity.

When we came in as an Administration, we looked at productivity. We began a measurement system, and we had three challenges that hit us. One was how to measure a government agency, because we do other things than just have output. We are dealing with public education. We are also dealing with legislative requirements and budgetary requirements and reporting requirements.

The second challenge was, how do you rate and benchmark enforcement? We have a mint police. It is protecting the nation's assets. It is something that I think Washington is going to have to come to grips with, but probably the nation also. There are a lot of enforcement agencies out there. How do you rate them and their productivity levels? Right now, the measurement we have is: What is the threat at any one of our places of operation and what is our level of readiness?

The third challenge that we had was how both time and money are valued quite differently in government. For instance, we have no cost of capital, so we put in measurements and everything from cycle time. Our cycle time when I started last year was a little over 300 days. We are now down to 108 days. Inventory values just on the circulating side were $467 million,

down now to $327 million. As to lost-time accidents, we were pleased that we could reduce 42 percent, but we have not yet reached J.T.'s level, and he is absolutely right that it affects your quality. It also affects your housekeeping and it affects how people look at their environment and the pride that J.T. mentions. It affects everything that you do.

We had a very good joint partnership with the Department of Labor, OSHA, our union and the mint this spring in Philadelphia. Cost of coin equivalence - we have a decrease in the cost of 1 to 4 percent per month now, and we have consumer measures. Given what Jim has mentioned about my background, I have been in small business, in large public companies, in nonprofits and in government. The challenge that I see is how you keep all of these sectors moving along productively. Right now, to my mind business is way out ahead. There are good productivity measurements for business. There are not good productivity measurements for government. As you can see, we have been hard at work and it is very difficult as a public agency. It is difficult in the nonprofit sector and it is also difficult when you are in small business. But if there were someone in this audience today that would like to take this on, it is the course of how to measure across sectors, as well as within a sector, and government is in great need of this.

The second thing that looms up before us is one that Phil just mentioned and so did Chairman Greenspan, which is technology R&D and how much we should invest. For us, we are looking at lasers, at CADs, at all sorts of systems, nano-technology. But it is not the output per worker or per hour; it is how we actually distribute it and get it out into the hands of the consumer. The software that underlies distribution systems is a key to this, but so

are other technologies. There is a strong demand on all of us for IT skills, and being able to pay for them. Lifelong learning, how do we train people so that they can be a flexible workforce; so that they can move, in our case, from an annealing plant over to be a coining operator?

There is one other part in this workforce that I think has come before all of us, and it is that we are now managing in a different world. Quality of life is exceedingly important to all of our employees. Whether it is a sniper or whether it is September 11th, people are rethinking their personal priorities. We need their minds, their hands, and their hearts all at work. We have developed a values system that we think is important within the mint. It has five parts: accountability, leadership, teamwork, trust and communication. It is important for any organization to have a value system so that everyone pulls toward the same end. Every time we feel like we are not making enough improvement in productivity, we look at what happened to us the first year, 1792, when the mint made 11,173 copper cents. Now we make in about 30 seconds what used to take a year. Adam Smith would be pleased.

Thank you.

GLASSMAN: Thank you, Henrietta. I just have three questions, two of which are very quick. When you were in the private sector, you had a company called Holsman International and another one called Stockton Products. What did they do?

HOLSMAN FORE: Holsman did trade and investments internationally, so it was backing up the premise that free trade is extremely important for the United States. Stockton is a

manufacturer of steel lathe for the construction industry, both commercial and residential.

GLASSMAN: Second, I think some people may be surprised to learn that the mint makes a profit. You do not do this by selling quarters for 27 cents, do you? How do you make a profit?

HOLSMAN FORE: We have two routes for profit, one in which we make a quarter for about five cents. We can put that into the Treasury. The second is that we sell numismatic items. We sell in about 60 countries around the world. We are the largest seller of gold, silver and platinum bullion in the world, and precious metals are up since September 11th. There are real profits. Our Internet business tells us that, and that goes into the general treasury also.

GLASSMAN: The more substantive question I have was about outsourcing. A lot of people believe that one of the reasons that productivity has increased is that more and more companies are concentrating on their own competitive advantage and letting other people do things like manufacturing. What are you doing at the mint?

HOLSMAN FORE: We have been working on trying to shorten the timelines between our suppliers and our activities. If we can shorten them enough, there are some things that we do not need to outsource. If we cannot shorten them, then they are prime targets for outsourcing. As any government agency, we do A-76 studies, which are outsourcing studies, and it will go through every department within the federal government and every part of every department. So in a five-year time period, every part of our organization will be looked at for outsourcing.

GLASSMAN: Who actually mints the coins?

HOLSMAN FORE: We do.

GLASSMAN: Is that something that you cannot change?

HOLSMAN FORE: The United States and most sovereign nations feel that the minting of money or the printing of money is one thing they would like to keep control over. So at the moment, we make the dyes that strike the coins that you find in your pockets. We also make the dyes that print the money that you carry in your wallet. Thank you.

"We have a very high percentage of healthcare dollars going for various levels of paper work, claims filing, and administrative issues. An automated medical record designed appropriately can make that entire process electronic."

- George Halvorson, Chairman and CEO, Kaiser Permanente

Kaiser Permanente is a vertically integrated healthcare delivery and financing system with about eight million members. We have about $22 billion in annual revenue and about 120,000 employees, so we are one of the larger healthcare delivery and financing systems in the world, but I am actually not here today to talk about Kaiser Permanente.

What I would like to talk about is the larger issue of productivity in American healthcare. We are at the point where we are facing an explosion of healthcare costs in this country. Healthcare costs are going up at the most rapid rate of the last couple decades. Costs are exploding. A combination of factors are driving that, but we are at the point now where the average premium for a family of four in most parts of the country now exceeds the entire minimum wage for a worker. A minimum wage worker who took the entire amount of money and spent it on healthcare premium could not pay for a complete premium for a family of four.

When you look at factors driving healthcare costs up, you can see there are new drugs, new technology, new procedures. We are seeing a shortage of healthcare workers in all kinds of key jobs. We are seeing an increased consolidation of the provider community. In the 1990s, the health plans had immense negotiating leverage, and managed to get deep discounts from most providers of care. Toward the latter part of the decade, providers began consolidating at a massive level. Now in most parts of the country, the balance of power has shifted. We are seeing anywhere from 20 to 200 percent increases in the amounts being charged by the consolidated providers post-merger. If you put all of those factors together, there are cost trends in front of us that are exceeding anything we have seen for quite a while. There is no particular

thing on the horizon that is likely to turn the situation around. We are not likely to give up on technology. We are not likely to give up on drugs.

Provider consolidation is probably at the point where it cannot be swept back, and we have an aging population. The baby boomers are all hitting the chronic care age. If you look at utilization charts, you see a very steep increase in the rate of utilization when people get into their fifties. If you look at our population, you see that the baby boomers are now approaching their fifties. So we have a population that has probably the highest expectations of any segment of the population that is coming to the point of needing chronic care on a regular basis, and the healthcare costs from all of those factors are exploding. As you look at that, trying to figure out what could possibly be done, one of the things that is obvious is that both buyers and governments are going to be unable to afford the current cost explosion as it is occurring. Employers are beginning to shift costs to employees through benefit shifts and through premium shifts. Again, if you look at a 14 percent increase in average premiums right now, it totally wipes out a 4 percent raise for the average worker.

We are in a position of having an increasing number of uninsured in this country, and an increasing number of people who are extremely unhappy about the costs of care, because the benefit cutbacks will cause them to feel out-of-pocket care costs. The premium shift will cause them to feel a decrease in their paycheck, and the number of people who are working and uninsured are going to be a population that is going to be heard from.

If you step back and look at the overall system, we have probably the best healthcare in the world - beyond any doubt the best health care in the world if you are extremely sick. If you need a heart-lung transplant, there is no place else that you would want to get that transplant. If you need laser surgery, we have the best lasers in the world and more of them than anywhere else. But if you look at the overall healthcare delivery system, the sad truth is that the system is extremely inconsistent. It is too often ineffective and it is too often unsafe for our citizens.

The healthcare delivery system is not a particularly well-designed system. In fact, it is an undesigned system. Most people in this country believe that care is consistent and safe, and that is absolutely not true. One study that I like to quote took 135 physicians, gave all 135 physicians one patient, and they came up with 82 different treatments. The reason they came up with 82 different treatments is some of them went to medical school last week, last year, 10 years ago, 20 years ago. They may or may not have read an article. They may or may not have gone to a seminar. They may or may not have had a salesperson call on them to sell them a treatment approach. The inconsistency that exists is massive.

The Institute of Medicine did a fascinating study a couple of years ago that was almost totally ignored by the American public. It talked about inconsistencies in the delivery of care. They basically said that about half the people in this country who have a heart attack get unsafe, inappropriate, inadequate follow-up care for the heart attack. This is something that, when you look at the overall productivity of the system, any system that is producing inadequate care for half the people it is treating is a system that has significant issues.

The American Diabetes Association says that only one out of three doctors is providing adequate care for diabetic follow-up. Diabetes is an epidemic in this country. The number of diabetics has gone up by 50 percent since 1990. About 25 percent of all dollars spent by Medicare are spent on diabetics, and most diabetics are getting inadequate care. The kidney dialysis units of America are full of people with failed kidneys who are there because the care delivery system failed them. If you go through the dialysis wards, you will find people with diabetes who were inappropriately treated.

There is a new study coming out that took a couple dozen major procedures, identified what the best practices were in healthcare for those couple of dozen conditions, and then went around the country, pulled 18,000 patient charts and examined each of the patient charts individually to see how many patients received appropriate care. The good news is, it was over half; it was 51 percent. Then they took a look at the number of cases where the science was so absolutely clear that no one could possibly disagree with that science, and checked to see in those cases who received best care, the number shot up to 52 percent.

What we have in the system is inconsistent care. It is delivered by care practitioners who all want to do exactly the right thing, but they are seeing a new patient every 15 minutes. There are 23,000 medical journals published annually with scientific information in them. The physicians are working hard. They are maintaining their practices. They are hiring and firing staff. They are meeting all of the coding laws. They are trying to maintain a personal life. They are trying to have a family. They are trying to keep up with 23,000 medical journals, but the likelihood of that happening is pretty unlikely. Add to that the fact that physicians are working

typically in an antiquated, totally uncomputerized environment, where they are working with a medical record that is a paper record with incomplete information.

As a patient, if you have two doctors, you have two medical records. Neither doctor sees the other medical record. If you have five doctors, you have five medical records. The ability of doctors to perform best care in that setting is significantly hampered. Add to that the fact that when the doctor is in the exam room, they are working from their memory. They are trying to remember for any given condition what the best practices are, whether or not you have had the appropriate tests, whether or not you have had the appropriate follow-up, and trying to stay on top of the situation. You can see why there is such a great inconsistency. Even the very best multi-specialty medical groups in the country who are working very hard at taking science-based best practices and rolling them out are plateauing at 90 to 95 percent best practice.

I was amused to hear Jim say that they had a crisis at 800 defective parts per million. In healthcare, you win awards for 10 defective parts per 100, and the national standard is around 49 defective parts per 100. Now, that is inconsistent care. If you are looking at productivity issues, you add to that the fact that the reporting systems of the country are burdened by all kinds of both insurance and government requirements for Medicare and Medicaid, and you find the healthcare workers are spending far too much time filling in paper work and too little time taking care of patients.

What can be done? The good news is that there is an answer in front of us that is beginning to be used. It is a critically important answer that will let us re-engineer healthcare. Without

that answer, we cannot re-engineer healthcare. With it, we have got a fighting chance. It basically is an automated medical record that provides complete information about the patient to the doctor, in the exam room, at the point of care. It also provides to the doctor all information about the patient's condition, the current best science about the condition, best practices about the condition, and appropriate follow-up steps for that patient at the time of care. It seems like an obvious and logical thing to do, and it does not exist. There are very few. Some of the very large organizations in the country, the Mayo Clinics and the Palo Alto Clinics are beginning to do automated medical records and going down that path, but the vast majority of care practitioners in this country have no access to that level of technology. Most patients are being taken care of in an environment that ends up with 49 percent inappropriate practice. The ability to go forward is right in front of us. The necessity is imperative. I think if we do not go down that path, we are not going to be able to re-engineer healthcare and get it to levels where productivity resembles what we need to see.

Another major issue is that administrative costs for healthcare in this country are extremely high. We have a very high percentage of healthcare dollars going for various levels of paper work, claims filing, and administrative issues. An automated medical record designed appropriately can make that entire process electronic, to the point where when a patient leaves the exam room, the money should have changed hands between the carrier and the physician. The co-payment should be clearly defined. If co-payments are going to a billing process of some kind, that process already occurred. The whole process ought to be done electronically, rather than through an immense, expensive, and inefficient infrastructure of insurance

administration, where again 97 percent claims accuracy has continued to be excellent.

Six Sigma does not exist in the insurance industry or in healthcare delivery. So as we are looking at productivity in this country, the ability to re-engineer healthcare delivery at the nursing level will require electronic support to get nurses out of the paper work business and back into the patient business. It will be required at the pharmacy level. Let me close by giving you a couple of examples. We have been doing pilot programs in the use of automated medical records. In Ohio, we took partially automated medical records, put it in place five years ago to focus on heart patients. We identified for each doctor at the point of care exactly what needed to be done for that patient relative to the patient's heart disease. Over those five years, we cut the rate of deaths from the three major forms of heart disease to less than 50 percent of the Ohio average.

In Colorado, we took a program with partially automated medical records and identified for patients who were going into surgery exactly what drugs had been prescribed to those patients from any and all of the doctors that they had seen. We then had those drugs run through a screen to see if the drugs had an inadvertent side effect of thinning blood. When that was true, we brought a pharmacologist into the picture. The pharmacologist took a look at the prescription and prescribed something else as an interim prescription for the period of the surgery. As a result of that simple process, we reduced the number of hemorrhages in surgery by 81 percent.

There are some very basic things that can be done with the use of an automated medical record that are not even being thought

about right now. So I just basically say, as you are thinking about healthcare, think about the need to re-engineer healthcare at a very basic level, to bring the computers into healthcare at a level that assists the doctor and helps the doctor do a much better job of providing care. Then we have a chance of doing something significant about the healthcare cost explosion we are facing in America. Thank you.

GLASSMAN: Thank you, George. You raised many important questions. What is the major obstacle to automated medical records? Is it privacy hysteria, or what?

HALVORSON: The privacy issues are significant and have to be dealt with, but the bigger issues are the fact that the healthcare delivery system is such a splintered system, has so many independent moving parts, and none of them interrelate to each other. There is no natural linkage in most cases that would allow doctor one to be linked to doctor two relative to patient information. So part of it is just the organization of the system; part of it is the rewards in the system. The system right now rewards all providers for incidence of care. There are 8,000 billing codes for incidence of care. There is not one single billing code for a cure. If you think about it, there is nothing in the system that encourages people to work together toward better health. Everything works toward rewarding people for taking care of the incident.

GLASSMAN: Just one last question, and we will get to the floor. Henrietta was talking about how difficult it is to measure productivity in a government agency. Isn't it extremely difficult to measure productivity in healthcare? Just because costs are rising, clearly there is more being accomplished with the amount of

money spent than was accomplished 20 years ago. So how do we measure productivity with healthcare?

HALVORSON: One way to measure productivity in healthcare is to take a look at issues like complications of diabetes, and identify the fact that one set of caregivers has twice as many people ending up with complications as another, or the death rate from heart disease, or the incidence of damage after stroke. There are a number of outcome measures that are possible and useable. The whole science of outcomes and measurement is relatively young, but it is beginning to be fairly robust and there is some good information available.

GLASSMAN: Thank you. Let's now hear questions from the floor.

QUESTION: Could some of you talk about the specific technologies that you see coming up to increase productivity, such as robotics or computer-aided drafting, or management of the manufacturing process with the computer overall operation, or online management of the construction process?

GLASSMAN: Where are those robots?

BENTLEY: Some of that sounds like I may be able to address it, especially in the engineering professions. It is amazing to sit here in 2002 and observe that cumulatively, where IT has been brought to bear for engineers is still very largely the tasks that one engineer does one at a time on his desktop involving outputs that look like a drawing or a specification. The insights of the past few years have been that computers are as useful for connecting as they are for computing. You have the opportunity for computers at

the server level to permit collaboration and productivity at the work group, and then the enterprise level, rather than just the task level and the individual desktop. So the things you describe are things that are underway, but having project-based work be collaborative work, where there is a digital model of the project, or the product, depending on whether you are in manufacturing doing product and part design, or whether you are in AEC doing asset and infrastructure design.

There is a great deal in the pipeline to improve that, and it is because no longer are we trying to do things faster one at a time on a desktop. It is because we are looking at the larger problem of the project than the collaborative effort required to do that. It is what we in computing say at the server level, helping people work together rather than getting things done faster individually. It is still productivity. It is more important.

There are orders of magnitude of productivity improvement to be accomplished at the server and at the project level. We are not at the point of diminishing returns at the task and the desktop level, but the faster returns are coming now in collaboration. Don't let anyone sell the Internet short. It is real and significant. It is just not overnight.

BATTENBERG: There are some obvious ones that are very effective in getting double-digit productivity. The computer-based design of work cells is very effective, such as the CAD work plan on metal-based removal of metal. There is a whole series of computer-based designs. The one that I would gravitate to that is the most effective is a little bit old-fashioned, and that is value chain flow management - going back to the concept of the metal or the ground itself, the dirt itself, and take it right through to the

customer, and borrowing a lot of the techniques from Toyota, which I think is probably one of the best in terms of seeing the flow of work from beginning to end. There are obviously huge amounts of productivity increases that can be utilized and gained using some pretty old-fashioned techniques. If you can speed it up with computer-aided design, that makes it that much more effective.

GLASSMAN: We heard a lot about just-in-time inventory. How important has that been in your industry?

BATTENBERG: Just-in-time inventory is critical. We are fortunate. We are in 42 countries so we are able to decentralize and diversify. For example 9-11, although as tragic as it was, we were able to never shut an auto producer down anywhere in the world simply because we were just-in-time and diversified and had small-lot operations. The terrible strike going on the West Coast now, same thing. As tragic as that is, we have not had any of our customers shut down. The Japanese plants are down because they cannot get their Japanese parts in from Asia in a timely manner. Small-lot size and small inventories are absolutely critical to productivity enhancement.

GLASSMAN: George and then Henrietta both want to comment on this question.

HALVORSON: The quick technology enhancement that is going to make a big difference in healthcare fairly quickly is e-visits - electronic connectivity with patients. Patients right now find it very inconvenient to leave the office, drive to the doctor's office, go through the parking lot, sit in the waiting room. All of those steps can be eliminated for somewhere between 20 and 25

percent of the visits, particularly follow-up visits. So electronic connectivity with the patient will add productivity both in the care setting and in the work setting.

HOLSMAN FORE: Your comment on robotics - we have that currently in our San Francisco mint. It has helped tremendously. We are also starting to use CAD designs, referring to the value chain. It shortens the lead-time for all the processes that underlie our work. Just-in-time has cut about 50 days in our cycle time at one of our major mints, but our eye is on nano-technology as one of the huge drivers coming up.

GLASSMAN: Could you elaborate on that briefly?

HOLSMAN FORE: Nano-technology has a variety of uses in the medical field, in the manufacturing field. For us, some sort of a molecular manufacturing, where molecules arrange themselves, could be utilized in a lot of our processes.

QUESTION: Phil Bond raised the issue of science and technology in productivity. I would like to raise the issue behind it of where do we get the scientists who are going to be there. Right now, our K-12 education system ranks at the bottom of the world in the capabilities of students graduating high school and going into college in math and science. We now have a major drop-off of 30 or 40 percent in people graduating in physics and mathematics and all these underlying sciences that we are counting on for the future - even computer sciences, which is grossly under-graduated. We only graduate a few hundred a year who finish their terms. I think what we are looking for here is this grand vision of what we can do, but the underpinnings of the future are at enormous risk. I would like to hear some comments in response to that.

BATTENBERG: I will take a shot at it. I think we are approaching it from two different aspects. One is in the junior highs and the high schools, with the organization FIRST, For Inspiration and Recognition of Science and Technology, which we throw a lot of money and time behind, where we get young people in America involved in robotics. We have 2,500 junior high schools involved in junior robotics and we have about 850 high schools involved in robotics on a national competitive level. Then we have about 65 full-ride scholarships to engineering schools that we give the most talented. On the other end, unfortunately, we have 16,000 engineers. We hire probably 1,000 a year, but we are hiring those electrical engineers and electronics engineers and setting up technical centers in Beijing, Krakow, India, Juarez, Mexico. And that is just the unfortunate situation, hooking them all up with CAD machines and working 24-7.

BOND: Thanks for your question. I think there are some things that we can do. There is a globalizing effect in terms of many of these disciplines. Certainly, the Bush Administration position is we want American folks filling those higher value-added jobs as much as possible. This was recognized in the education bill with the emphasis on math and science. It is realized at the Department of Labor. They are working the Office of the 21st Century Workforce, and also at the Department of Commerce, where we try to focus on workforce issues and are getting ready to send an IT workforce report to Congress. So I think there are some things we can do. They include market forces that will come to play. They include use of the bully pulpit of the government. The President has national medals of technology and science that he awards each year and we need to use the bully pulpit to inspire another generation of young boys and girls to choose science and technology. This morning I was at a national

competition where they were giving out awards to middle school technologists and scientists. It is phenomenal. We need to hold those up as our future.

QUESTION: My question is addressed primarily to Mr. Halvorson. He talked about the supply side, and I am glad to see the much over-praised healthcare industry having him disabuse us of some of that praise, but it does not seem to me you get at the fundamental problem, and that is a lack of patient power. We know that competition, globalization, and consumer power combine to make for a high productivity growth environment, yet we have this system that is shot through with third-party payments. Patients pay less than 15 cents on a dollar. They are just number-drivers in a very hard bureaucratizing-type system.

The answer to that would be that we have got a problem in our tax code, where healthcare benefits are primarily acquired through our employment. We have an answer to that in the form of medical savings accounts - buying a high, financial catastrophe, low-premium-for-big-dollar health plan. On the other hand, you are also going to be a thrifty shopper. You are going to stimulate competition. What do you think about the problem on the demand side from an economist's point of view, where patients are just number-drivers? They are like my students at Texas A&M University, right? That is the way the professors treat them, like number-drivers. They are not really important in my income.

HALVORSON: Good question. The medical savings account model would work if the premium charged was actually the usual charge that people paid for healthcare and there was an even distribution of healthcare. What is true is 75 percent of the people use 15 percent of the cost; 20 percent of the people use zero percent

of the cost; 1 percent of the people use 30 percent of cost; and 5 percent of the people use 50 percent of the cost. Medical savings accounts are completely and totally irrelevant for all of the people over on the 1 percent, 5 percent range, because you blow through any deductible in 6 hours in the hospital.

All of the costs are with a very small number of people. What you need to do for those people is manage their disease better and prevent them from moving to that level of disease. Medical savings accounts take the 75 percent of the people at 15 percent of the cost, give them an extra $1,000 to spend on back rubs and other therapeutic massages, and expect them to go out into the marketplace and make conscious decisions. If you are having a heart attack, you are not going to issue an RFP. If you have had cancer diagnosed, you are not going to sit down with your oncologist and negotiate a lower fee. The whole process is theoretically sound only if everybody has an equivalent amount of care. Since care costs are distributed so unevenly, medical savings accounts are a nice theory, but in practice they only lead to risk skimming and risk selection.

GLASSMAN: When you talk about 5 percent of the people paying 50 percent of the costs, I thought you were referring to the tax system.

HALVORSON: It is true there, too.

GLASSMAN: Let me raise something else. The economists in the audience can correct me if I am wrong, but I remember reading an economist at Princeton, William Baumol, talking about how there are two sectors to the economy, healthcare and education, in which productivity gains are impossible because of the nature of

the business. In other words, in education, you have one teacher in front of a classroom of 30 kids. In healthcare, you have to have an individual doctor taking care of people. Is there something different about healthcare as far as productivity gains are concerned?

HALVORSON: Traditionally, healthcare has been perversely incented. The physicians and other providers of care have been paid more for doing more complex things. There has been absolutely no incentive to be more efficient. There has been no incentive to actually improve health or improve health status or health outcomes. Physicians work in those directions because they are good people trying to do the right thing, but the system itself economically does not reward any of those right things. What you need is a system that takes care of populations of people and rewards teams of caregivers for improving the health populations. Consumers need adequate information so consumers can make meaningful choices about the caregivers that they are selecting and the care teams that they are selecting. That would be a more reasonable marketplace. We have never actually had a values-based marketplace in healthcare. We have had a very dysfunctional, perversely incented marketplace in healthcare.

GLASSMAN: Do you think removing or somehow diminishing the layer between buyers and providers of healthcare would make the system more rational just like everything else?

HALVORSON: To some degree it is true. I think there should be some additional cost-sharing, and I think an absolute and total insulation from the impact of costs of care probably does not work very well. On the other hand, when you are talking about the 1

percent of the people who drive 30 percent of the cost, you are not going to involve them in any meaningful way in any insurance model in the cost of that care. They are going to have $1,000 deductibles and be done with it halfway through their first day of treatment. The issue of where the dollars are is where we need to focus our attention, and where the dollars are is not touched by that kind of thinking.

GLASSMAN: Kevin?

HASSETT: I just want to remark first on the amazing confluence between the discussion this afternoon and what went on this morning, and even what went on during the Chairman's talk. Steve Oliner told us that he and his colleague Dan Sichel are optimistic about productivity growth in the next 10 years because they see things in the pipeline that we can do to make things better that are probably going to happen. That is what you are saying here. You are saying, here is what we are doing; here are the things that we can do soon, and they will probably happen. Therefore, you are more or less agreeing with the Chairman and with Steve.

It occurs to me in listening to the conversation that there is a question that can get to the longer run, because we do not just care about the next 10 years. We care about the next 100 years. My favorite fun fact is that if in the last century, we grew 1 percent a year slower - and that is the difference in productivity we are talking about today - then we would have a standard of living today below that of Mexico. So that 1 percent we are talking about beyond 10 years can be a big thing. Here is the question - it is retrospective, though, you do not have to think about the future - Do you people who actually run large organizations feel that you are better at finding productivity improvements today than you were five years ago?

HALVORSON: Yes.

HASSETT: If the answer is yes, then I think it is probably true that the information technology revolution has made it so that we are permanently more able to grow at a faster rate.

GLASSMAN: Let me add to Kevin's question. If the answer is yes, why is that? Is it because things have gotten more competitive and you have to do it?

BATTENBERG: There is no question in my mind that the productivity gains are there and we know how to get them. Industry can get the productivity gains. Self-survival is a good terminology. If you do not get them, you will not be here because the headwinds are coming so fast. The increase in the price of steel, the increase in the price of insurance, the increase in director's insurance - these are huge impacts in a recessionary or deflationary environment where prices go down. Every meeting you have with your customers, they want price downs, not price ups. So it is wages going up, prices going down, and healthcare is exploding. These headwinds are huge. It wipes out all of your productivity improvements, so you have to really run hard just to keep your head above water. If you do not get the productivity improvements, these headwinds just keep coming. You will not be around for long, and that is why there are record levels of bankruptcy, at least in the auto industry and the supplier community. There are just a lot of people who are not going to be here next year.

HOLSMAN FORE: If we could also focus on making government leaner with less regulation, it would help. It is part of those headwinds that J.T. talks about. That is something that we can do. If we can focus on it, it would really help.

QUESTION: It is about the education sector that you mentioned before. This is a sector *prima facie* that has had negative productivity growth over the years, more and more resources, less and less results in terms of metric results. My question is, why aren't we giving more attention to doing what we are doing in the manufacturing sector in terms of lean manufacturing, lean production? In addition to competition through vouchers, we should move there. But why not get some Six Sigma black-and-green belts into the public education system? I could give you a lot of stories about how you could increase productivity in a hurry, both for teachers in the classroom, and even more, the personnel that keep growing outside the classroom.

GLASSMAN: You mean in government in general? Not just in education?

QUESTION: The level of management is at all levels - municipal, state, federal - but why aren't we focusing on increasing productivity? The metric objectives are right there. In the manufacturing sector, I can say there are a lot of processes and ways to go about it, as you are doing at the mint. Why not get at this big sector, which is so critical, which is public education?

BOND: I am safe to speak on this subject because I am a grandson, son, and husband of teachers. The pressure is building and it is inevitable. We saw it in the NEA's embrace of trying to bring more technology into teaching itself, and changing the definition of teaching: Instead of providers of knowledge, to guiders through knowledge. We are going to be swimming in information and the job of teachers is going to change. I believe that as that changes, the future for the profession is very bright. Your audience, your market, will be unlimited, thanks to the

Internet. If you are a great guider through knowledge, you will attract a big audience. I think it is starting. I was incredibly encouraged to have the NEA be part of this effort that we had at Commerce with the Department of Education. I think that the pressure of public budgets and everything else is such that it is the force of reality.

GLASSMAN: Thank you. Any other comments?

BENTLEY: I think part of the premise of your question was, are we worrying enough about that? Those of us who are practitioners and run companies have made this problem of education, especially technical education, a real centerpiece. It is something that we worry about almost every day. Where the rubber hits the road is indeed where the middle-schoolers decide to make their career, whether it is in the technical professions or not. Our company has programs; others here do as well. We sponsor nationally a contest called "Future Cities," which is part of National Engineers Week every year, where seventh- and eighth-

graders work in teams of two or three with a teacher, but also with a practicing engineer. It is up to 18,000 teams now. They use "SimCity." In my own household with four teenagers, if they have a chance, they spend their time on the computer and they use "SimCity." So that is where this simulation of future cities takes place. It is a very gratifying thing. We had the CEO of IBM two years ago and the CEO of DuPont last year spend the day with these kids at the national final. It is that level of priority for these companies.

During National Engineers Week, something else caught my attention. It is something you would not have supposed could possibly be the case. There are a number of award programs; some of them have been referenced. Someone has now endowed a prize for engineering educators granted annually. The prize is $1 million; $500,000 goes to the school and $500,000 goes to the individual engineering educator. So there is a lot of attention to this problem and people are doing what they can. I do not think that the picture that we are letting the wheels spin down is necessarily accurate, but that last question - still a very good one - is one where a lot of us sitting in practitioner level cannot address the fundamentals.

GLASSMAN: Thank you, Greg, and thank you, panel.

We are using the term "practitioners," and I have to say as somebody who goes to these conferences all the time, it is really refreshing to have people who are actually out doing things - not that people in government or economists do not do things, but the kind of people that we do not always see here at AEI. I am very pleased to have all of you on the panel. People who are running businesses in America are trying to find ways to get more output for the same input, or the same output for less inputs.

There is a lot more work to be done. George makes it very clear that we should be seeing productivity gains of a significant nature in the years to come, and that this mystery of productivity gains is not simply a statistical fluke. It is for real, and the question is, is it going to continue? We are getting an inkling that it will continue.

I now have the very great pleasure to introduce the U.S. Secretary of Labor Elaine L. Chao, who has been a very dynamic Secretary. One of the things I really like about Elaine, among others, is that she is interested and excited about ideas. That is why we are here today. This has been a very valuable collaboration. Thank you so much for putting this together.

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"I think after a day like this, we all recognize that productivity growth is absolutely key to our economic future. How we encourage and manage this very, very important asset will determine the standard of living for the next generation of American workers."

- U.S. Secretary of Labor Elaine L. Chao

CLOSING REMARKS

Thank you, Jim. Once again, it has been a real pleasure for the U.S. Department of Labor to partner with the American Enterprise Institute to host this very important conference on productivity. I want to thank all of the distinguished panelists from academia, government, business and public policy organizations who have given their time to participate in this conference. I also want to thank the Chairman of the President's Council of Economic Advisers, Dr. Glenn Hubbard, who was here earlier in the morning, and also the Chairman of the Federal Reserve Board of Governors, Dr. Alan Greenspan, for taking time out of their very busy schedules to share some thoughts with us. I also want to recognize our very distinguished moderators: Kevin Hassett, Ben Wattenberg and Jim Glassman of the AEI. You did a great job.

I think this conference has demonstrated just how important productivity growth is to maintaining a healthy economy and also a high standard of living for America's workers. Not only is there a strong correlation between productivity growth, higher wages and lower prices. But, as we have learned, a 1 percent increase in the productivity growth rate has the power to cut the federal deficit by $2 trillion over the next 10 years. And it has the power to trim the Social Security shortfall by one-quarter to one-half over 75 years. These benefits are simply too large to ignore. That is why I believe that productivity growth -- how to achieve it, and how to temper its short-term effect on workers -- should be a part of every public policy discussion and debate in government. I think we made a great start today in focusing public policy attention on this very, very important issue.

As Secretary of Labor, my focus is on the human side of the productivity equation, and that means its impact on jobs and

workers. Many of the programs and policies of the Labor Department are specifically designed to mitigate the short-term dislocations that can occur in our very dynamic and fluid economy. I am reminded how incredibly fluid and dynamic our economy is every month when the Bureau of Labor Statistics reports on the monthly unemployment numbers. According to the most recent data, nearly 40 percent of unemployed job seekers find a new job in five weeks or less.

Our economy is incredibly dynamic and it is churning all the time. Our mission at the Department of Labor is to do everything in our power to ensure that one group of workers does not bear the brunt of the inevitable shifts that are bound to occur. So to better target our programs, we need the most accurate information. That is why I have asked the Bureau of Labor Statistics Commissioner Kathleen Utgoff to expand the number of business sectors in which BLS measures productivity. In 1995, the Bureau of Labor Statistics productivity surveys covered only 40 percent of the non-farm sector. This year, we are up to 60 percent. Our goal is to cover the entire non-farm business sector. That is the best way to ensure that this tool will remain a relevant measurement of the 21st century workforce.

After a day like this, we all recognize that productivity growth is absolutely key to our economic future. How we encourage and manage this very important asset will determine the standard of living for the next generation of American workers. So thank you, everyone, very much for coming today. I know it is difficult to set aside an entire day to attend a policy conference, but I am sure you will agree that this one was certainly worth it. I cannot think of

any other topic more worthy of our time and our deliberation. So thank you, everyone, for your time and your participation.

The conference is now concluded.

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