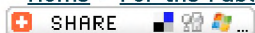


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## Universities, Innovation, and Economic Growth

Welcome to the second day of our two-day conference on Universities, Innovation, and Economic Growth. This is the third year that our Bank has sponsored a conference on education. Some of you may be asking: Why is a Federal Reserve Bank, which is engaged in setting national monetary policy, focusing on education? After all, the Federal Reserve's objectives for monetary policy are price stability and maximum sustainable economic growth.

Let me share my enthusiasm for studying the connection between education and economic growth. As president of the Federal Reserve Bank of Cleveland, I serve the Fourth Federal Reserve District, which includes Ohio, western Pennsylvania, eastern Kentucky and the panhandle of West Virginia. After I was named president in early 2003, I spent a lot of time meeting with business leaders throughout the District. I found that my conversations with them were dominated by concerns about the economic challenges we were facing as a region.

Although the national economy was recovering from the recession, our District was not recovering at the same pace. Indeed, our District is still lagging the nation, especially in terms of employment growth.

Nationally, employment growth has rebounded. Nearly 3 1/2 million net jobs have been created since the business cycle peak.

In the Fourth District states, however, employment has yet to return to its pre-recession levels. Indeed, we are still down by about 36,000 net jobs. This disappointing economic performance has caused our Bank to devote more research to the factors that drive economic growth.

Economists at our Bank have been studying this aspect of the economy for several years now. Recently, they have concluded that differences in state income levels over the past 75 years can be explained mostly by two factors: innovation and education. In simple terms, those states that enhance their knowledge base are the ones that are likely to prosper in the future.

For example, states that have a high degree of inventiveness - which is measured by the number of patents per resident - can gain economic dividends that last for generations. The same is true for education - residents of states that have a large share of highly educated graduates can produce significantly higher incomes.

Here in Ohio, we are lagging the national average in terms of our level of educational attainment, and our advantage in patent creation is not as large as it used to be. The hard truth is that having a strong traditional manufacturing base no longer guarantees the

### Additional Information

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prosperity it once did. I don't mean to say that we should leave manufacturing behind - it still provides a lot of value. However, a state can improve its relative economic position by focusing on companies - including manufacturing companies -- that invest in new and innovative technologies.

The second way to make major gains is by investing in education. It is interesting to note that Kentucky has made a lot of inroads in education over the past generation. The state still has a low overall rate of educational attainment, but the numbers are moving higher. With those gains, Kentuckians have also seen an improvement in their per capita incomes. Our keynote speaker today, Dr. Lee Todd, will tell us a bit about this story from his perspective as the president of the University of Kentucky.

Overall, our research shows that states with the highest share of college-educated adults - states like Massachusetts, Connecticut and Colorado - have higher income levels. So it is in our best interest, no matter where we live, to build up our "stocks of knowledge" through innovation and education.

History also gives us some interesting perspectives on what drives income growth. It may be hard to imagine, but for nearly all of recorded history there was virtually no per capita income growth. Zero. Before the 19th century, the rate of population growth pretty much offset any gains from technology.

Then came the Industrial Revolution, which ushered in a period of unprecedented innovation, invention, and income growth. Since 1890, per capita income has risen by 10 times in the United States alone - from \$5,000 to \$50,000, measured in year 2000 dollars. Many experts believe that the accumulation of knowledge and skills - or human capital - made the big difference in the success of the Industrial Revolution.

The more skilled the population, the faster is the rate of innovation. Skilled labor then becomes more valuable and commands higher earnings. Higher earnings, in turn, create incentives for people to acquire more skills, or more human capital. Economists refer to this process as endogenous growth. It simply means that more innovation leads to higher skill accumulation, which leads to more innovation, and so on.

Universities truly stand at the crossroads of education and innovation. They contribute to the process by educating their students - who are then better prepared to innovate and work with new technologies and business practices -- and by conducting basic research.

However, universities can play additional roles - seeking patents and then selling or licensing the technology, incubating new businesses, setting up faculty members in operating companies, helping to take companies public, and so on. Universities can even cooperate with local governments and private companies in their neighborhoods to coordinate office space, transportation, housing, and retail space.

In yesterday's paper about technology transfer, Gerald Marschke and his co-authors studied the diffusion of technology by looking at U.S. patent data. Essentially, they found that from the mid-1980s to the late 1990s, industry increasingly turned to inventors who had university research experience. The authors interpret this trend as evidence of growth in the influence of university research on industrial innovation.

So we know that universities support economic growth by educating students, conducting basic and applied research, and fostering the formation of new business ventures. Do universities need to build a

critical mass of activity in each of these activities in order to be successful? And if they do, how big is big enough? Some of the experts you will hear from today will share their ideas on how to get there from where we stand now.

We should also ask ourselves what role public policy should play in promoting innovation and education. At a basic level, public support of universities makes a great deal of sense, since there is so much potential for society as a whole to benefit.

This support for universities can be directed in various ways. The wish list is long. Parents of university students want lower tuition, more course offerings, and more connections between students and faculty members. Faculty members want more time for basic research and may not be interested in commercial applications. Business leaders want greater access to university faculty and facilities for commercial purposes. Local economic development agencies want to leverage the university presence for neighborhood development.

Clearly, universities cannot be all things to all people. Making the appropriate choices can be difficult for universities, because governments and communities have limited funds to support those choices. The more we know about how universities can affect growth, the better the choices we are likely to make.

For example, should government incentives encourage universities to incubate businesses that could become larger companies, or should government incentives be focused more on basic research? Would society be better served if universities owned and managed their patents, or if universities sold their patents to others? After all, private companies conduct research, develop new products, and create new businesses. In what areas should universities compete with the private business sector and in what areas should they cooperate? Until we have more concrete answers to these questions, public policymakers should be mindful that their actions could impede the process of innovation and human capital development.

Besides the factors that lead to greater innovation, we would also like to know how knowledge and technology spread throughout society at large. Suppose that innovation increases in settings with more face-to-face contact, meaning that we should expect more innovation in locations with large research centers. If so, perhaps government should favor a smaller number of large research-intensive universities. In this case, what happens to people who do not live in these locations? Are there ways to enhance the ability of these populations to learn through publications and the Internet? Answers to many of the questions I have posed this morning can help promote both regional growth and growth for the entire economy.

Today, we plan to build on yesterday's session by hearing from a distinguished group of people who make business or public policy decisions every day that require an understanding of the relationships between universities, innovation, and economic development.

These experts cover the waterfront, from managing networks of federal research labs, to running a large, flagship state university, to coordinating tech transfer and economic development at two neighboring universities. Other experts lead new business development inside a Fortune 100 company and direct science and technology policy in one of our fastest-growing states. We will also hear from a panel of venture capitalists.

By the end of the day, I expect that we will begin to see a comprehensive and realistic picture of what it takes to transform ideas into bankable companies that contribute to regional prosperity. We hope this information will be beneficial in helping our region

address its challenges.

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